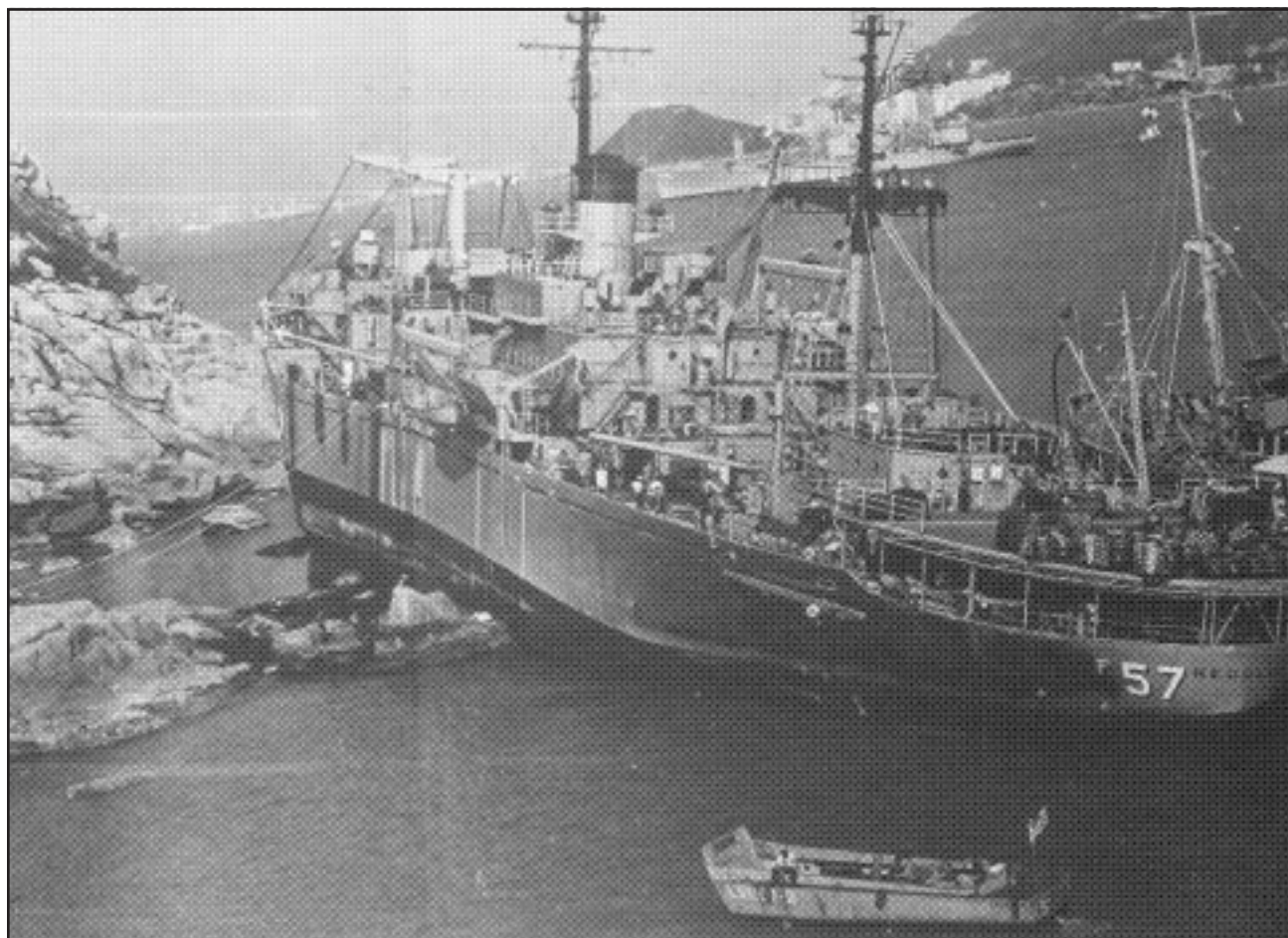




# Mariners Weather Log

Vol. 42, No. 3

December 1998



**The USS REGULUS, a U.S. Navy ship, aground in the harbor area of Hong Kong with rocks penetrating the hull as a result of Typhoon Rose (August 1971). This incident initiated the requirement for assistance in severe weather port decision-making as described in the article by Sam Brand, page 4.**

**Photograph courtesy of the U.S. Navy.**



### Mariners Weather Log



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The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this department. Use of funds for printing this periodical has been approved by the director of the Office of Management and Budget through December 1999.

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### From the Editorial Supervisor

The Mariners Weather Log is now available on the World Wide Web. Beginning with the August 1998 issue, you can find the Log at <http://www.nws.noaa.gov/om/mwl/mwl.htm>. You will need the Adobe Acrobat Reader (available from the web site) to view the magazine.

We are privileged to have another article on the Automated Mutual-assistance Vessel Rescue (AMVER) program, with several dramatic accounts of rescues at sea. In one notable incident, a fishing vessel, the SEA LION, adrift without engine power in the North Pacific during August 1998, began taking on water. In heavy seas, all ten crew members abandoned ship into a lifeboat. U.S. Coast Guard rescue coordinators located the AMVER vessel SOLAR WING a few miles away, and a boat-to-boat transfer was soon completed without loss of life.

We encourage all mariners to participate in the AMVER program. Now in its 40th year, AMVER has 12,000 participating ships from 143 nations. Over the last five years alone, AMVER has rescued over 1,500 people, most of whom would have perished were it not for this extraordinary program. It's very easy to join AMVER. Simply complete an SAR Questionnaire (SAR-Q), available by fax from the AMVER Maritime Relations Office. You then provide AMVER with your sail plan before leaving port and update your position once every 48 hours while underway. Should you require assistance at sea, alert the nearest rescue coordination center in one of several ways, including INMARSAT, Radiotelex, EPIRB, or the distress button on your satellite or DSC terminal.

For Voluntary Observing Ships, the special AMVER/SEAS software is now available to simplify preparation of weather and AMVER messages. When COMSAT receives weather messages formatted by this software, your vessel call sign and position is forwarded to the AMVER center (eliminating the need to send a separate AMVER position update), while the weather message goes to the National Weather Service. There is no cost to vessels using AMVER/SEAS software.

A Y2K compliant version of the AMVER/SEAS software is now available (AMVER/SEAS version 4.51), and vessels are encouraged to obtain free copies. You can download this software from the web at <http://seas.nos.noaa.gov/seas.html>.

For more information about AMVER, contact Mr. Rick Kenney, U.S. Coast Guard Maritime Relations Officer. For more information about the AMVER/SEAS software, contact Mr. Steve Cook, SEAS Program Manager. Both are listed in the back of this publication. Port Meteorological Officers and SEAS Field Representatives can also provide information about these valuable programs.

By the time this issue is in print, Mariners Weather Log readers with complimentary subscriptions will have received questionnaires through the mail. This is to update our mailing list. Please fill out and return the questionnaire promptly, no later than May 30, 1999.

Martin S. Baron↓



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## Severe Weather Port Evaluation Effort at the Naval Research Laboratory

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### Abstract

The U.S. Navy operates throughout the world and many of the U.S. Navy ships are in port at any instant in time. Environmental phenomena such as strong winds, high waves, storm surge, restrictions to visibility, and thunderstorms can be hazardous to these ships while in these ports, or maneuvering in or out of port. Because the U.S. Navy recognized this as a serious concern to Navy ship captains, the Marine Meteorology Division of the Naval Research Laboratory, Monterey, California, was asked to evaluate the severe weather suitability of numerous ports and document the results. The resulting analyses provide decision-making guidance for ship captains as well as environmental information for operational forecasters. Well over a hundred port evaluations have been completed and disseminated.

This article will describe the development strategy for these port studies, provide insight into the details of the presentation of the information, and discuss the future direction and enhancements.

### 1. Introduction

U.S. Navy ship captains operating throughout the globe often find themselves in new port locations, with experience providing the cornerstone of operational safety, whether in peacetime or in time of conflict. Severe weather decision making can be extremely challenging for these ship captains. For example, when faced with an approaching tropical cyclone, a timely decision regarding the necessity and method of evasion must be reached. In complex regions such as the Mediterranean, the wind systems that are produced challenge the most skilled

ship captains. A number of “local” wind events, including the Mistral, Bora, Levante, etc., are characterized by rapid onset and cessation and greatly varying spatial variations. These winds can cause an unprepared ship captain to drag anchor or part mooring lines.

For over 20 years, the Naval Research Laboratory Marine Meteorology Division (formerly Naval Environmental Prediction Research Facility and Naval Oceanographic and Atmospheric Research Laboratory) has been developing severe weather port guidance for the U.S. Navy. The guidance research efforts can be categorized as follows:

- 1) Tropical Cyclone Haven Studies
- 2) Mediterranean Severe Weather Port Studies

*Continued on Page 5*



## Port Evaluation

*Continued from Page 4*

### 3) Regional Severe Weather Guide Development

The purpose of this article is to describe the development strategy for each of the above categories, provide insight into the details of the presentation of the information in hard copy and electronic form, and discuss future enhancements and requirements.

## 2. Tropical Cyclone Haven Studies

Tropical cyclones are among the most destructive weather phenomena a ship captain may encounter, whether the ship be in port or at sea. The dilemma to the ship captain is as follows: Should the ship remain in port, evade at sea, or if at sea, should the ship seek the shelter of a nearby port? In general, it is an oversimplification to label a harbor as merely good or bad. Consequently, enough information has to be conveyed for the ship commanding officer to reach a sound decision. The decision often is not based on weather conditions alone because the characteristics of the harbor and the ship itself must also be considered (Brand, 1978).

The Naval Research Laboratory (NRL) Marine Meteorology Division has developed tropical cyclone "havens" handbooks for the western Pacific/Indian Ocean region (Brand, 1996) and the Atlantic Ocean region (Turpin and Brand, 1982; Perryman et al,

1993). Figures 1 and 2 provide locator maps for the two regions and identify ports evaluated. The port evaluations themselves were based on extensive data collection efforts and discussions with local port and meteorological officials. The format for each of the port studies included the following:

- 1) A brief description of the port location and surrounding topography.
- 2) A brief description of the harbor and facilities.
- 3) Tropical cyclone climatological information for the port.
- 4) Effects of storm surge and wave action within the harbor.
- 5) Effects of topography on tropical cyclone winds and seas.
- 6) Evasion rationale, including discussion of pertinent factors to consider in making a decision to remain in port or try to evade a tropical cyclone at sea.
- 7) General conclusions concerning the harbor as a tropical cyclone haven.

As the typhoon and hurricane haven studies were completed, they were distributed to all U.S. Navy ships and shore locations in the Pacific and Atlantic areas.

## 3. Mediterranean Severe Weather Port Studies

The complex land and sea distributions in and around the Mediterranean have a strong influence on the synoptic and mesoscale weather affecting many port and harbor areas. In addition, because

of the irregular coastline and numerous islands in the Mediterranean, swell can be refracted around barriers and come from directions which vary greatly from those of the wind and wind waves. Anchored ships may experience winds and seas from one direction and swell from a different direction. This can be extremely hazardous for close maneuvering, tending of vessels, refueling, and small boating operations.

During the past decade, the U.S. Navy identified 55 ports of interest in the Mediterranean region to be evaluated with respect to severe weather suitability. The following approach was used to develop the individual studies:

- 1) A literature search for reference material was performed.
- 2) Navy cruise reports were reviewed, if available.
- 3) Navy personnel with current or previous area experience were interviewed.
- 4) A preliminary report, which included questions on various local conditions, was developed.
- 5) Port visits were made by U.S. Navy and/or their representatives who gathered information through interviews with local harbor pilots, harbor masters, tug masters, meteorologists, etc. Local reference material was also obtained.
- 6) The cumulative information was reviewed, combined, and condensed for each port study.

*Continued on Page 8*



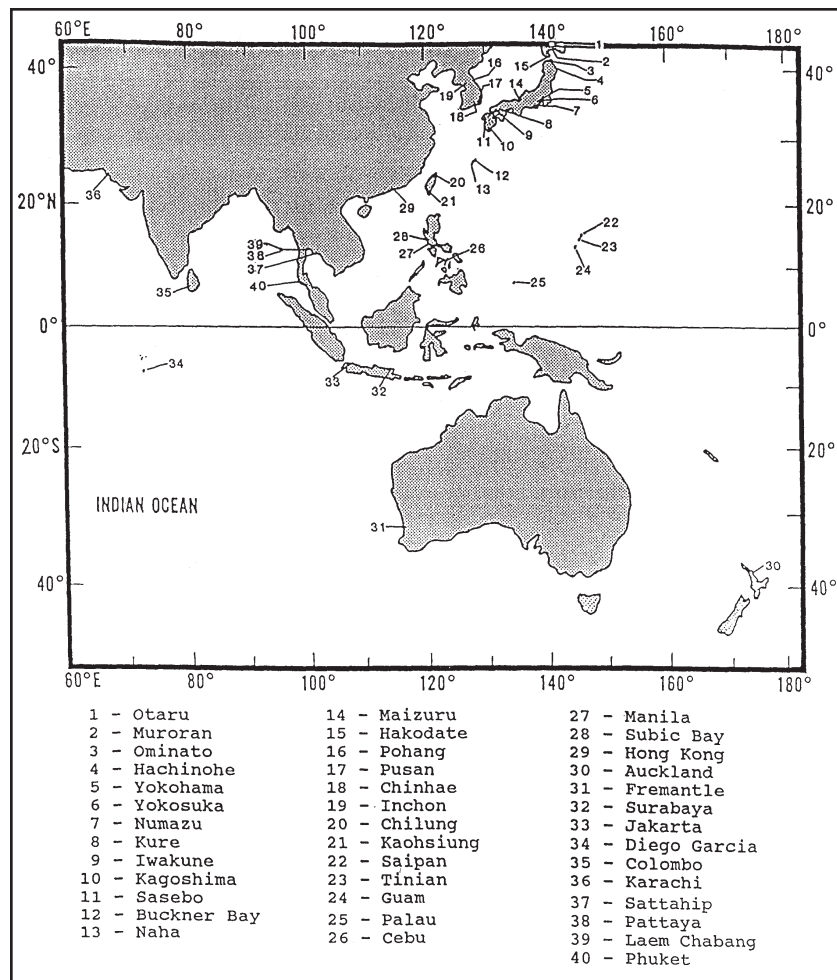
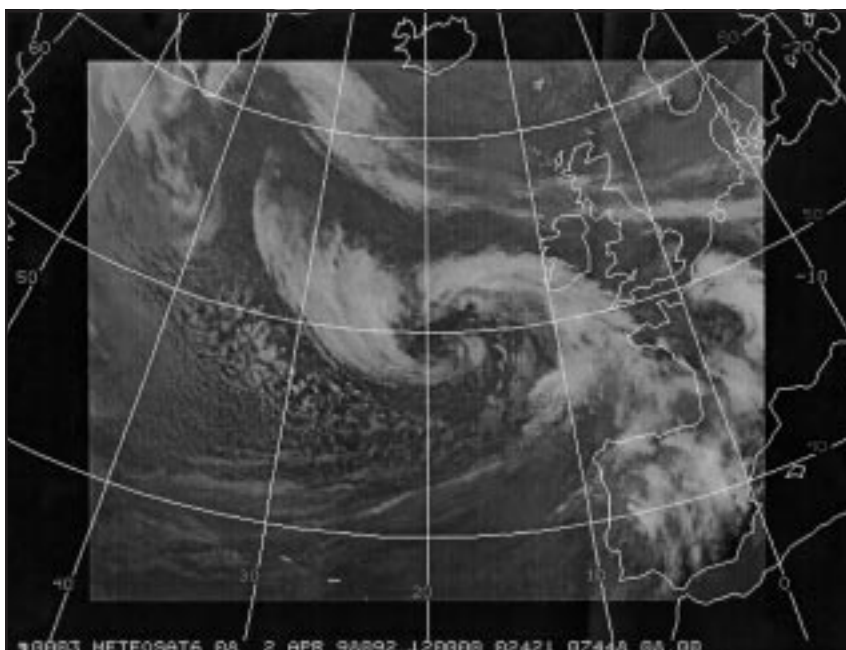


Figure 1. Locator map for the 40 ports evaluated for the typhoon haven studies for the western Pacific/ Indian Ocean regions.



METEOSAT-6 infrared satellite image of early April 1998 storm which affected the eastern North Atlantic. Note the layered frontal cloud band with high (cold) tops wrapping around the south and southeast sides of the center and cumulus-type clouds streaming into the “dry slot” farther to the south. The storm was near maximum intensity and centered near 39N 19W with 958 mb central pressure at the time of the image (1200 UTC 02 April 1998).

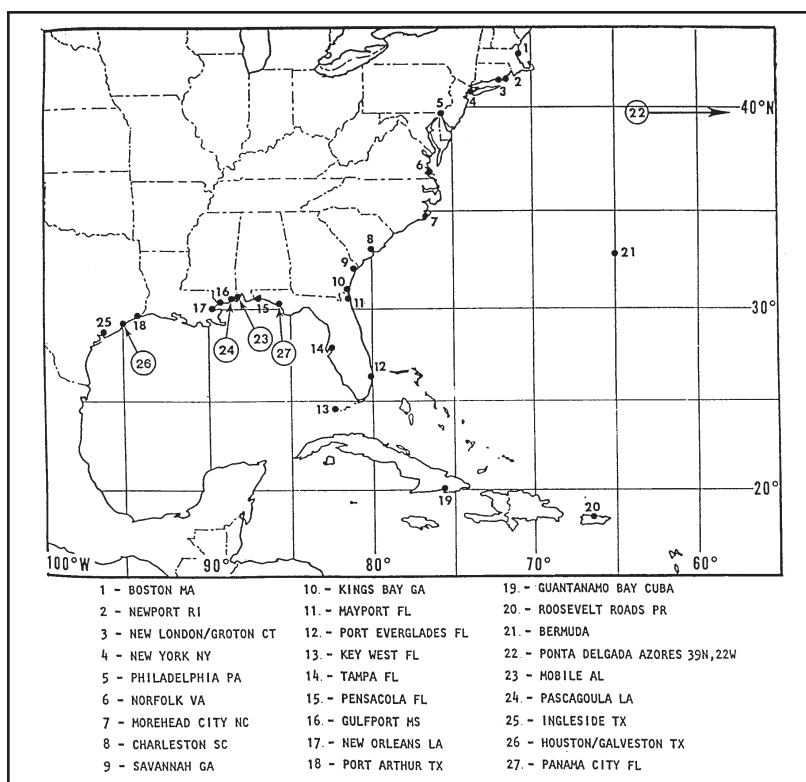


Figure 2. Locator map for the 29 ports evaluated for the hurricane haven studies for the North Atlantic Ocean.

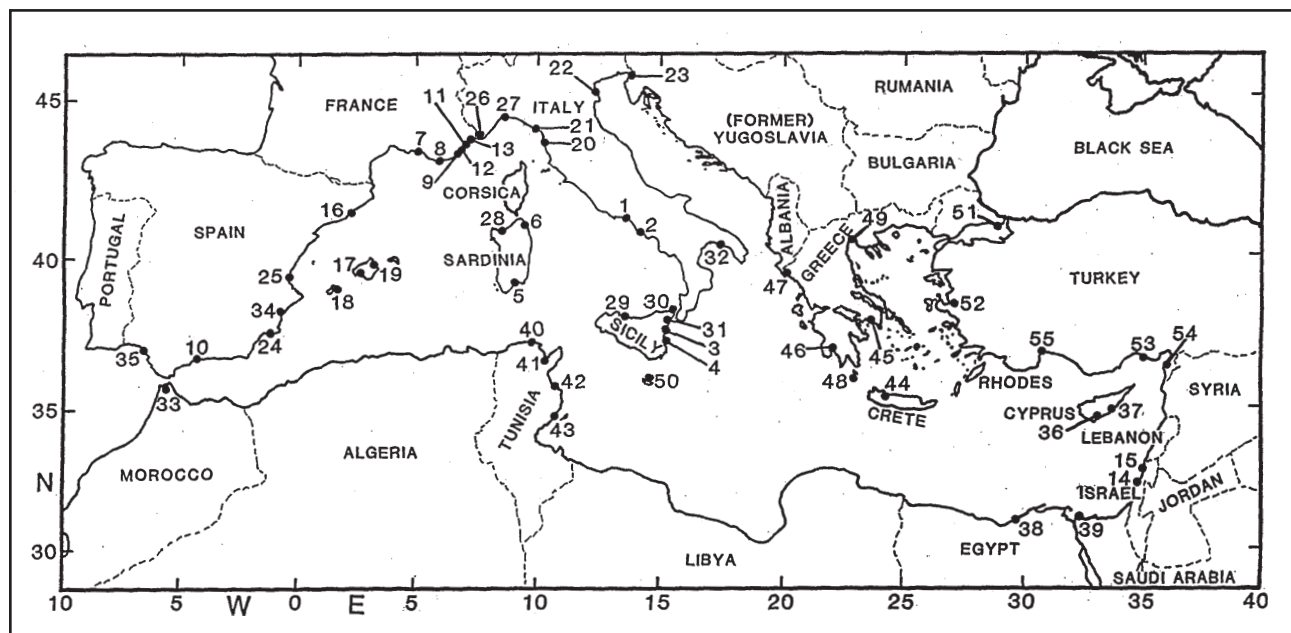


Figure 3. Mediterranean ports evaluated for the severe weather guide series. Port numbers are those listed in Table 1.



## Port Evaluation

*Continued from Page 5*

Hard copy port studies were produced (U.S. Navy, 1988-1995) containing two port-specific information sections (preceded by a brief introduction offering general guidance). The first section summarized harbor conditions and was intended for use as a quick reference guide by ship captains, navigators, harbor officials, or other in-port or at-sea personnel. This section contained the following:

- 1) A brief narrative summary of severe weather hazards.
- 2) A table display of vessel location/situations, potential

severe weather hazards, advance indicators of the hazards, and effects of hazards and precautionary/evasion actions.

- 3) Local wind and wave conditions.
- 4) Tables depicting wave conditions at selected harbor locations resulting from propagation of deep-water swell into the harbor.

The second section of the port study contained additional details and background information on hazardous conditions as a function of season. This section was designed to serve personnel who had a need for additional insights

on severe weather hazards and related weather events, and was intended more for use by operational weather forecasters.

The 55 port evaluations were developed during the eight-year period 1988-1995. As they were completed, they were distributed to all U.S. Navy ships and shore locations in the Atlantic and Mediterranean regions in hard copy form. Because of interest in a compilation of the port studies as a ready-reference guide, the evaluations were condensed and disseminated as one handbook (Brand, 1997). In addition, to satisfy the demand for presentations via electronic media, the 55 port studies were also disseminated in CD-ROM form as well (U.S. Navy, 1995).

| No. | Port                 | No. | Port                      |
|-----|----------------------|-----|---------------------------|
| 1   | GAETA, ITALY         | 29  | PALERMO, ITALY            |
| 2   | NAPLES, ITALY        | 30  | MESSINA, ITALY            |
| 3   | CATANIA, ITALY       | 31  | TAORMINA, ITALY           |
| 4   | AUGUSTA BAY, ITALY   | 32  | TARANTO, ITALY            |
| 5   | CAGLIARI, ITALY      | 33  | TANGIER, MOROCCO          |
| 6   | LA MADDALENA, ITALY  | 34  | BENIDORM, SPAIN           |
| 7   | MARSEILLE, FRANCE    | 35  | ROTA, SPAIN               |
| 8   | TOULON, FRANCE       | 36  | LIMASSOL, CYPRUS          |
| 9   | VILLEFRANCHE, FRANCE | 37  | LARNACA, CYPRUS           |
| 10  | MALAGA, SPAIN        | 38  | ALEXANDRIA, EGYPT         |
| 11  | NICE, FRANCE         | 39  | PORT SAID, EGYPT          |
| 12  | CANNES, FRANCE       | 40  | BIZERTE, TUNISIA          |
| 13  | MONACO               | 41  | TUNIS, TUNISIA            |
| 14  | ASHDOD, ISRAEL       | 42  | SOUSSE, TUNISIA           |
| 15  | HAIFA, ISRAEL        | 43  | SFAX, TUNISIA             |
| 16  | BARCELONA, SPAIN     | 44  | SOUDA BAY (CRETE), GREECE |
| 17  | PALMA, SPAIN         | 45  | PIRAEUS, GREECE           |
| 18  | IBIZA, SPAIN         | 46  | KALAMATA, GREECE          |
| 19  | POLLENSA BAY, SPAIN  | 47  | KERKIRA (CORFU), GREECE   |
| 20  | LIVORNO, ITALY       | 48  | KITHIRA, GREECE           |
| 21  | LA SPEZIA, ITALY     | 49  | THESSALONIKI, GREECE      |
| 22  | VENICE, ITALY        | 50  | VALLETTA, MALTA           |
| 23  | TRIESTE, ITALY       | 51  | ISTANBUL, TURKEY          |
| 24  | CARTAGENA, SPAIN     | 52  | IZMIR, TURKEY             |
| 25  | VALENCIA, SPAIN      | 53  | MERSIN, TURKEY            |
| 26  | SAN REMO, ITALY      | 54  | ISKENDERUN, TURKEY        |
| 27  | GENOA, ITALY         | 55  | ANTALYA, TURKEY           |
| 28  | PORTO TORRES, ITALY  |     |                           |

## 4. Regional Severe Weather Guide Development

A good example of a regional severe weather guide is the Puget Sound area port guide (Gilmore et al., 1996). The guide was developed in response to a Navy request to evaluate the severe weather in a region where there were many Navy assets concentrated in one general location. Its prime purpose was to aid ship captains and other Navy officials in evaluating adverse weather situations and assist them in making decisions whether to move to a better anchorage, move to another port in the Puget Sound area, or to remain in a specific harbor.

*Continued on Page 9*

**Table 1. Mediterranean ports evaluated by study number and port name.**





## Port Evaluation

*Continued from Page 8*

Puget Sound is located in an area of complex topography. Strong southerly winds are common over Puget Sound during late autumn, winter and early spring. The most severe weather conditions are associated with fronts and low pressure systems approaching from the Pacific. The effects of strong winds across the Puget Sound region varies greatly from one location to another. Wind conditions that may adversely affect one area of the Sound may have little or no effect on another. Many of the sites evaluated in the

guide are located adjacent to significant topographic features that either shield the port area from strong winds or enhance the wind flow at that location. Figure 4 shows the locations in Puget Sound of interest to the U.S. Navy that were evaluated in the severe weather guide.

The guide presented the following information for each of the port locations shown in Figure 4:

- 1) A brief description of port location and surrounding topography.
- 2) A brief description of the harbor and facilities.

- 3) A description of normal and extreme weather conditions at the port.
- 4) A description of indicators of hazardous weather conditions.
- 5) A description of protective/mitigating measures that can be taken.

In addition to the above, the guide provided a description of general environmental conditions in the Puget Sound area, a discussion of the weather patterns by season, a presentation of extreme weather events, and a section describing sources of weather forecasts and warnings.

*Continued on Page 10*

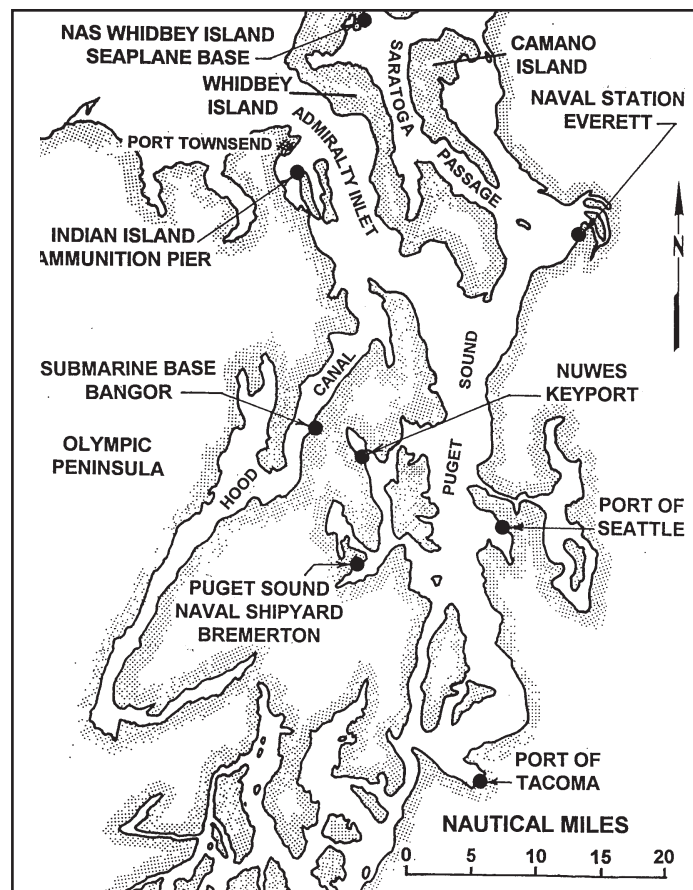


Figure 4. Locations in Puget Sound area (black dots) evaluated in severe weather guide.



## Port Evaluation

*Continued from Page 9*

### 5. Future Direction

Navy decision makers ashore and afloat are requesting that all of the documents discussed above be placed into electronic format. The electronic implementation could be flexible and allow for both Web and CD-ROM customer demand. Another future enhancement could be the capability to provide ship captains a simulated entry or exit view, in animated form, of the harbor region under a wide variety of conditions, such as day versus night, restricted visibility, etc. This would be extremely useful as a training tool for ship captains not familiar with local reference points or hazards. The CD-ROM is an ideal vehicle for this kind of simulated training or rehearsal, particularly for U.S. Navy ship captains who continuously find themselves in unfamiliar port situations.

Requests for documents discussed in this article should be made in letter form to Naval Research Laboratory, Attn: Sam Brand, 7 Grace Hopper Avenue, Monterey, CA 93943-5502. For electronic examples of the Typhoon Havens Handbook and Hurricane Havens Handbook, refer to <http://www.cnmoc.navy.mil>.

The requirement for new or updates of port evaluations is continuous and will ensure severe weather port studies for many years to come. For example, the Navy recently requested 147 ports be evaluated in the European

region. Many will be updates of previous studies, but most were new due to the ever-changing political scene in the European area. Navy ships are visiting many eastern European countries that they never thought they would be visiting a few years ago. In these new locations, the vulnerability to severe weather is still very real and significant.

### Acknowledgments

Funding for this effort has been provided by the Commander, Naval Meteorology and Oceanography Command. Numerous U.S. Navy and contractor personnel have been involved in port visits and data gathering for the past two decades. In addition, the author would like to thank the hundreds of port, harbor, and meteorological officials who contributed input, comments, and suggestions to the studies.

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## The Sinking of The Argus

*Skip Gillham  
Vineland, Ontario, Canada*

**T**his fall marks the 85th anniversary of the great storm of 1913. For days the winds howled, building mountainous seas and hurling all forms of blinding precipitation. From November 7-11, 1913, the upper Great Lakes offered no safety for ship or sailor. Most avoided confrontation with the elements and waited in port. Others, caught by the wintry blast, found no place to hide. The casualty toll was enormous, with 251 lives lost, 12 ships sunk, and many others damaged. Among those lost with all hands was the ARGUS.

The ship ARGUS was built by the American Shipbuilding Co. and launched at Lorain, Ohio, on August 5, 1903. The 436 foot long freighter, originally known as the LEWIS WOODRUFF, went to work for the Gilchrist Transportation Company. The steam powered carrier could haul about 7000 tons of cargo per trip and usually brought iron ore or grain down the lakes and returned upbound with coal. Gilchrist transportation experienced hard times and when their fleet was disbanded, several vessels joined the Interlake Steamship Company. In 1913

LEWIS WOODRUFF was among the latter and sailed as the ARGUS.

ARGUS departed November 7, 1913, from Buffalo with a load of coal and got as far as Lake Huron. There, on November 9-10, it went down with all hands. Reports from the nearby GEORGE G. CRAWFORD indicated the snow stopped falling long enough to watch the demise. Apparently, ARGUS got caught in the trough and could not pull out. The hull "crumpled like an egg shell" and sank.

A total of 24 sailors perished. The ship was valued at \$136,000 (U.S. dollars in 1913).

*Note: Skip Gillham is the author of 18 books, most related to Great Lakes ships and shipping. "Seaway Era Shipwrecks," released in 1994, tells the story of 100 ship accidents from the opening of the St. Lawrence Seaway in 1959. Copies are available from the author for a fee.☺*



**The ARGUS sank November 9-10, 1913, on Lake Huron. Twenty-four sailors perished. Photo courtesy of Milwaukee Public Library.**



### The National Hurricane Center Weathers the Storm

Debi Iacovelli  
Cape Coral, Florida

*Debi Iacovelli is a freelance writer specializing in tropical meteorology. Her stories have appeared in Weatherwise, Mariner's Weather Log, the Navy's "Fathom" magazine, The American Weather Observer, and the Weather Watcher Review.*

*[Editors Note: This is a look back to 1992 (August 22-25), when the National Hurricane Center withstood the forces of Hurricane Andrew. The article was written in November 1992.]*

More than one hundred people stood silent, eyes wide open in sudden fright, as the crash shook the National Hurricane Center (NHC), which was located on the sixth floor of the IRE Building (Gables One Tower) in Coral Gables, Florida. On the roof above the 12th floor, the white dome that

enclosed the radar unit shattered in the winds of Hurricane Andrew, shaking the entire building, sending the now-exposed radar unit crashing to the roof. "Hearts stopped for a second and everyone's eyes got real big," remembers Joel Cline, a meteorologist at the NHC who worked in the Tropical Satellite Analysis and Forecasting Unit, all the while thinking to himself, "It sounded like the radar fell off the roof!" The silence that descended on the crowd of media, photographers, weather specialists, and their family members was broken by the lone figure who walked out of the radar room. "I lost the scope" he said, with a look of disbelief.

"Somewhere about 4:45 to 4:50 am or so, all the systems blew away," according to the National Hurricane Center's Director, Dr. Robert Sheets. "The instrumentation blew away, the radome itself shattered

and blew away. Even before that, we lost our satellite antennas; they were destroyed by the wind. The radar antenna itself was blown off of something like a little penthouse that sits on our roof. It's about fifteen feet above the normal roof level. So when it blew off, it fell onto the roof. It weighs a couple of tons and shook the whole building. Everybody sort of looked. I knew what it was and what had happened just based on the weight and the thud that took place. We didn't know how much damage that it may have caused on the roof, but fortunately, it did not cause any structural damage itself. The building was shaking from the wind anyway, sort of swaying a little bit."

The NHC and Miami's National Weather Service (NWS) shared the sixth floor of the IRE Building,

*Continued on Page 13*



### Hurricane Andrew

*Continued from Page 12*

which was the only floor in the building with hurricane shutters. “We had encapsulated ourselves with the exterior shutters we have for our floor,” said Sheets. “They were all closed early Sunday evening before the winds ever started to pick up. There we were, concrete floor above us, concrete floor below us, in this engineered building. So we felt reasonably safe from the elements of the hurricane.”

Suddenly, around 3:30 am, the NHC lost electricity. Emergency generators roared to life. However, a problem with the generators prevented the Center’s air conditioning system from operating. Temperatures climbed to 95 degrees inside the cramped quarters, and stayed there for the next few days. Because of the excessive heat, some of the computer systems had to be shut down.

Around 4:30 am, the eyewall of Hurricane Andrew began to cut a swath of destruction along South Florida’s coastline. “Here at the Hurricane Center itself, we were just outside of the eyewall. That meant that we did not get the strongest conditions, but we got strong enough to cause considerable problems here,” said Sheets. “On the roof of our building, which is an elevation of 150 feet or so, we measured sustained winds up to 120 to 125 mph, with gusts to 168 mph, about 3:30-4:00 in the morning, as the center approached the coast.”

Joel Cline stood in the darkness at the back door of the IRE Building, watching in amazement, as the satellite dishes were blown away in the early morning hours. “The thing that impacted our work the most was the satellite dishes that blew away, because that allows us to see from Africa to Hawaii,” says Cline. The duties of the fallen WSR-57 radar unit at the NHC were absorbed by other NWS radars. “We were using the new SR-88D (Doppler) radar out of Melbourne to track the hurricane as it moved across the state,” said Sheets. “We had been doing that prior to our own radar failure, but continued that every fifteen minutes that we were bringing in the imagery; we had that in loop form; until it got well out of range, out over the Gulf of Mexico. We also had the Tampa radar that we were monitoring as it was moving along, and then the Key West radar. So, even though we lost our radar, we still had three others that were on it.”

Anticipating the worst, early in the morning on Sunday, August 23rd, the NHC sent six of their staff to the National Meteorological Center (NMC, now known as NCEP [National Centers for Environmental Prediction]) Meteorological Operations Division in Washington. Among them were Jerry Jarrell, Deputy Director of the NHC, and hurricane specialist Miles Lawrence. This move was made because the forecast track had Andrew at the front door of the NHC. The NMC is the alternate site used to send out hurricane watches and warn-

ings in case the NHC cannot operate. Although, in the end, the NHC never lost their forecasting abilities, once their satellite dishes were destroyed, they did require help from the NMC to get satellite data. Satellite imagery was sent by Ethernet line from Washington to Wallops Island, Virginia, then on to the NHC. Thus, satellite pictures continued to come in to the NHC, though delayed 40 minutes due to the rerouting. Although radar and satellite data was somewhat disrupted, reconnaissance aircraft flew into the hurricane continuously right up to the Miami coastline. When Andrew emerged in the Gulf of Mexico, the planes picked it up again. “We did not lose (reconnaissance) communications,” according to Sheets. “We lost the direct link to the recon through the satellite link, but we were able to link those through Keesler Air Force Base and phone communications. So, we were at a reduced capacity, but continuing with the vital data.”

The NHC held steadfastly to the computer forecast models of a possible landfall in the southern part of Florida, even when the hurricane weakened within a few millibars of being dismissed as a tropical system.

Andrew started to increase in forward motion on Saturday, August 22, but the track remained consistent. “In fact, our forecast, some 30 hours or so before the center moved across the coast was

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## Hurricane Andrew-1992

### Hurricane Andrew

*Continued from Page 13*

within eight miles of where it made landfall” said Sheets. “We were about three hours slow in our forecast 30 hours before it struck. We had forecast that the center would cross the coast somewhere around 8:00 am on Monday morning, and it turned out to be closer to 5:00 am. So we were about three hours slow, but right on track with that.”

When asked what he attributed to the accuracy in the forecast track of Hurricane Andrew, Cline responded, “It was a straight-moving storm. The synoptic patterns were well forecast by models, and the pattern was not one that was rapidly changing. When you have a straight-moving storm, as opposed to a recurvature, then it doesn’t matter which ocean you’re in, you’re always going to come out with a fairly accurate landfall forecast. You could even look back at forecasts of others that have done that same thing. Hugo was a good forecast. From the time it went around Puerto Rico until it hit Charleston, the course it took was pretty much a straight line.” According to Sheets, since pressures were extremely high to the north, that forced Andrew on a westward track rather than the normal recurvature out in the Atlantic. For a hurricane or a tropical storm that gets into that high of a latitude, they would normally start turning toward the north, as this storm did temporarily. Then the high pressure to the north strengthened, and it also got up under an upper level

anticyclone, so it was in a favorable area for strengthening.

While the winds and destruction raged outside, the forecasters had to concentrate on their duties inside, not on their personal losses. Many employees had their mates and children, along with other family members, at the NHC to ride out the storm together. This was a policy that Sheets insisted on if ever a hurricane hit the area. Sheets added, “I’d rather have their families up here rather than everyone worrying about them.” As positive proof to this statement, after the radar fell and shook the building, Sheets went back to check on all the families huddled at the NHC. Although he was in the middle of what would prove to be the most terrible natural disaster to hit the United States, he never lost sight of the reality that the people under his roof were all living through a terrifying experience.

Even after being severely affected by the hurricane, Sheets and his department could not afford to contemplate what had happened because the West coast of Florida was expecting 120 mph winds as the storm moved out into the Gulf of Mexico. “Even though the hurricane was striking us, we still had the responsibility to put out warnings for Southwest Florida and the North Gulf Coast, because we knew it was going to go out into the Gulf and continue to strengthen,” recalled Sheets. “Our primary thoughts were on continuing the forecast and warning process. There wasn’t much we could do about this area at that

stage. We had already done as much as we could in terms of the forecasts and warnings that took place here.”

It is ironic that the forecasters at the NHC can “see” over 8,000 miles of ocean and land, but during this night, they were only left to wonder what terrible devastation was occurring literally in their own back yards. “I knew that my family had been evacuated out of the area to the west part of the county,” said Sheets. “I thought that they’d be reasonably safe there in a well constructed cinder block and stucco-type structure. But, I don’t think any of us comprehended the degree of damage that had actually taken place until we got out into the community and saw what had happened.”

In the rage of Andrew’s winds, many NHC and NWS employees faced the terrible truth that they would never see their homes again. “I did what I could, but quite frankly, I live closest to the water,” explained Cline. “I took pictures of my house and took my insurance papers with me. Although no employees were injured in the hurricane, many had no homes to come back to. “There were ten whose homes were either destroyed or not livable after the hurricane,” said Sheets.

As Hurricane Andrew moved west, many at the NHC reflected on that long night spent battling the storm and the personal price they paid trying to help save lives. “I was on the 4:00 pm to midnight

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## Hurricane Andrew-1992

### Hurricane Andrew

*Continued from Page 14*

shift, and had to be back on at 7:00 am” remembers Cline. “So then, during the height of the storm I could help out, because there was no way I was going to get to sleep. Early in the evening, right after I did the classification of the system at 8:00 pm, I knew a good deal about the hurricane. I got kind of quiet and started thinking about things. I was looking out the window and it’s overcast, but not ominous. One of my friends, who is a producer for a TV network, walked over and said, ‘What are you thinking about, Joel? What’s going through your mind?’” Cline replied, “No matter what we did, no matter how many hours Bob sits in front of your TV cameras, no matter how

many interviews he gives, no matter how many times people call here, no matter how many police went out to beat on doors and evacuate people off barrier islands, no matter how many Spanish stations, Haitian radio stations broadcast everything, people are alive now that will not be alive at 8:00 in the morning.”

“It’s a very sobering and a very true statement,” said Cline. “That makes me feel worse than saying goodbye to my house. In essence, you have no control over whether your house is there or not. That’s what insurance money is for, to rebuild or whatever. You can’t rebuild a human life. Our job is to warn people so they get can out. You’re not going to control it and you’re not going to stop it from damaging any property. We’re not

here for that purpose. What we are here for is so people won’t die. And you know that no matter what you do, or how good you do it, or how long you let people know, people will die. The next one that hits the United States, people will die. People in Galveston may remember, Mobile may remember Camille, people in Charleston remember Hugo, and people here will remember Andrew for a long time.”

### Acknowledgments

My gratitude to Dr. Robert Sheets, Joel Cline, and Vivian Jorge, who at the time worked at the National Hurricane Center. My thanks also to NOAA cartographer Kevin Shaw for his research.↴

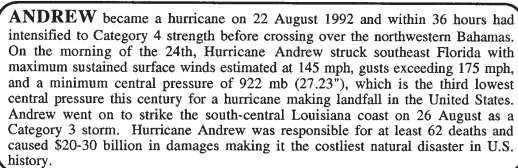
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## Hurricane Andrew Hits Fowey Rocks C-Man (Coastal Marine Automated Network) Station

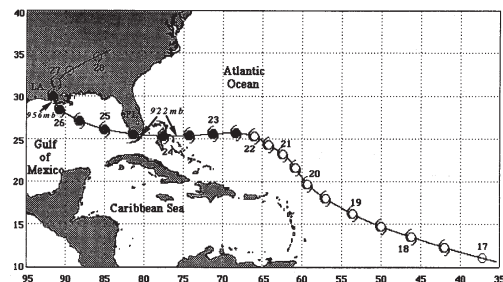
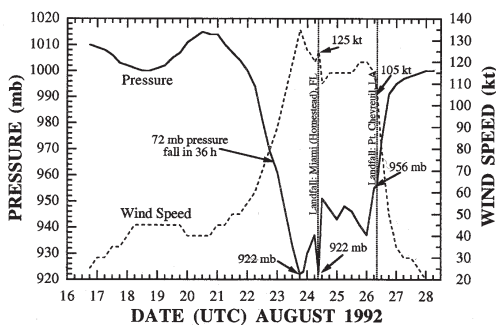
**I**n August of 1992, Fowey Rocks C-MAN station (FWIF1) was in the direct path of Hurricane Andrew. The Category four hurricane blew out all the glass in the structure, and most of the weather equipment on this C-MAN station was either destroyed or damaged. The intense winds bent the 30 foot high trolley mast that held the sensor cross arm, wind speed sensors, and remote barometer port. The mast

was bent 90 degrees to the west about 5 feet above its base. The cross arm and sensor mounts from the trolley mast were found about 150 feet west of the lighthouse base in 10 feet of water. The GOES antenna was broken off and the outboard solar panel was impacted by debris, leaving only the aluminum frame intact. Although Fowey Rocks took the brunt of Hurricane Andrew, it measured wind speed and direc-

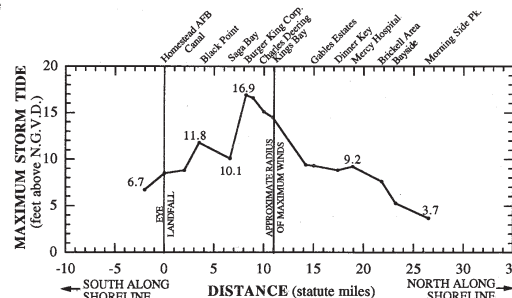
tion, peak winds, sea level pressure, and temperature until the station failed due to the intensity of the hurricane. Wind was measured at 140 mph (two-minute average) with a five-second peak of 169 mph. This data helped forecasters verify meteorological information gathered from radar, satellites, and reconnaissance aircraft, along with provided data for further research after the storm.↴



**Comments on Hurricane Andrew color radar image (opposite side):** The picture is from the last full sweep of the National Weather Service's Miami WSR-57 radar (located at the National Hurricane Center [NHC]) before the radar was destroyed by the storm. The digitized radar imagery shows the eye centered over Elliott Key just before landfall at Homestead Air Force Base (HAFB). As Andrew traveled due west, the heaviest damage occurred in those areas affected by the eyewall (doughnut-shaped region with echoes greater than 42 dBZ). The weather radar measures the power from the portion of the radar beam scattered back by raindrops and ice particles. The colors associated with higher dBZ (i.e., red) correspond to areas with larger amounts of rain, which typically are also regions of stronger winds. Areas with high dBZ in the center of the eye are because of ground clutter from islands. (Ground clutter is the reflection of the radar beam by terrain, large structures, and rough water.) Ground clutter in the vicinity of NHC has been removed and is shown in gray. **Radar data recorded and processed by the Hurricane Research Division/AOML/NOAA.**



Best track positions for Hurricane Andrew (August 16-28, 1992). Positions at 00 and 12 UTC are shown. Dates are at the 00 UTC locations. Tropical depression, tropical storm and hurricane strengths are represented by open circles and open and filled hurricane symbols, respectively. Locations of lowest minimum central pressure are shown. Data for this and other black and white figures are from National Hurricane Center's preliminary report.



Preliminary storm tide heights (sum of storm surge and astronomical tide) along western shore of Biscayne Bay associated with Hurricane Andrew, 24 August 1992. (Data provided by the U.S. Geological Survey under a mission assignment from FEMA.) Heights in feet above NGVD - National Geodetic Vertical Datum - zero elevation - i.e., mean sea level of 1929.



## Hurricane Andrew-1992



**Fowey Rocks C-MAN station before Hurricane Andrew.**



**Fowey Rocks trolley mast bent 90° by Hurricane Andrew.**



**Fowey Rocks C-MAN cross arm and sensor mounts under 10 feet of water.**



## Rescues Up and Down The Pacific Ocean Demonstrate the Value of AMVER Participation

*Rick Kenney  
AMVER Maritime Relations Officer  
United States Coast Guard*

**I**n a dramatic series of rescues stretching the length of the Pacific Ocean, merchant ships were responsible for the recovery of 19 survivors in three emergency incidents over the course of a one month period. Quick location, and the quick reaction of masters and crews, made the literal difference between life and death at sea.

### **Fishermen Fished Out!**

On August 15, 1998, the captain of an 80-foot fishing vessel, the SUN LION (Belize flag), radioed the U.S. Coast Guard in Juneau that his vessel had been adrift for 48 hours. The vessel then began taking on water in its engine room 375 miles south of Dutch Harbor, Alaska. Its Philippine crew of ten abandoned ship into a lifeboat in 10-foot seas and 20-knot winds. A Hercules C-130 aircraft was launched from USCG Air Station Kodiak. At the same time, a

Japanese specialized cargo ship, the SOLAR WING, was located by rescue coordinators using the AMVER system. The C-130 vectored the merchant ship three miles to the location of the survivors, where a boat-to-boat transfer was accomplished. The ship carried the survivors to its next port of call in Tokyo, where it was presented with a U.S. Coast Guard Public Service Commendation.

### **Deliverers Delivered!**

A leaking fuel line caused the 44-foot sailboat KATHI II to catch fire 76 nm southeast of Baja, Mexico, on July 20, 1998. Two sailors delivering a friend's boat from Mexico to Newport Beach, California, were forced to abandon the boat, which soon became engulfed in flames. A 406 MHz EPIRB signal was received at the

Coast Guard Command Center in San Diego, California, and a C-130 aircraft from the USCG Air Station in Sacramento, on a scheduled patrol nearby, was diverted. It located two persons in a life raft and dropped a radio to establish communications.

Again, rescuers queried the AMVER system and located the American President Lines ship, M/V PRESIDENT HOOVER, only 12 miles away. The two sailors were recovered after only five hours in the raft as the 900-foot ship maneuvered within six feet of the raft and dropped its accommodation ladder. The ship carried Rick Wempe, described as "Captain Calm" by his "terrified" partner Tim Anderson, to Long Beach, California, where they were met by news media and

*Continued on Page 20*





Grateful survivors from the SUN LION strike a pose with rescuers from the M/S SOLAR WING.

## Certificate of Appreciation

*Presented in recognition of outstanding  
assistance to the U.S. Coast Guard*

### **The Master and Crew of M/S Solar Wing**

*are recognized for their humanitarian service in rescuing the crewmembers of the fishing vessel  
"Sun Lion" in the North Pacific Ocean in the early hours of 15 August 1998.*

*When the Master and Crew of "SOLAR WING" were requested by the U.S. Coast Guard to assist a  
foundering vessel, they diverted from their course without hesitation, sailed more than 100 miles, lowered their  
lifeboats in the dark, and successfully rescued all 10 crewmembers from the sinking fishing vessel "SUN LION."  
They welcomed the rescued sailors aboard their ship for the next 6 days while they completed their westbound  
voyage, and delivered them safely ashore in Tokyo, Japan. By their selfless actions, the Master and Crew of  
"SOLAR WING" have upheld the very highest traditions of the sea.*



Joseph P. Brusseau, Captain, U.S. Coast Guard  
Commander, Activities Far East



### Rescues

*Continued from Page 18*

interviewed about their rescue, which became the lead story on local newscasts that evening.

Anderson described a HOOVER crew member crouched at the bottom of the big ship's ladder as "being dunked as the ship rolled, yet telling me to walk on top of him to get on the ladder – he is the bravest man I ever met in my life!" Captain Peter Arnstadt, Master of the PRESIDENT HOOVER, put his extraordinary ship handling role in perspective during a television interview when he said: "that's what we get paid to do!" The retired Navy Captain also commented that the crew of the Coast Guard C-130 could have won the Navy's aerial bombing competition with their precise radio drop!

### Back to the Future—New Ship on Maiden Voyage Saves Seven from Historic Sailing Craft

Combining the best elements of an exciting adventure novel, Coast Guard rescue coordinators in Honolulu relied on today's modern technology to save the crew of an historic mahogany catamaran sailing canoe, which replicated the purported design of ancient sailing vessels. On a voyage in planning for over seven years, the 75-foot FEATHERED SERPENT III was en route from Hawaii to Brisbane, Australia on August 20, 1998, via Fiji, as part of a multi-year circumnavigation expedition to prove suspected sea travel of ancient

Peruvians and possible contact with Pacific Islanders. The vessel encountered heavy weather which caused it to capsize and break up 1,400 nm south of Oahu.

The crew scrambled into life rafts, which were secured together with the wreckage. Among contemporary safety equipment carried aboard were VHF and single sideband (SSB) radios, celestial navigation equipment, and a 406 MHz EPIRB. It was the EPIRB's satellite signal that alerted rescue officials to the catamaran's plight. Among the resources marshaled to assist were a U.S. Coast Guard C-130 from Air Station Barbers Point, Hawaii; elements of the U.S. Navy's Pacific fleet and Third Fleet (opportunistically returning from deployment); and a French container ship participating in AMVER, the DIRECT FALCON, which diverted from a position 484 nm (or 28 steaming hours) away. An Urgent Marine Information Broadcast (UMIB) was also issued to all ships in the area.

One of those ships, the M/V EVER VICTORY, a Taiwanese bulk carrier on its maiden voyage from its builder's shipyard in Rio De Janeiro to Tokyo, responded to the UMIB and voluntarily diverted at best speed from its position only 195 nm away. The C-130 arrived on scene and dropped an additional life raft and

radio to the survivors. At dawn, the EVER VICTORY appeared and picked up the survivors, all in good condition. The expedition's leader is Gene Savoy, a 70-year-old, well-known explorer noted for the discovery of several ancient cities in the Peruvian rain forests since the 1950s.

The Master of the EVER VICTORY, Captain D.M. Huang, normally participates in AMVER, but could not on the maiden voyage because reporting instructions had not yet been placed aboard. The critical difference in response time from a ship identified at a distance of 195 nm as opposed to 484 nm from the position of the emergency points up the advantage of maximum ship participation in AMVER by the world's merchant fleet!⚓



**Rick Wempe and Tim Anderson hold a souvenir life ring signed by PRESIDENT HOOVER crew. They were forced to abandon the sailboat KATHI II after she caught fire 76 nm southeast of Baja, Mexico.**



## Why Are the Tides So Predictable?

*Bruce Parker  
National Ocean Service*

*Bruce Parker is the Chief of the Coast Survey Development Laboratory, National Ocean Service, NOAA.*

Methods for precisely predicting the tide have been known for more than a 100 years, and cruder but still useful methods have been known for centuries, perhaps even back 2000 years. With only a few days of data from a tide gauge, the tide can be predicted at that location for years into the future. With six months of data, such predictions can be accurate to the nearest inch and the nearest couple of minutes.

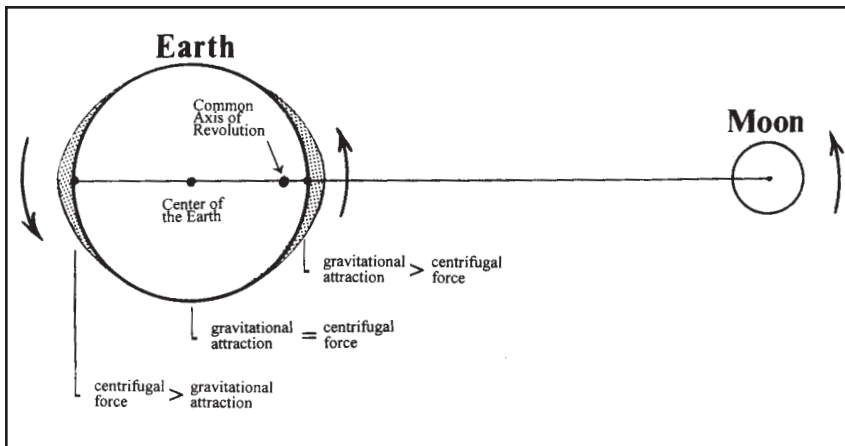
I should clarify here that by the tide I mean the astronomical tide, namely, the tide that is predicted in national Tide Tables. That may be obvious to most readers of this column, but changes in water level,

including the changes due to wind and atmospheric pressure, are sometimes still referred to as the tide. During storms and hurricanes, the term storm tide is often used by the media. Wind and barometric pressure are part of the weather and so their affect on water level can vary greatly. When a tide prediction does not exactly match the measured water level, it is because of the wind and pressure and, in some places, because of river discharge. But the astronomical tide is another story and the key to its predictability is, of course, the word astronomical. The tide is caused by the gravitational effects of the moon and the sun. The rotations, revolutions, and orbits involving the Earth, moon, and sun are all periodic motions with fixed and precisely known time periods. We will see that the predictability of the tide can be traced back to the predict-

ability of these astronomical motions.

To answer the question in the title of this column, we first need to describe how the tides are caused. Let's look at the moon first, because, being much closer than the sun, it is the largest generator of the tides. The Earth and moon both actually revolve around a common point, which, because the Earth is much more massive than the moon, is inside the Earth, but not at the Earth's center (see Figure 1). At the center of the Earth, there is a balance between the gravitational attraction of the moon (trying to pull the Earth and moon together) and the centrifugal force of the revolving Earth (trying to push the Earth outward away from the moon—but see last issue's column for the real explanation of this fictitious force). At a

*Continued on Page 22*



**Figure 1. The Earth-Moon system (viewed from above the North Pole) revolving around a common axis (just inside the Earth). The Earth is shown with a hypothetical ocean covering the whole Earth (with no continents) and two bulges, resulting from the imbalances of gravitational and centrifugal forces.**

## Tides

*Continued from Page 21*

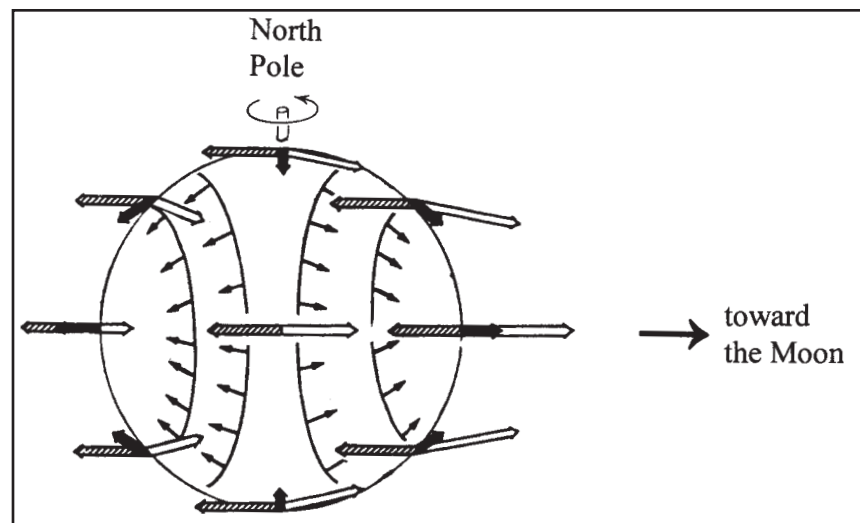
location on the Earth's surface closest to the moon, the gravitational attraction of the moon is greater than the centrifugal force. On the opposite side of the Earth, facing away from the moon, the centrifugal force is greater than the moon's gravitational attraction. Figure 1 shows a hypothetical ocean (covering the whole Earth with no continents) with two bulges, one facing the moon and one facing away from the moon. These bulges result from the two imbalances of gravitational and centrifugal forces. However, if we look at the side facing the moon, the force vertically upward from the Earth toward the moon overhead (due to the gravitational force of the moon being greater than the centrifugal force of the Earth's revolution) is so small compared to the Earth's gravitational force as to be insignificant.

So what then actually causes the bulges?

If we move away to another point on the Earth that is not directly under the moon, we see that the

attractive force is still pointing toward the moon, but is no longer perfectly vertical relative to the Earth. The further away we get from the point under the moon, the less vertical the force is (see Figure 2). At these other points we now have both a vertical component of the force and a horizontal component, the latter one being parallel to the Earth's surface. This horizontal force, though small, has nothing opposing it, and so it can move the water in the ocean. One can see from Figure 2 that all the horizontal components shown tend to move the water into a bulge centered around the point that is directly under the moon. Similarly, on the other side of the Earth (where the centrifugal force is greater than the moon's gravitational attraction) another bulge results.

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**Figure 2. The tide generating forces (the thick black arrows) on the Earth resulting from the difference between gravitational attraction (the open arrows) and centrifugal force (the hatched arrows). The small black arrows are the horizontal components of the tide generating forces, which tend to move the water into the two bulges shown in Figure 1.**



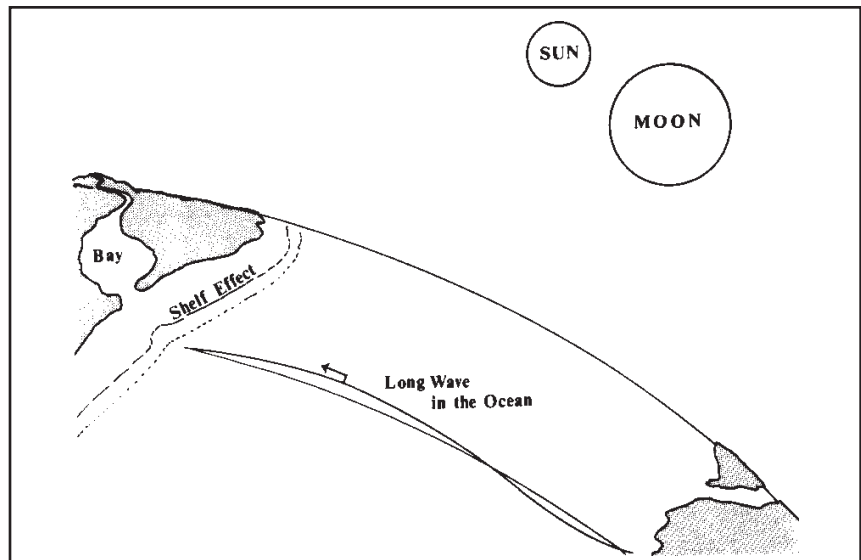


### Tides

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One can envision the Earth rotating under these bulges in this hypothetical ocean that covers the entire Earth. In one complete rotation in one day, there will be two high tides (when under a bulge) and two low tides (when halfway between bulges), and thus one entire tidal cycle would be completed in half a day. However, this is still an extreme simplification. Not only are the continents left out, but this assumes that the oceans respond instantly to the tide-generating force. There is a lot more to explain.

Let's add the continents in and look at one of the oceans, the Atlantic, for example. And let's also look at a bay connected to the Atlantic. The tide-generating force is extremely small, too small to cause a tide directly in the bay. Only in a large ocean are the cumulative effects of the tide-generating force throughout the ocean large enough to produce a tide. What is actually generated is a very long wave with a fairly small amplitude, on the order of a foot or two (see Figure 3). However, when this wave reaches the reduced depths of the continental shelf, there is a partial reflection of the wave, and the part of the wave that continues toward the coast is increased in amplitude. At the coast, another reflection further increases the height of this tidal wave (NOT to be confused with the tsunami caused by an earthquake), now reaching at least a



**Figure 3. The tide generating forces caused by the moon and sun produce in the ocean a very long wave of relatively small amplitude. When this long wave reaches the continental shelf, then the coast, and finally propagates up a bay, it is amplified by an amount that depends on the length and depth of each of the basins.**

few feet or more along most coasts. When the wave moves up into a bay, there can be even more amplification, depending on the depth and length of the bay, with the highest tidal ranges seen in the Bay of Fundy (on the order of 50 feet).

At this point I need to talk briefly about pendulums and coffee cups and bath tubs in order to explain what makes tides higher in some places than others, and ultimately to explain why tides are so predictable. There are two main parts in the study of tides, the part dealing with astronomy (which we will get back to in a minute) and the part dealing with the motion of water in a basin, namely, the hydrodynamics, which I will talk briefly about, as soon as we look at the pendulum. If we have a

simple pendulum, say a ball hanging on a string, and we hit the ball sideways just once, and then let it swing back and forth, it will always take the same amount of time to complete one oscillation back and forth. This period of oscillation depends only on the length of the string, a longer string producing a longer period of oscillation. If we have a basin of water and we push down once on the water to get its surface oscillating back and forth (like a seesaw, with the center point not moving and the ends moving up and down) it also will have a period of oscillation. This natural period of oscillation of a basin depends both on its length and its depth. The longer the basin, the larger the period of oscillation;

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### Tides

*Continued from Page 23*

however, the deeper the basin, the smaller the period of oscillation. The length effect is more dominant. If, for example, we increase both the length and depth of a basin by say 100 times, the period of oscillation will increase by about 10 times (and the frequency of oscillation will decrease by 10 times). Thus, water in a tea cup will have a shorter period of oscillation (and will oscillate back and forth much faster) than water in a bath tub. The bathtub, in turn, has a much shorter period of oscillation than the Atlantic Ocean (which has a natural period of about 19 hours).

When we hit the pendulum once, and let it go, the resulting oscillation is called a free oscillation. But we could keep hitting the pendulum at a regular time interval. Suppose the natural period of a pendulum is 6 seconds, but we hit the pendulum every 4 seconds, namely, before it has time to do a complete oscillation we send it back in the opposite direction again. If we keep this up, the period of oscillation of the pendulum is 4 seconds, and this is called a forced oscillation.

The same is true for water in a basin; if we push down on the water at a regular interval, we can cause the water to have a forced oscillation with a period that matches our interval of pushing. This is essentially what the tide-generating forces do in the Atlantic Ocean, except that it is not a

single push downward; it is continuous horizontal pushing of the water everywhere over the entire ocean with the direction varying over a 12.42 hour period (why this is more than twelve hours will be explained below when we get back to the astronomy part of the story). The small arrows in Figure 2 show the horizontal tide generating forces at one instant in time. As the Earth rotates, and we follow one point on the Earth's surface around, we can see that the direction of the force will rotate completely around the compass.

How large the tide range is depends on how close the natural period of the basin is to the period of the tide-generating force. Look again at the pendulum. If the pendulum does one complete oscillation from right to left and back again, and is just beginning to move to the left again as we hit it to the left, we impart the additional energy at just the right time and the pendulum swings higher than it would have. Likewise, if the natural period of the basin is the same as the period of the tide-generating force, then the energy from the tidal forcing will be input just at the right time and the tide range will be larger. This is called resonance. The Atlantic Ocean is too wide for there to be resonance (its 19-hour natural period being much longer than 12.42 hours). [There may, however, have been a time in Earth's history, before continental drift got as far as is has today, when the Atlantic was smaller, and perhaps the tides

were larger.] The largest tide ranges in the world are in shallower basins with just the right length and depth combination, like the Bay of Fundy, or along ocean coasts with very wide continental shelves and the right depth, like off southern Argentina.

There is not enough space in this column to explain all aspects of the hydrodynamics of the tides, but for the purposes of answering the question in the title of this column, we really don't need to know any more about the hydrodynamics. It doesn't matter how the hydrodynamics has affected the tide range or the times of high water and low water. All that matters is that, because this is a forced oscillating system, the tide will oscillate with the periods determined by the relative motions of the Earth, moon, and sun. Then all we need to do is to analyze a few days (or months) of water level data in order to accurately predict the tide at the location where the data were taken. However, we need to go back to the astronomy because there is not just a single tidal period to consider. There are many different periods involved due to the complex nature of the orbit of the moon around the Earth and of the orbit of the Earth around the sun. To accurately predict the tide, one must consider the most important of these periods.

Let's start with the most important tidal period, the 12.42 hour period already mentioned. The Earth rotates on its axis, taking approxi-

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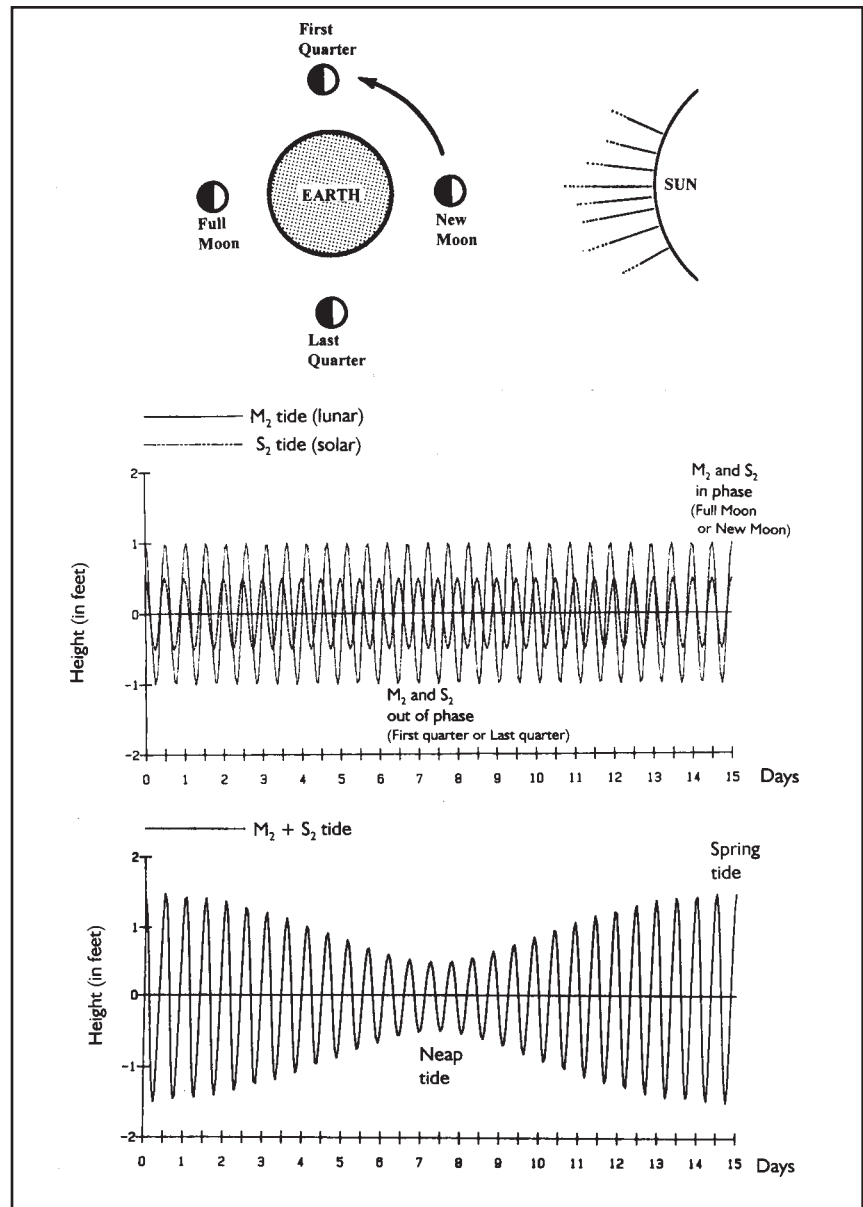


## Tides

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mately 24 hours to go through a complete day-night cycle. If the moon was standing still, then the two high water bulges on the Earth mentioned above (see Figure 1 again) would be 12 hours apart. However, the moon is moving around the the Earth in the same direction that the Earth is rotating. By the time the Earth has made one complete rotation (in 24 hours) the moon has moved a little, so it actually takes 24.84 hours before that same point on the Earth is directly under the moon again. And thus the two high water bulges are really separated by 12.42 hours (the principal lunar period). The tidal constituent representing this lunar period is called  $M_2$  (for moon, twice a day).

Another tidal period comes from the effect of the sun. Although the sun is much more massive than the moon, it is so far away that the tide generating force of the sun is less than half that of the moon. The principal solar constituent (called  $S_2$ ) has a period of exactly 12 hours, as one would expect. There are two times of the month when the moon and sun are in line with the Earth, at which time they both work together to produce higher tides, called spring tides (see Figure 4). This occurs when the sun and moon are on opposite sides of the Earth (full moon), or on the same side (new moon). When the moon is in first quarter or third quarter, the moon and sun work against each other and so the



**Figure 4. The combined effect of the moon and sun varies throughout the month. When the moon and sun are working with each other (at Full Moon and New Moon), one sees the highest tides (spring tides). At First Quarter and Last Quarter, the moon and sun work against each other, resulting in smaller tides (neap tides).**

result is tides that are not as high, called neap tides.

Another tidal period comes from the fact that the moon's orbit

around the Earth is not a perfect circle, but is an ellipse. Thus the moon moves closest to the Earth (called perigee) and then to a point

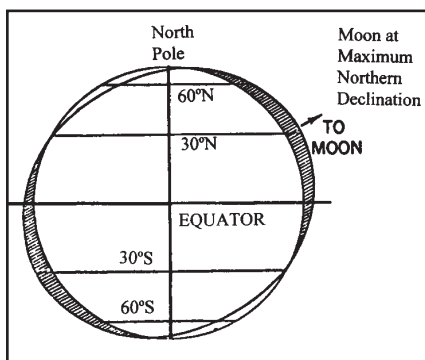
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### Tides

*Continued from Page 25*

farthest away (called apogee) and then to the closest point again in the orbit, the whole cycle taking 25.5 days. The tides will be larger when the moon is closest to the Earth (perigean tides) and smaller when the moon is farthest from the Earth (apogean tides). The period of this elliptical tidal constituent (called N2) is 12.66 hours, and it is a little trickier to understand where this number comes from. If two waves are added together, one with a larger amplitude and a period of 12.42 hours and one with a smaller amplitude and a period of 12.66 hours, the result will be a wave with a 12.42-hour period that slowly varies in amplitude over a 25.5-day period. In other words, one can represent the variation in tide range due to the changing distance of the moon from the Earth by simply adding a wave with 12.66-hour period to the



**Figure 5. When the moon is at maximum declination north or south of the equator, the tidal bulge also shifts north or south. When this happens, certain locations on the Earth would rotate under only one high water bulge.**

principal lunar wave with period of 12.42 hours. We can use Figure 4 to illustrate this, if, in that figure, we replace S2 with N2, spring tide with perigean tide, and neap tide with apogean tide. The difference is that with the M2 plus S2 case there really are two distinct effects being added, but in the case of the changing distance between the moon and Earth, this directly varies the amplitude of the tide; and N2 is merely a convenient way (in combination with M2) to represent this variation of amplitude.

There are many other variations in the moon's orbit, the Earth's rotation, and the Earth's orbit about the sun, and these all can be represented by other tidal constituents with appropriate periods to represent the various affects on the tide's amplitude. I will mention only two others, because at some locations on the Earth they can lead to (with some help from hydrodynamics) only one high water per day instead of two. The moon is directly over the Earth's equator only two times a month. Half the time it moves north of the equator, and half the time it moves south of the equator. At the point when the moon is the farthest north of the equator (or farthest south) the bulge is shifted also. In Figure 5, one can see places north of 30°N where the Earth would rotate under only one high water bulge. In the real world, the size of a particular basin would determine whether these diurnal tidal periods would dominate over the semidiurnal periods described above. In many places there are

still two high waters a day, but one is larger than the other (and likewise for the low waters); this is referred to as a mixed tide.

Knowing the periods of these and other smaller tidal constituents, which are derived from the relative astronomical motions of the Earth, moon, and sun, one can analyze a data series of water level observations from a particular location. The result of such a harmonic analysis is an amplitude and phase for each of these tidal constituents, which represent how large each effect is at that particular location, and when in time the peak of each effect will take place [for example, relative to when the moon passes over (transits) that location]. The hydrodynamics affect both the amplitude and phase (timing) of each tidal constituent, but we really don't need to know the details of how it happened, only that it did happen. And, as long as the hydrodynamics stay the same, the tide predictions from these calculated harmonic constants (the amplitudes and phases) will be accurate. The hydrodynamics will stay the same as long as the length and depth of the basin stays the same. For small bays, shoaling or dredging can change the hydrodynamics and thus change the tide range and times of high and low waters.

The method of harmonic analysis was first invented by Sir William Thomson (Lord Kelvin) in 1867 and later refined by George

*Continued on Page 27*



### Tides

*Continued from Page 26*

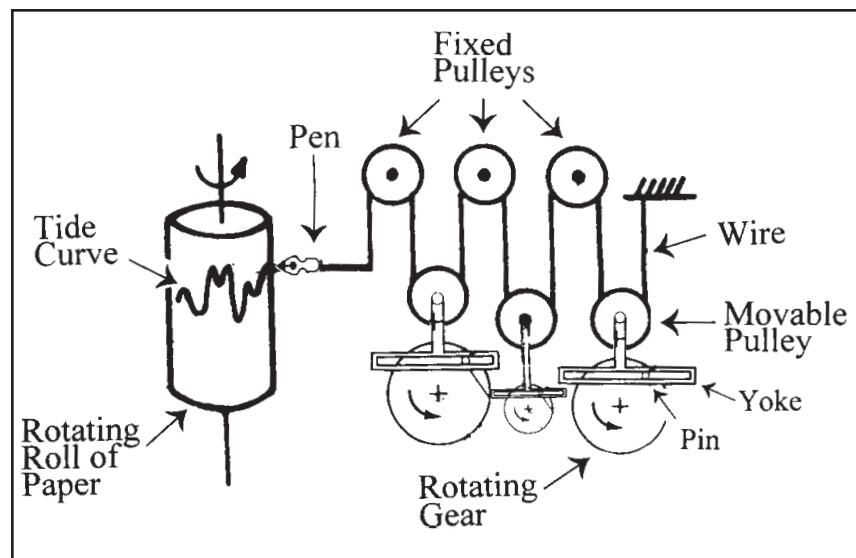
Darwin (son of Charles Darwin). To carry out a tide prediction in that era, long before computers, machines were built with gears and pulleys connected by a wire to a pen. Each tidal constituent had a different size rotating gear and a pin and yoke system connected to a pulley (see Figure 6). The pin and yoke system turned the rotating motion of the gear into a vertical up and down motion of the pulley, which moved the wire over it and thus moved the pen up and down on a roll of moving paper. The wire ran over a number of pulleys so all the constituent effects could be added together. The first tide predicting machine was a wooden model built for Kelvin in 1872, but later models were huge brass machines with dozens of finely made gears and

pulleys. The first one built in the U.S. was by William Ferrel in 1885.

Prior to the use of harmonic analysis, there were other less sophisticated methods based upon recognized relationships between the tides and the movements of the moon and sun. For example, for a particular place, high tide might occur a certain number of hours after the moon was directly overhead, and the highest (spring) tide might occur a certain number of days after full moon or after new moon. In many of the early maritime nations, tide prediction schemes were treasured family secrets passed on to the next generation. One of the earliest tide tables discovered was for London Bridge in the early 1200s.

The earliest recognition of the connection between the tides and

the moon appears to be by a Greek geographer, Pytheas of Massilia, around 325 B.C. Pytheas had traveled from his home in the Mediterranean Sea, which does not have a noticeable tide, to the British Isles, where he observed significant tides and even tried to measure them. Other Greek and Roman thinkers went on to describe many patterns in the tides and their similarity to motions of the moon and sun. Yet no one could come up with an explanation of how the moon and sun actually caused the tide. They were especially confused by there being two high waters a day, one of those occurring in the day when the moon was nowhere to be seen. A variety of strange ideas were proposed. Some regarded the Earth as an animal and attributed the tides to its respiration or to its alternate drinking in and spouting out of water. Others attributed it to the heat of the sun or to river discharges or to winds caused by the sun or moon striking the water. Even those that believed that the moon had to be the cause did not know how. In 1609, Kepler proposed that the tides were due to the gravitational attraction of the moon, but he seemed to think that the second high tide was due to the waters rushing back after the moon had pulled them westward, where they had hit a continent and were freed from the moon's pull as it continued around to the other side of the Earth. It was not until 1687 that Newton, in his book *Principia*, finally explained the cause of the tides, including the reason for two high waters per day.☪



**Figure 6.** A schematic of an early tide prediction machine. Each gear and pulley combination represented one tidal constituent. The wire running over every pulley summed the motions and moved a pen on a moving roll of paper to draw a tide curve.



## Marine Familiarization Float on Board the S/S ARCO FAIRBANKS—January 16-21, 1998

*Dave Hefner, Marine Forecaster  
Fairbanks, Alaska*

**T**he S/S ARCO FAIRBANKS was built by Bethlehem Steel in 1974. The ship is 880 feet long, and on this trip was carrying about 800,000 barrels of oil. This was trip number 556 for the ship. A typical journey of this type from Valdez, Alaska, to Cherry Point, Washington, can be completed in about three and one-half days with good sea conditions. However, this trip took just over five days, as we encountered rough weather and sea conditions along the way.

My trip began at 0400 from Valdez on Friday, January 16, 1998. The weather was beautiful with partly cloudy skies and plenty of stars out. The area was in a typical winter pattern of high pressure over the interior, providing some cold northeast winds.

With a complement of escort vessels, and a harbor pilot on board, we headed out through the Valdez Narrows into Prince

William Sound. With the slower speed limits in the sound, we did not reach Hinchinbrook entrance to the Gulf of Alaska until noon on Friday.

The S/S ARCO FAIRBANKS receives marine facsimile data from both Kodiak and Point Reyes. From Kodiak, they receive the surface analysis and a 36-hour surface forecast, both prepared by the Anchorage forecast office. From Point Reyes, they receive a North Pacific surface analysis (from Japan to California), and a 12- and 24-hour forecast of winds and seas. These charts are all prepared by the National Centers for Environmental Prediction (NCEP), Marine Prediction Center (MPC). They also have access to marine text forecasts via INMARSAT-C SafetyNET.

Second Mate Statler spent quite a bit of time with me talking about weather. He has quite an interest in weather and considers himself

an amateur observer. He was quite knowledgeable of general weather conditions. He said the ship takes an 18Z observation everyday. Their observation equipment consists of a barometer, barograph, thermometers for both air temperature and wet-bulb temperature, and a weather vane and cup anemometer.

Twenty-four hours into the trip, we started hitting swells of 10 to 15 feet. These were obviously swells generated by a distant storm, as we were under partly cloudy skies, with just a hint of layered clouds to the far south. Winds were only 15 to 20 kts. For a while, the swells were hitting us head on, with beautiful displays of water spraying high into the air off the bow. But soon the swells started to hit us at a bit of an angle and the water really started to wash over the main deck. By the time we reached about 55 north

*Continued on Page 29*





### Fam Float

*Continued from Page 28*

latitude, we hit the back side of a strong storm, and winds increased northwest to 50 kts. The seas became quite chaotic, increasing to about 15 to 20 feet. In addition to the seas washing across the

deck, we were receiving quite a bit of sea spray, even up to the windows on the bridge.

The normal cruising speed for this tanker is around 15 kts. For most of Saturday and Sunday we had only been traveling between 5 and 10 kts, putting us quite a bit

behind schedule. By 1000 Sunday, we were only abreast of the northern Queen Charlotte Islands, which is a little short of half way to Cherry Point, Washington. The seas did begin to smooth out, though swells remained 10 to 15 feet. By Monday evening we were only about 150 miles from Port Angeles.

We reached the Straits of Juan de Fuca Tuesday evening. We made a quick stop to pick up the harbor pilot near Port Angeles.

We reached Cherry Point at 0600 Wednesday. Cherry Point is very remote, located on the Washington coast north of Bellingham, and only about 10 miles from the Canadian border. The facilities are located out from moderately sized cliffs, and pipes carry the oil to a refinery at least one-half mile inland. There are two other unloading piers in the area, both being about one-half mile apart. One pier was for unloading bulk cargo, and the other one was for unloading oil. It takes about 24 to 28 hours to unload one of these tankers. Some of the crew told me that the return trip back to Valdez becomes significantly rougher given the same sea conditions, due to riding so much higher out of the water.

I truly enjoyed the trip as it was a real learning experience for me to see how marine conditions can vary on the open sea, especially the north Pacific. I appreciated the opportunity to sail with the crew of the S/S ARCO FAIRBANKS on this trip.∩



**Photo of inbound tanker in Prince William Sound heading for Valdez to pick up a load of crude oil. Picture taken from the bridge of the outbound S/S ARCO FAIRBANKS.**



**Photo taken from the bridge of the S/S ARCO FAIRBANKS during a storm in the North Pacific en route to Cherry Point, Washington.**



## Northeast Pacific Cooperative Drifter Program

*Michael K. Burdette*  
*National Data Buoy Center*

United States and Canadian forecasters are continually challenged in their efforts to prepare accurate forecasts for the coastal areas of the Northeast Pacific. The Gulf of Alaska and the North Pacific are well known as areas for development and intensification of major storm systems which pose a moderate to severe threat to the coastal and land areas of the U.S. and Canada. Although the Northeast Pacific is well served by U.S. and Canadian moored buoys and Voluntary Observing Ships, large expanses of ocean still exist where little meteorological information is available to forecasters.

This noted lack of meteorological observations, along with the

associated risk, was severely felt on October 11, 1984, when an under-forecasted, rapidly deepening storm, a "marine bomb," struck the West Coast of Canada, resulting in the loss of seven fishing vessels and five lives. Subsequent investigation into the incident, known as the "Le Blonde Report," highlighted the importance of understanding the physics of rapidly deepening storms, and developing methods for early detection. One action addressing requirements identified in the report was to supplement the existing moored buoy networks on the west coast with drifting buoys that could measure needed parameters such as wind speed and direction, pressure, and sea state, as future developments allowed.

Since that time, Environment Canada has attempted to maintain a network of 10-12 drifting buoys in the Northeast Pacific as an early warning network. The National Data Buoy Center (NDBC) has also deployed a few drifters in the area for other unrelated projects. Over the years, however, it has been difficult for Environment Canada to maintain the network with little or no assistance.

In 1997, the Atmospheric Environment Branch of Environment Canada contacted NDBC, recommending a joint effort to deploy and maintain a drifter array for three years. The resulting network would be larger, more reliable, and

*Continued on Page 31*



## Drifter Program

*Continued from Page 30*

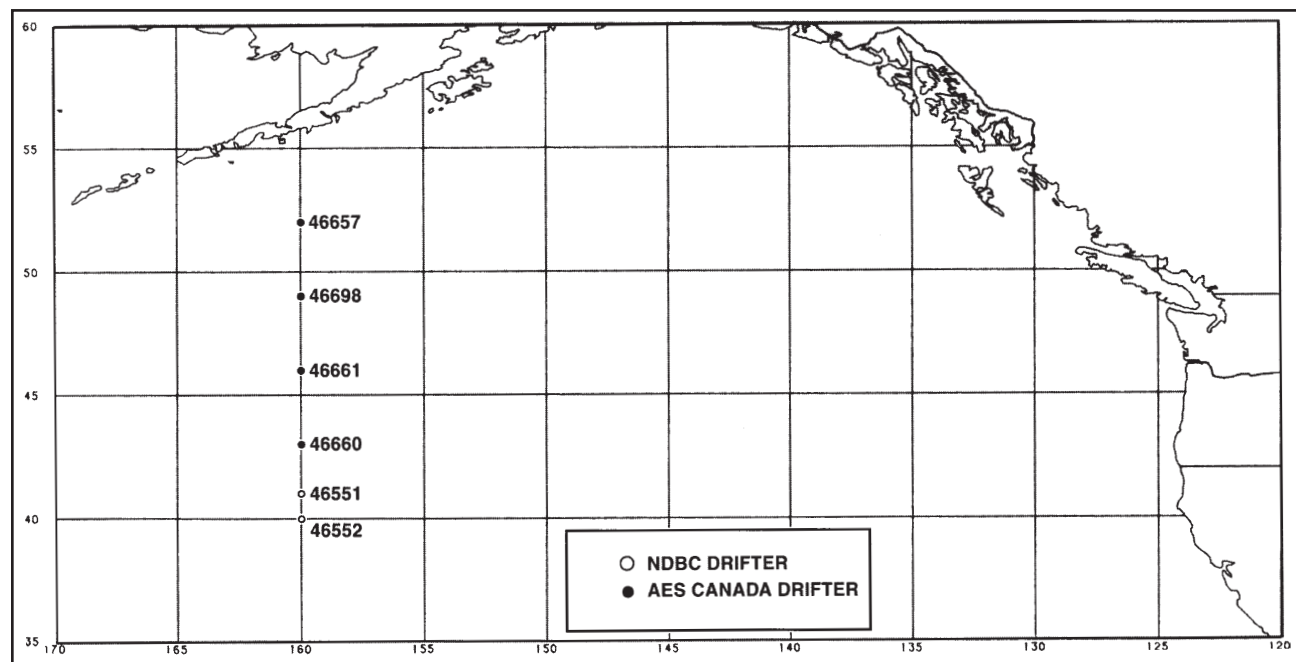
more valuable than either could support individually.

In September 1998, the first six deployments were successfully made. Drifters measuring wind speed and direction, barometric pressure, air temperature, sea temperature, and location were placed along 160W longitude, at 40N, 41N, 43N, 46N, 49N, and 52N latitudes. The buoys are expected to slowly drift towards the west coast of the U.S. and

Canada over the next two years. They will report through the Polar Orbiting Environmental Satellites, with data being distributed through Service Argos to the Global Telecommunications System. Data will be available to all west coast forecasters on the SSVX08 header. Marine interests should note that the data will also be plotted on standard National Centers for Environmental Prediction (NCEP) Surface Analysis Charts. One important point to be kept in mind when analyzing the data is that the winds are measured at one meter above the sea

surface and contain no adjustment to the standard 10-meter observation height. If not adjusted to 10-meter height for use, the data will show a low wind speed bias.

NDBC and Environment Canada are expecting to add additional buoys to the array over the next two years. As current buoys drift slowly towards the coastlines of the U.S. and Canada, additional buoys will be deployed behind them. The result will be a comprehensive buoy array stretching from 160W toward the coastlines in 1999 and 2000.∩



Under the Northeast Pacific Cooperative Drifter Program, six drifting buoys were deployed in September 1998. This is a joint U.S. and Canadian effort. More buoys will be deployed over the next two years.



## Marine Weather Review North Atlantic Area April–July 1998

*George P. Bancroft  
Meteorologist  
Marine Prediction Center*

Like the North Pacific, the North Atlantic experienced its most active weather early in April. A series of frontal waves moved east or southeast from near the Canadian Maritimes, into the base of a mean upper low (trough) southeast of Greenland and amplified. The strongest of these became an intense storm in the eastern Atlantic, dropping 31 mb in 24 hours from 12Z April 1 to 12Z April 2, therefore qualifying as a meteorological “bomb” (see Figure 1). In the second panel or part of Figure 1, the storm has almost finished deepening, and actually bottomed out at 954 mb at 18Z April 2. This was the most intense storm in the North Atlantic during this April to July period. Note the 60 kt west wind southwest of the center. It is conceivable that this storm produced

hurricane force winds in the strongest portion of the storm. The third panel of Figure 1 shows the storm slowing. The system subsequently became stationary over Great Britain, increasing in size and dominating much of the eastern North Atlantic until April 8. This storm developed seas of 16 ft or higher from Great Britain south to near 40N in the eastern North Atlantic, with a maximum of 43 ft (13 meters) in the Bay of Biscay on April 3.

Figure 1 also shows a change in the upper air pattern in the western Atlantic to a trough near the U.S. east coast which continued into June, supporting a series of lows moving off the east coast, while a ridge developed in the eastern North Atlantic. Split flow over the western North Atlantic and parts of North America was apparent

during this period, with separate northern and southern jet streams, perhaps the remnants of El Niño. This also led to cutoff lows at southern latitudes. Figure 2 is an example from this period, showing a separate 500 mb northern stream sending short wave troughs east and northeast toward the Greenland area, with associated surface development. A low is moving off the east coast and a cutoff low is shown forming near 33N 35W, with developing gale conditions. East coast low pressure developments beginning late in April remained below storm strength. However, one long-lasting low, cut off at southern latitudes, off the Carolinas on May 11 remained for several days, resulting in a large area of north-

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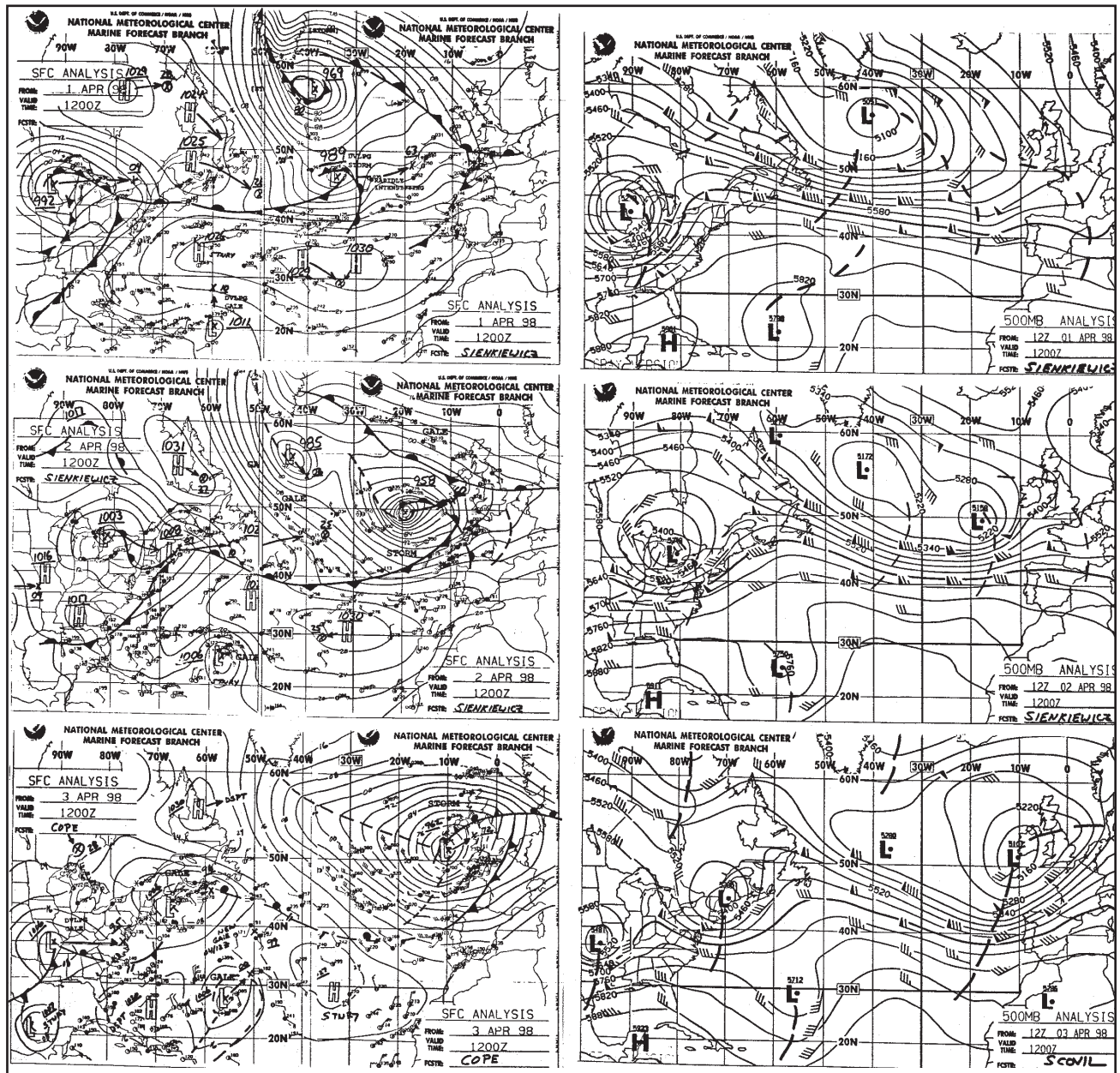


Figure 1. Three-panel display of surface and 500-mb analysis charts produced by the MPC for the dates April 1, 2, and 3, valid at 12Z, showing development of the most intense storm of the April to July 1998 period.





## Marine Weather Review

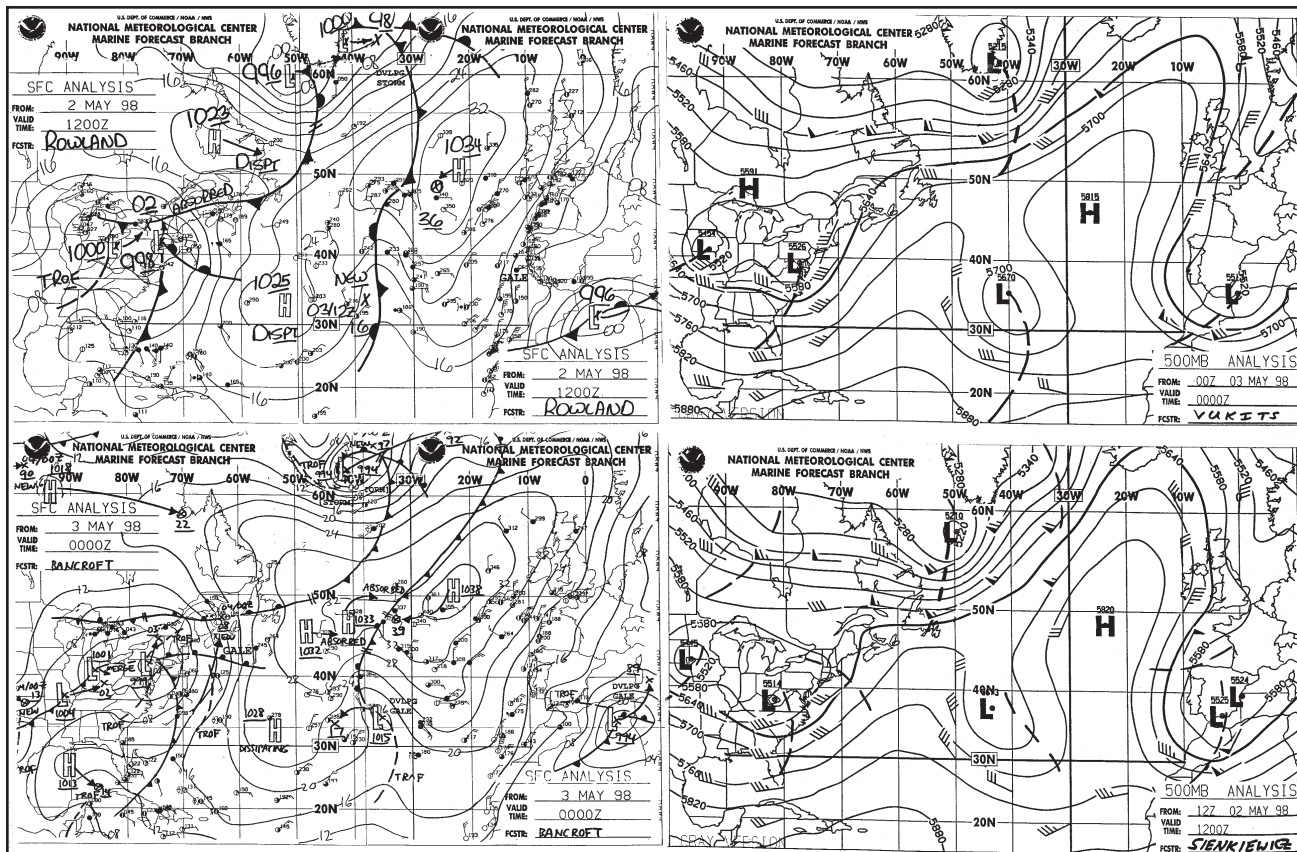


Figure 2. Two-panel display of surface analysis and corresponding 500-mb charts for 12Z May 2 and 00Z May 3, 1998, showing “split flow.”

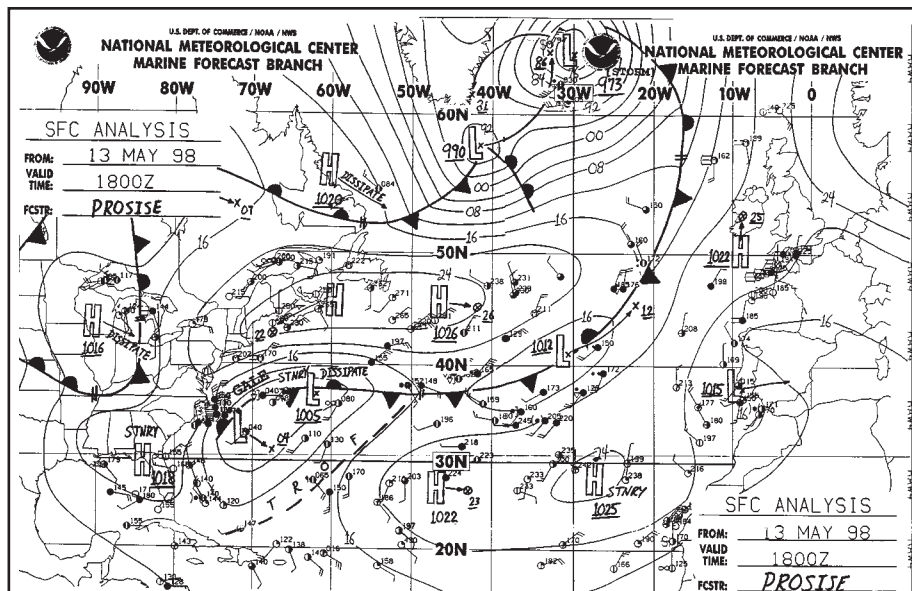


Figure 3. Surface analysis for 18Z May 13, 1998, showing a large cutoff low with gale winds off the east coast of the U.S.



### North Atlantic Area *Continued from Page 32*

east gales over the western and northern offshore waters (Figure 3). Highest reported seas were 16 to 23 ft (5 to 7 meters). This system started to weaken on the 15th, but took until the 18th of May to move out and pass east of Newfoundland.

By early June, a blocking area of higher pressure in the Greenland area resulted in slow moving systems out of the northeastern

U.S. to the Canadian Maritimes with winds of gale strength or less. One of these moved slowly from New England on June 3 as a complex gale, taking a week to reach Great Britain. The blocking receded north by the middle of June, allowing systems to turn north toward the Labrador Sea. The strongest of these moved off the New England coast on June 27 and intensified. Figure 4 depicts this development over a period of 30 hours to a mature system with strong gales reported around the

south, west, and north sides at 06Z June 29. This was the system closest to being a storm in MPC's portion of the North Atlantic during the June to July period, a time when cyclonic activity is approaching a minimum for the year.

### Reference

Joe Sienkiewicz and Lee Chesneau, *Mariner's Guide to the 500-Millibar Chart* (Mariners Weather Log, Winter 1995).<sup>1</sup>

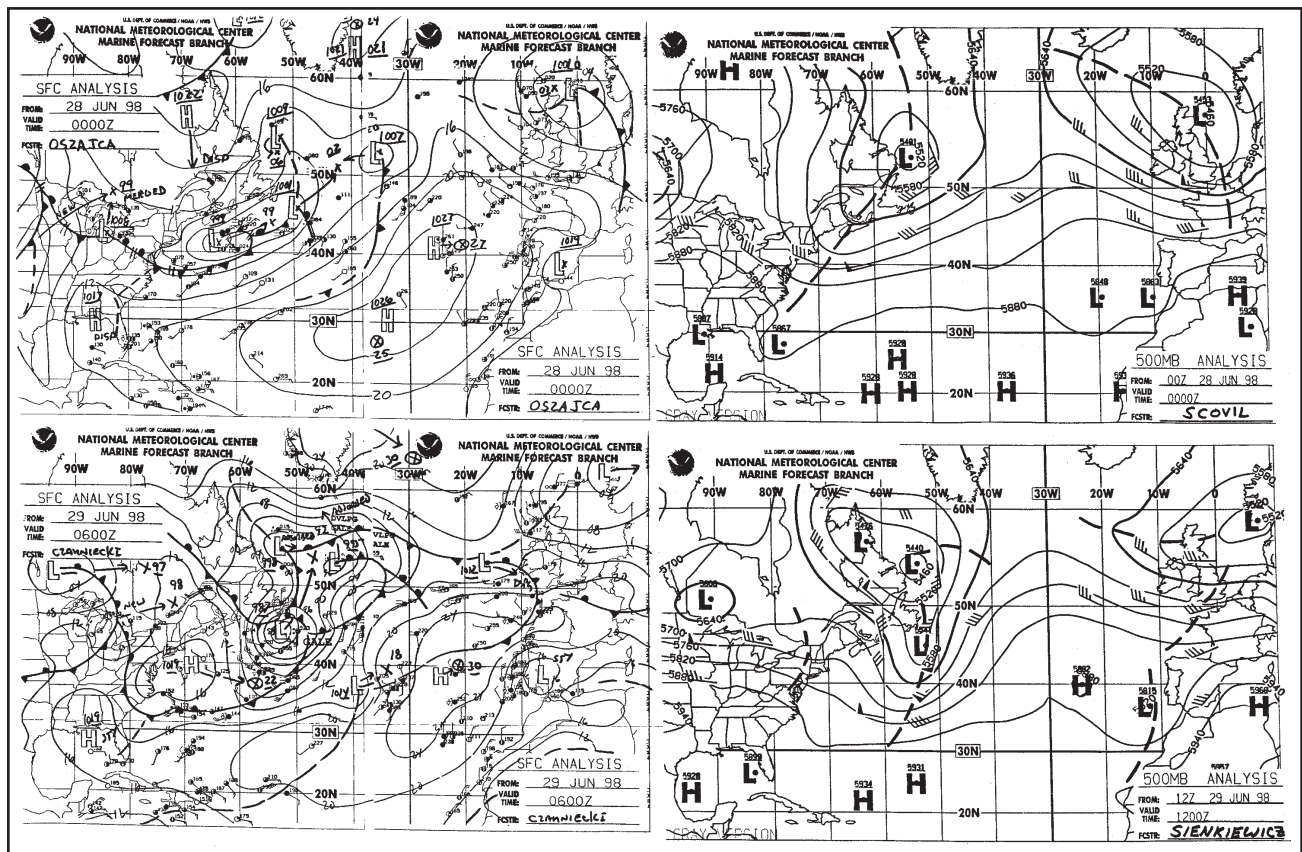


Figure 4. Two-panel display of surface and 500-mb analysis charts showing the development of a strong gale of June 28 at 00Z to June 29 at 06Z. The analysis time of 06Z was chosen for the second-panel surface analysis to show the system at maximum development.

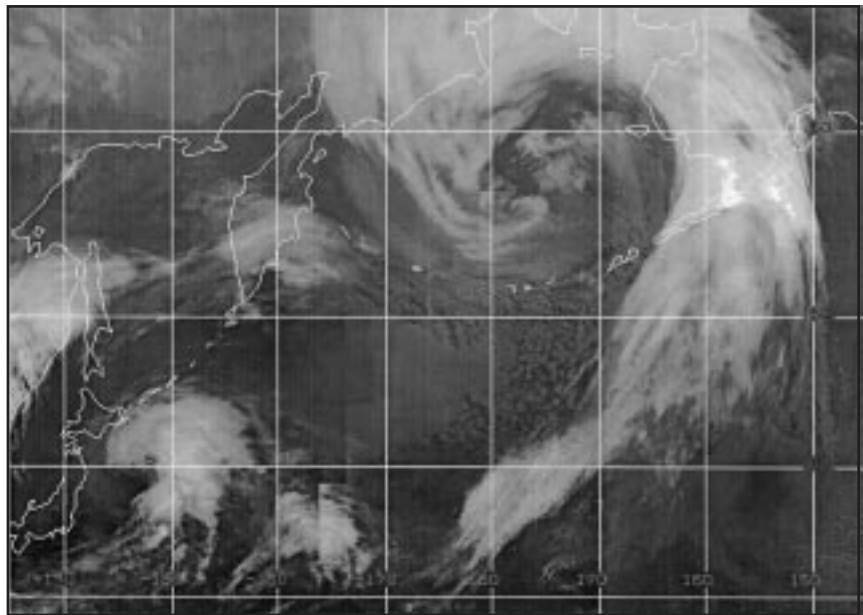


## Marine Weather Review North Pacific Area April–July 1998

*George P. Bancroft  
Meteorologist  
Marine Prediction Center*

The weather pattern over the North Pacific was unusually active in April and May, with developing lows frequently tracking from near Japan to the Bering Sea, with some of these passing or redeveloping south of the Alaska Peninsula. April began with a weakening gale, formerly a storm, in the northern Bering Sea, with residual swells reported in the 20 to 32 ft range (6 to 10 meters) around the eastern Aleutians both on the North Pacific and Bering sides. The ships at 54N 170W and 54N 163W both reported 32 ft seas (10 meters) and west winds of 40 kt. This system was soon replaced by a rapidly intensifying developing storm, depicted in the first panel

*Continued on Page 40*



GMS infrared satellite image of Bering Sea storm of April 9-10, 1998. Note the broad frontal cloud band with high (cold) tops northwest, north, and east of the storm center. The storm was near maximum intensity and centered near 58N 177W with 956 mb central pressure at the time of the image (2345 UTC 09 April 1998).



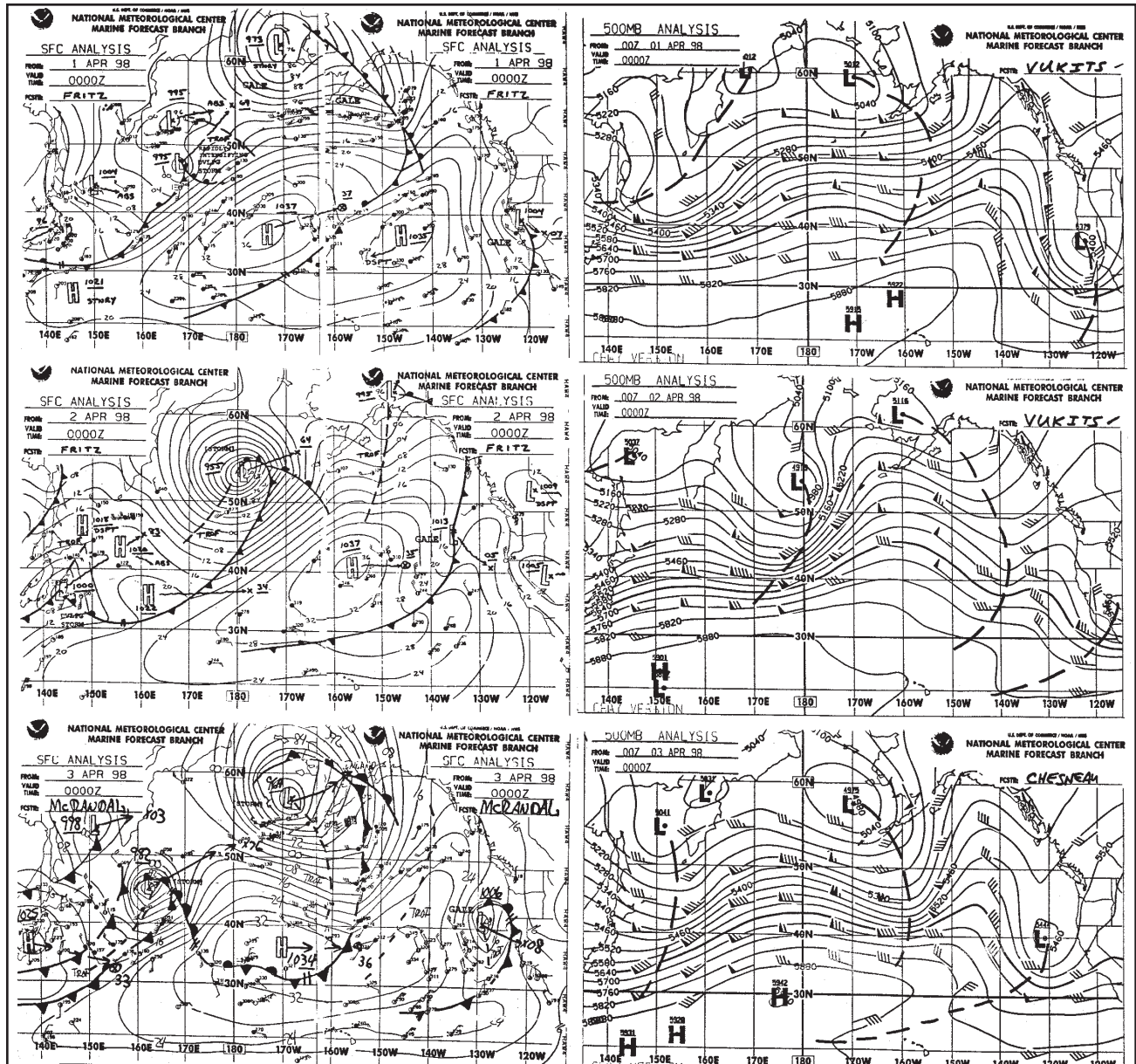


Figure 1. Three-panel display of surface and 500-mb analysis charts produced by MPC for the dates April 1, 2, and 3, 1998, with valid time 00Z.

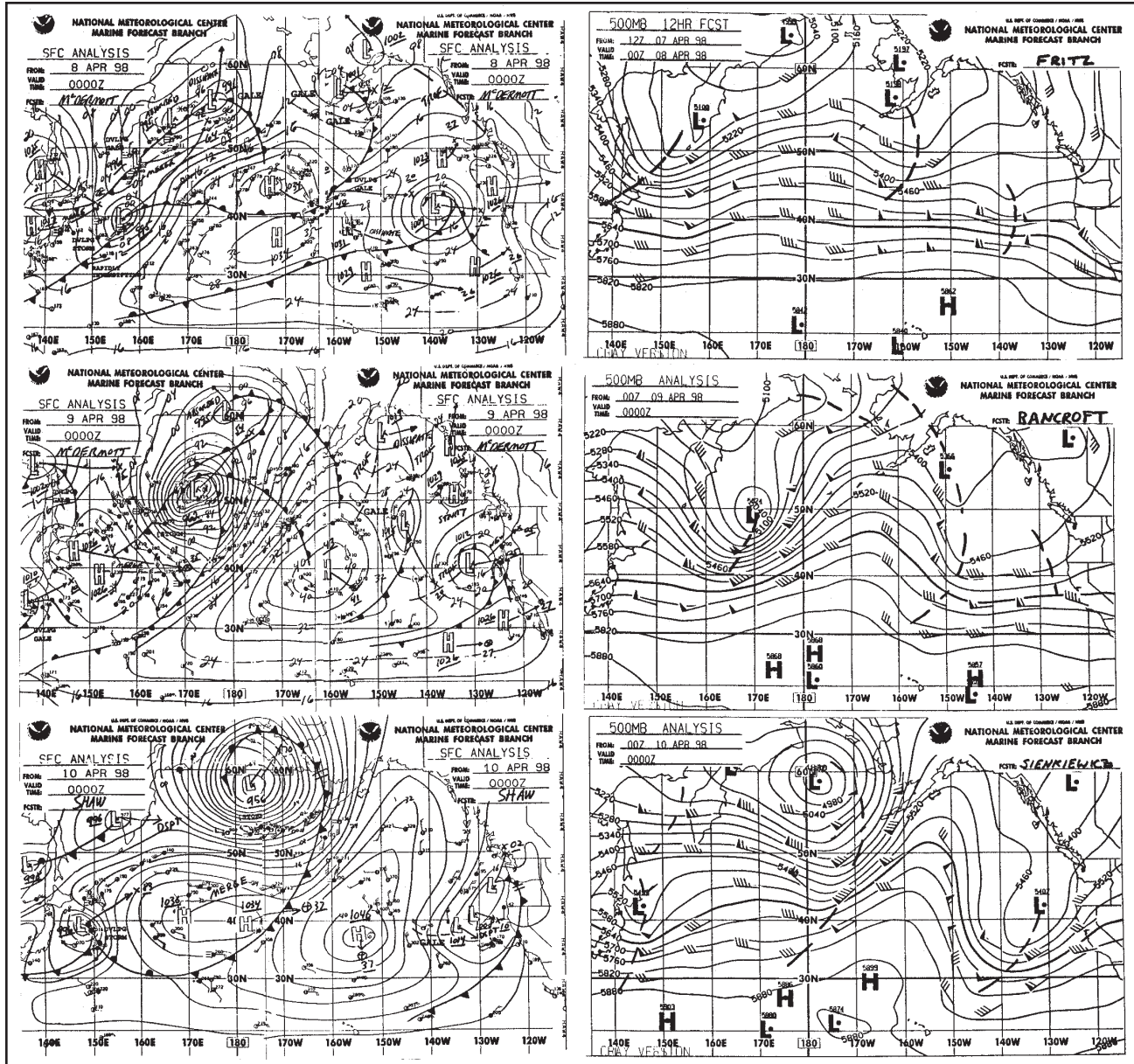


Figure 2. Three-panel display of surface and 500-mb analysis charts produced by MPC for the dated April 8, 9, and 10, 1998, with valid time 00Z. The 500-mb chart valid for 00Z April 8 is a 12-hour forecast from a computer model used in this case in lieu of a 500-mb.



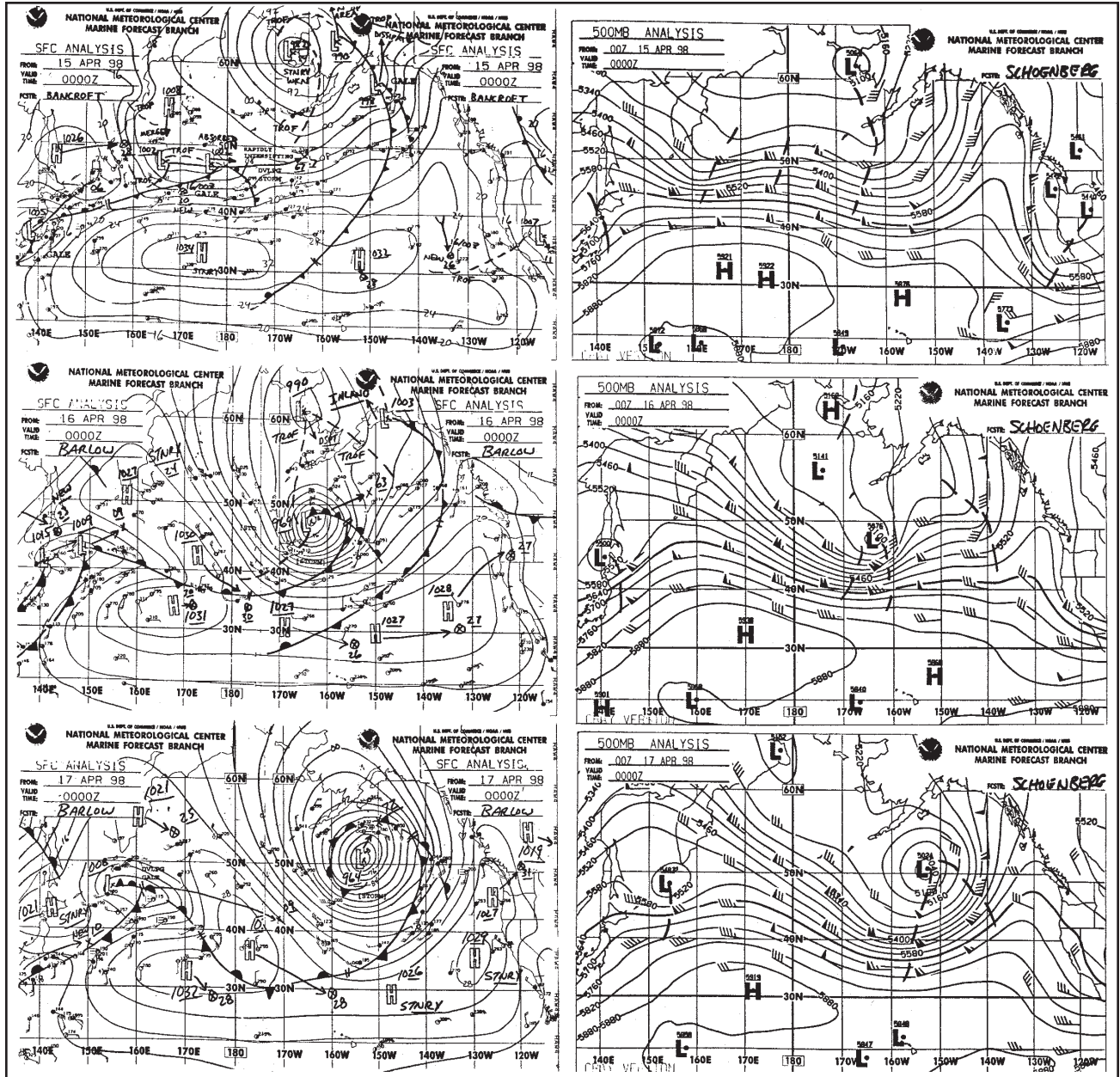


Figure 3. Three-panel display of surface and 500-mb analysis charts produced by the MPC for the dates April 15, 16, and 17, 1998, with valid time 00Z.



### North Pacific Area *Continued from Page 36*

of Figure 1, approaching the western Aleutians at the start of April. The second two panels of Figure 1 show intensification of a 500 mb low. Storm force winds were observed by 12Z April 1 ahead of the front south of the center near 50N 173E. Central pressure dropped from 995 mb at 00Z April 1 to 955 mb at 00Z April 2, bottoming out at 954 mb at 06Z April 2, with the center moving through the southern Bering Sea. A southwest wind of 60 kt was observed southeast of the center at 53N 176W along with 43 ft seas (13 meters). Note

the ship reports in the third panel of Figure 1 with 45 to 60 kt in the southern Bering Sea at 00Z April 3. The ship at 54N 174W reported west winds 60 kt and also reported the highest seas in this event, 56 ft (17 meters). At 00Z April 2, buoy 46035 56N 178W reported an 8-minute average wind of NE 45 kt. By 00Z April 3, gale force winds and seas to 23 ft (7 meters) extended down to 42N south of the eastern Aleutians as this system started to weaken in the southeast Bering Sea.

A similar rapid development in the western Pacific occurred on April 8-10 as depicted in Figure 2. A

storm developed 18 hours later near 50N 167E at 978 mb with a ship reporting NW 55 kt winds and 30 ft seas (9 meters) southwest of the center at 48N 163E (not shown). The storm center moved northeast and deepened to 958 mb by 18Z April 9. Winds of 45 to 60 kt and 33 to 50 ft seas (10 to 15 meters) were reported from ships around the central and eastern Aleutians and southwest Gulf of Alaska on April 9. The third panel of Figure 2 shows the system near maximum intensity at 00Z April 10. By 18Z April 10, the system was weakening to a

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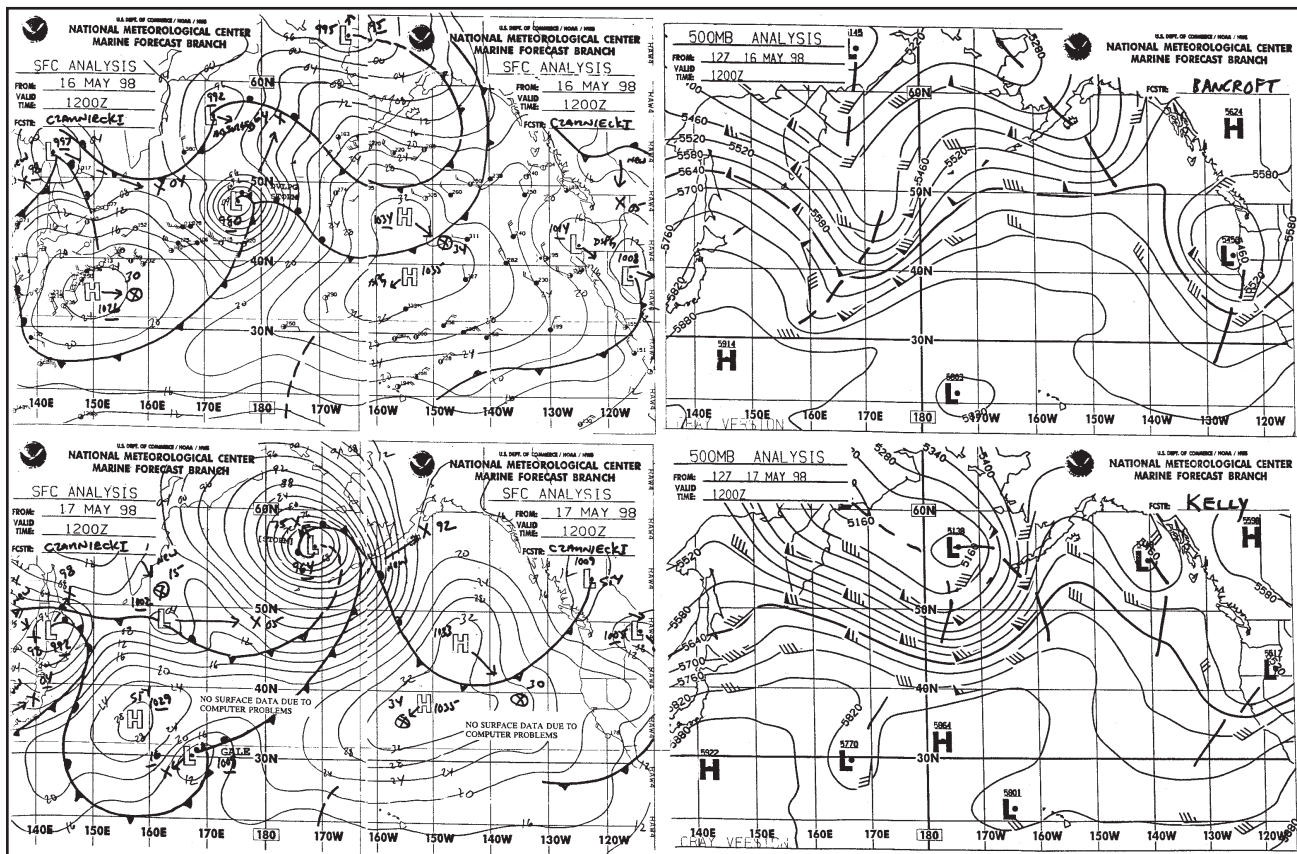


Figure 4. Two-panel display of surface and 500-mb analysis charts valid May 16 and 17, 1998, at 12Z.



### North Pacific Area

*Continued from Page 40*

gale in the northern Bering Sea, but a ship south of the center was still reporting a SW wind of 45 kt and 52 ft seas (16 meters).

In mid-April the only storm of the month to move into the northeast Pacific and pass south of the eastern Aleutians developed from a frontal wave south of the western Aleutians on the 14th near 47N 174E. The storm developed rapidly by 18Z on the 15th near 47N 169W, with a pressure of 975 mb. Figure 3 shows this development. At 00Z April 17, ship reports show winds of 45 to 55 kt south of the center, and seas were 23 to 36 ft (7 to 11 meters). The lowest pressure was 958 mb six

hours before map time of the third panel of Figure 3. The center then drifted northeast into the Gulf of Alaska and weakened on the 18th, while secondary development on a front southwest of the old system subsequently spun up another storm near 48N 145W, although not as strong (976 mb at 06Z April 20).

Subsequent storm development occurred in the northwest Pacific late in April and into May, with systems tracking northeast into the Bering Sea. The strongest of these is shown in Figure 4 as northern and southern systems combine to form a storm, unusually intense for May, in the southeast Bering Sea by 12Z on May 17. Ship reports showed 50 kt winds near

the eastern Aleutians at 00Z May 17 (not shown) and seas up to 25 ft (8 meters) in the eastern Bering Sea on May 17th and 18th. This was the last system of the 1997-98 fall-winter-spring period with storm force winds in MPC's North Pacific area.

In June, lows tracked east along the latitude of Japan then turned northeast toward the eastern Aleutians and western Gulf of Alaska, blocked by an upper ridge over the eastern Pacific. The strongest of these intensified to 975 mb as it moved north to the Alaska Peninsula and developed winds of 35 to 45 kt and seas 20 to 25 ft (6 to 8 meters) on June 7-8. See Figure 5. The north portion of

*Continued on Page 42*

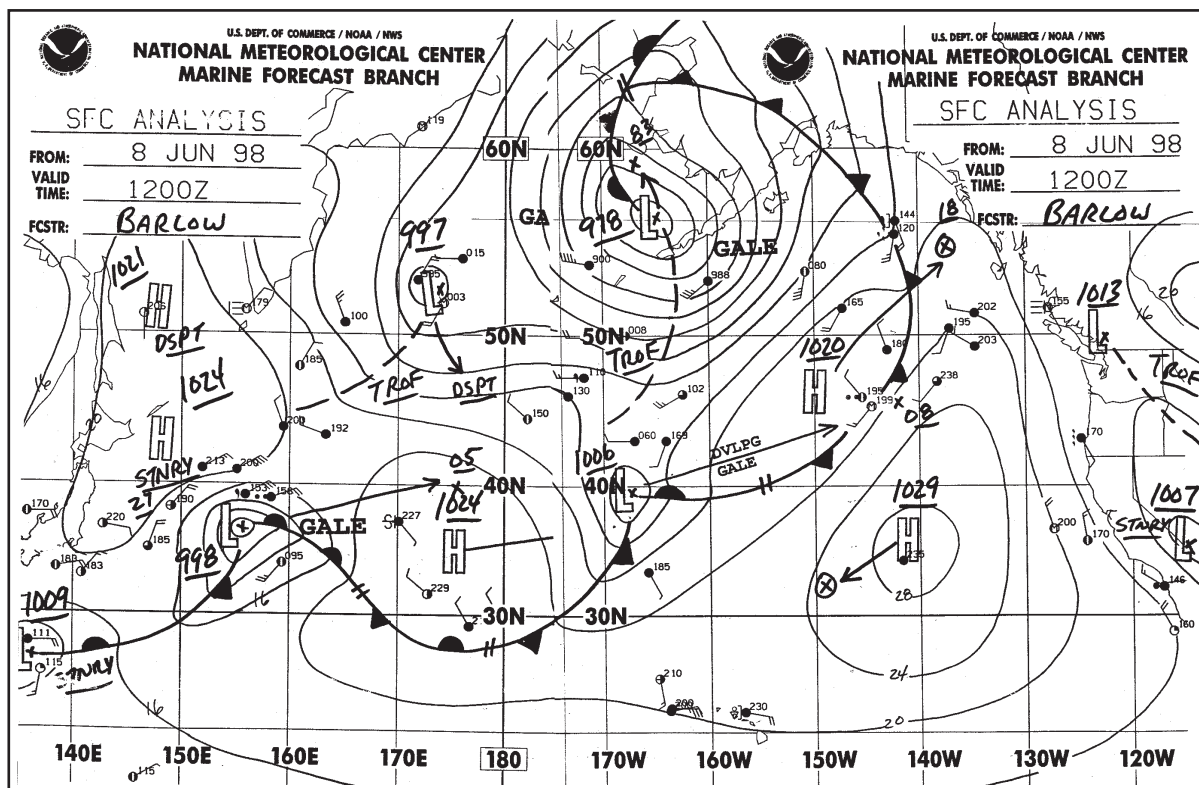


Figure 5. Surface analysis valid at 12Z June 8, 1998.





### North Pacific Area

*Continued from Page 41*

the upper ridge weakened in mid-June, allowing lows to move into the eastern Gulf of Alaska. By June's end, cyclonic activity weakened and much of the North Pacific was dominated by high pressure.

In July, the eastern Pacific ridge shifted west and allowed the westerlies to shift unusually far south for July off the west coast of North America. A series of lows moved from well west of northern California to the coast near Vancouver Island. The first panel of Figure 6 shows the pattern, a deep trough aloft over the north-east Pacific. The strong short wave trough approaching the coast is associated with the gale center approaching the British Columbia coast (second panel of Figure 6) with 40 kt south winds reported in the Vancouver Island and Washington offshore waters. Around this time, another deep upper trough was near Japan and supported the development of the deepest low of July on a front off Japan. The low deepened briefly to 984 mb when over the warm Kuroshio Current (third panel of Figure 6) before moving north toward the Kamchatka Peninsula and weakening.

### Reference

Joe Sienkiewicz and Lee Chesneau, *Mariner's Guide to the 500-Millibar Chart* (Mariners Weather Log, Winter 1995).⚓

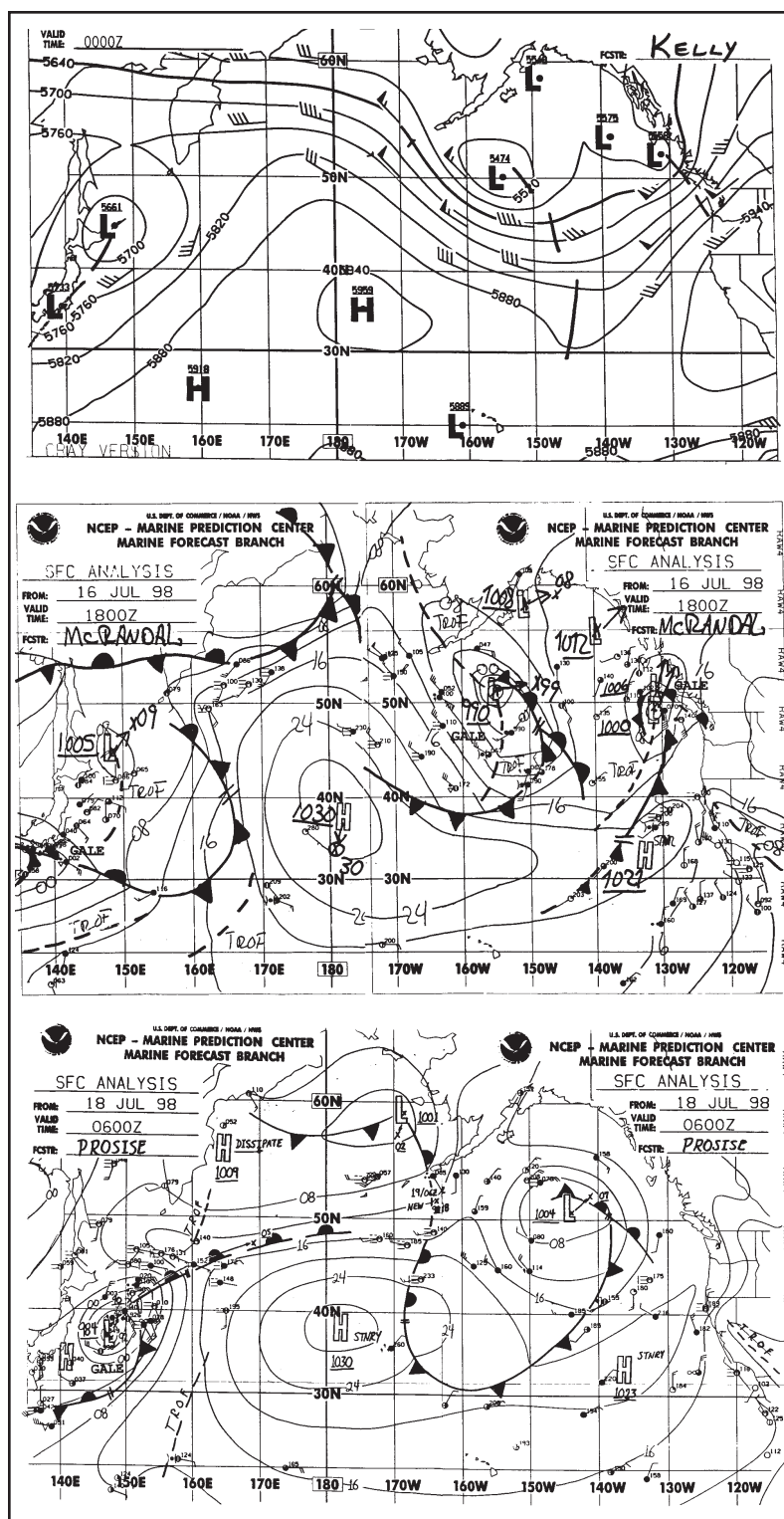


Figure 6. A 500-mb analysis valid at 00Z July 17, 1998, plus a surface analysis valid six hours prior to this time, and a third chart which is a surface analysis valid at 06Z July 18, 1998, showing significant July weather events.





## Marine Weather Review

### Tropical Atlantic and Tropical East Pacific Areas

### May–August 1998

*Dr. Jack Beven  
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Tropical Analysis and Forecast Branch  
Miami, Florida*

#### I. Introduction

A combination of a waning El Niño and the normal northward movement of the jet stream ended the series of strong winter storms in the TPC area. The Atlantic and Eastern Pacific Hurricane seasons both started slowly; however, by the end of August, both basins were showing near normal activity.

#### II. Ship Encounters with Tropical Cyclones

Ships generally avoid tropical cyclones, especially the central core region. Forecasts and warnings transmitted by radio facsimile and the International SafetyNET service usually enable ships to take evasive action long before encountering the storms. However, ships occasionally wind up in the core of a tropical cyclone.

The greatest example of this occurred on 18 August 1927, when a ship measured an 887 mb pressure in a western Pacific typhoon. This is apparently a record low pressure measured by a ship. All lower pressures in tropical cyclones have been measured by reconnaissance aircraft.

A more recent example was on 6-7 September 1995, when the TEAL ARROW sailed into the eye of Atlantic Hurricane Luis. The ship reported a minimum pressure of 942 mb at 1800 UTC 6 September, which was very close to that reported by aircraft. It estimated 125 kt wind gusts and 50 ft seas as it passed through the eyewall.

Another example occurred on 25 August 1998, when the BRITISH HAWK sailed through the center of Hurricane Bonnie (Table 1).

The ship reported maximum sustained winds of 75 kt at 1200 UTC, with a minimum pressure of 965.8 mb three hours later. The data suggest the ship was inside Bonnie's large and poorly defined eye. However, no maximum wind or minimum pressure data is available between the observations. Maximum combined seas reported by the ship were 33 ft at 1800 UTC.

If a ship does encounter the core of a tropical cyclone, the crew should try to document the encounter as best as possible. The TPC normally asks for three hourly ship reports within 300 nm of a tropical cyclone. However, a ship in the core should try to report every hour to provide the TPC (or other warning centers) with the best possible information. Peak conditions between reports

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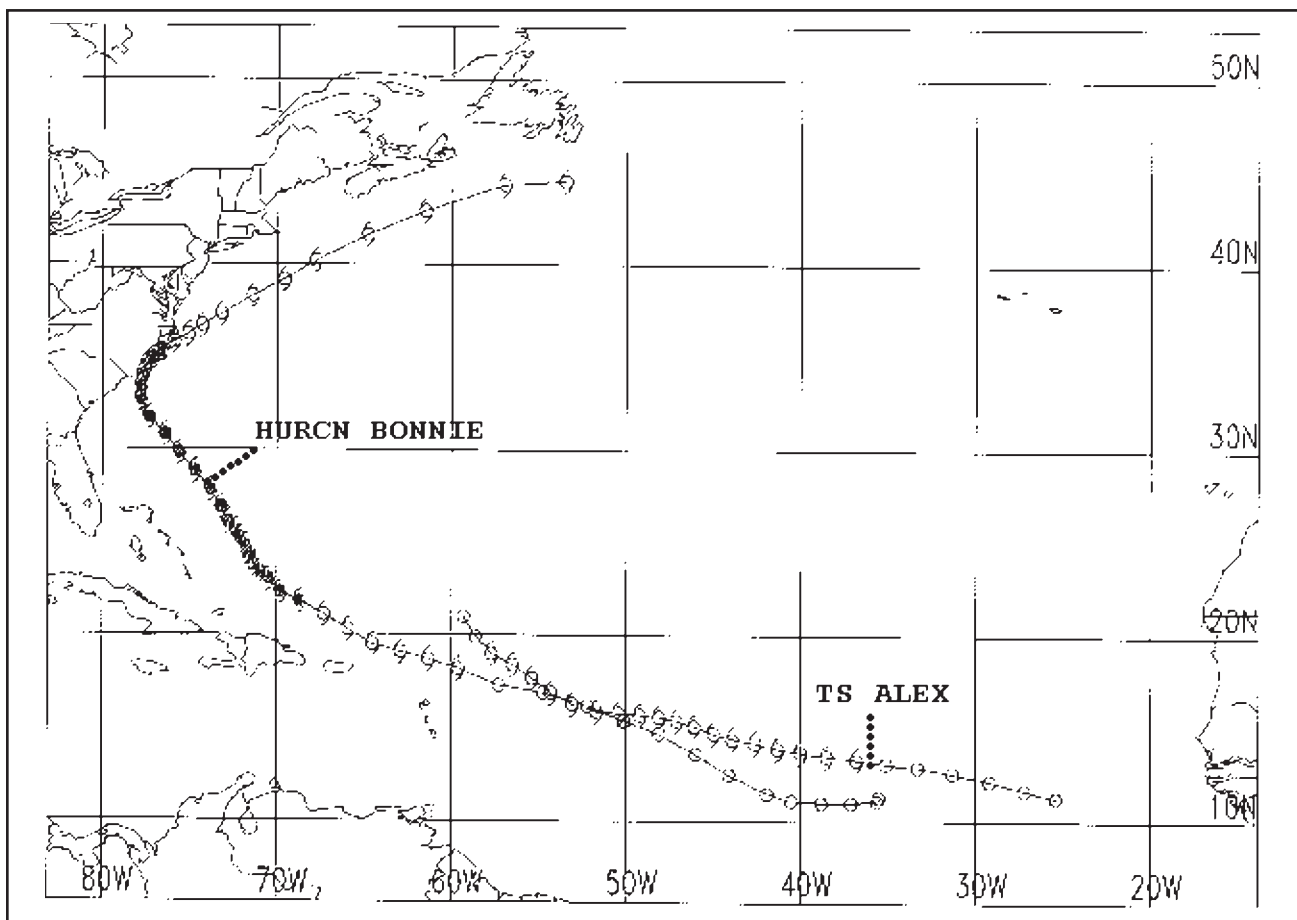
| Time<br>(UTC) | Lat.<br>(°N) | Lon.<br>(°W) | Wind Dir./<br>Speed (kt) | Pressure<br>(mb) |
|---------------|--------------|--------------|--------------------------|------------------|
| 0900          | 29.7         | 74.7         | 050/60                   | 997.7            |
| 1200          | 29.7         | 74.9         | 060/75                   | 980.3            |
| 1500          | 29.2         | 75.3         | 290/50                   | 965.8            |
| 1800          | 29.1         | 74.9         | 200/70                   | 991.0            |
| 2100          | 29.3         | 74.2         | 180/50                   | 1001.9           |

### Tropical Prediction Center *Continued from Page 43*

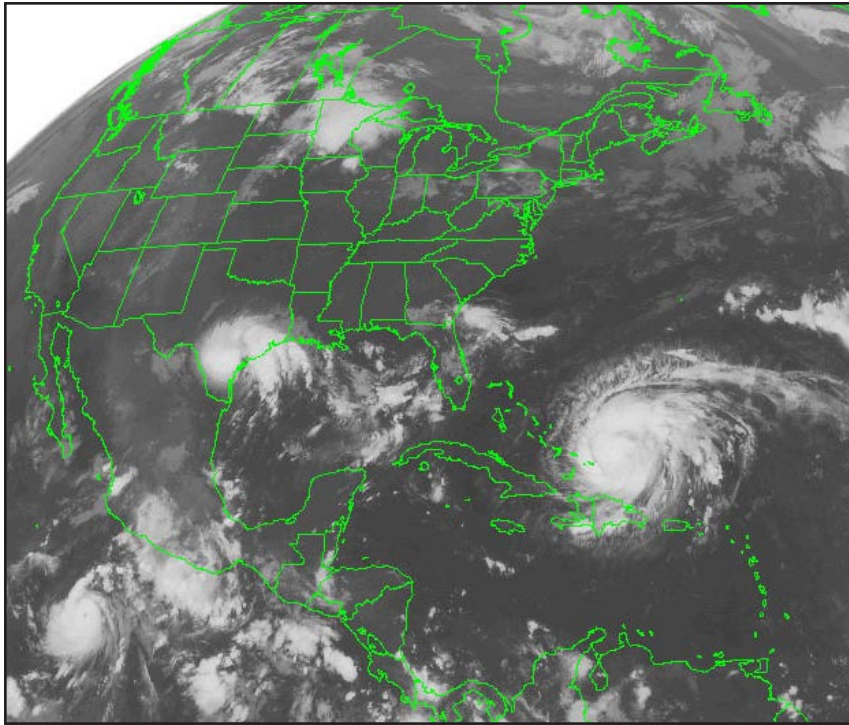
should be noted in plain language remarks whenever possible. If such observations are not possible, the ships' Captain or weather observer could mail the TPC (or other warning centers) a log of the observations after the fact. This would prove useful in the TPC's post-analysis of the storm.

*Continued on Page 45*

**Table 1. Meteorological data reported by the BRITISH HAWK during its encounter with Hurricane Bonnie, August 25, 1998.**



**Figure 1. Preliminary tracks for Tropical Storm Alex and Hurricane Bonnie. Open circles represent tropical disturbance or tropical depression phase. Open symbols are tropical storm phase, while shaded symbols are hurricane phase.**



**Figure 2. GOES-8 infrared image at 1215 UTC 22 August. Hurricane Bonnie is near the southeastern Bahamas, while Tropical Storm Charley is making landfall in Texas. Hurricane Howard is intensifying in the Pacific. Image courtesy of the National Climatic Data Center.**

**Tropical Prediction Center**  
*Continued from Page 44*

### **III. Significant Weather of the Period**

A. Tropical Cyclones: The Atlantic produced two hurricanes and three other tropical storms during the May-August period, with the third storm (Earl) reaching hurricane strength in September. The Eastern Pacific produced eight named storms, of which five reached hurricane strength. There was also one Eastern Pacific tropical depression.

All information on the storms is preliminary and all times are UTC.

#### *1. Atlantic*

**Tropical Storm Alex:** A tropical wave moved off the African coast on 26 July (Figure 1). It became Tropical Depression One near 12N 27W the next day. Moving generally west, the cyclone reached tropical storm strength early on 29 July. Alex continued generally west through 31 July, then turned west-northwest on 1 August. An unfavorable environment limited strengthening, and Alex reached a peak intensity of 45 kt during the 30 July-1 August period. Steady weakening then occurred, and Alex dissipated near 21N 60W late on 2 August.

Alex never affected land during its life, and most ships avoided the cyclone. However, ship FNPH (FORT DESAIX) reported 64 kt winds (believed to be convective gusts) north of the center at 1800 UTC 1 August. Ships ELLE9 (CAPE HORN), 3ENX9 (ROYAL STAR), and ELVV2 (name unknown) encountered Alex just as it was developing, and their observations were invaluable in determining that a depression had formed.

**Hurricane Bonnie:** A large tropical wave gradually organized over the eastern and central tropical Atlantic in mid-July. It became Tropical Depression Two near 16N 51W on 19 August (Figure 1). Moving rapidly west-northwest, the system reached tropical storm strength just northeast of the Leeward Islands on 20 August. Bonnie continued a slower west-northwest track on 21-22 August, with the storm reaching hurricane strength on 22 August (Figure 2). The hurricane slowed to an erratic northwest drift on 23-24 August while just east of the Bahama Islands. It reached its peak intensity of 100 kt on 24 August and maintained this intensity until it made landfall. A north-northwest motion developed on 25 August, with a turn to the north on 26 August. This brought Bonnie's center to the North Carolina coast at Cape Fear late on 26 August.

Bonnie slowed again as it made landfall and turned northeast. It

*Continued on Page 46*



### Tropical Prediction Center

*Continued from Page 45*

was not until early on 28 August that the center moved back into the Atlantic near Manteo, North Carolina. Bonnie weakened to a tropical storm over land, but regained minimal hurricane strength as it moved offshore. Slow weakening occurred as Bonnie moved generally northeast, with the storm passing just south of Sable Island early on 30 August. Bonnie became extratropical later that day near 45N 52W.

Bonnie's large circulation affected the Leeward Islands, the Virgin Islands, Puerto Rico, the Bahamas, and the eastern parts of North and South Carolina. It also affected many ships, buoys, and automated stations besides the BRITISH HAWK. The Coastal Marine Automated Network (C-MAN) station at Frying Pan Shoals, North Carolina, reported a 10-minute average wind of 76 kt, with a gust to 90 kt between 2000-2100 UTC 26 August. The station reported a minimum pressure of 964.6 mb at 1700 UTC. The SABRINA reported 60 kt winds with 75 kt gusts on 26 August, along with 23-26 ft seas. An oil rig near Sable Island reported 65 kt winds above the surface at 0300 UTC 30 August. Finally, a reconnaissance plane reported a 954 mb central pressure at 0151 UTC 24 August.

Bonnie is blamed for three deaths at this time. Damage figures are still incomplete, but may be in the hundreds of millions of dollars.

Bonnie was one of the most researched hurricanes in history. Five NOAA and NASA research planes flew experimental missions in and around the storm. They were aided by the NASA Tropical Rainfall Measuring Mission (TRMM) satellite.

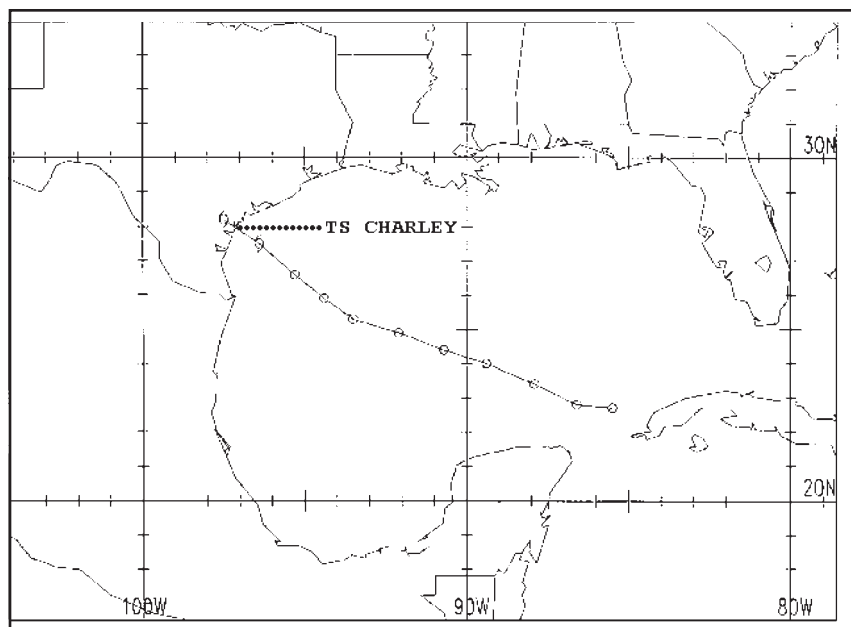
**Tropical Storm Charley:** A tropical wave accompanied by a broad area of low pressure moved into the southeast Gulf of Mexico on 19 August. The low moved west-northwest and organized into a tropical depression near 26N 95W on 21 August (Figure 3). The depression continued west-northwest and became Tropical Storm Charley later that day. Charley steadily strengthened to a peak intensity of 50 kt as it made landfall on 22 August just north of Port Arkansas, Texas (Figure 2). The storm turned west and weak-

ened to a low pressure area over south Texas later that day. While this was the end of Charley as a tropical cyclone, the remnant low continued to spread heavy rain through south Texas, causing severe flooding in Del Rio and elsewhere along the Rio Grande.

Oil Rig K7R8 reported 40 kt winds with gusts to 50 kt above the surface at 1647 UTC 21 August. Several additional reports of 40-60 kt gusts were received from the middle and upper Texas coast. Rockport, Texas, reported a 1000.7 mb pressure at 1053 UTC 22 August. There are no known ship reports of tropical storm-force winds.

Charley is blamed for 21 deaths, mainly due to the severe flooding around Del Rio.

*Continued on Page 47*



**Figure 3. Preliminary track for Tropical Storm Charley. Open circles represent tropical disturbance or tropical depression phase. Open symbols represent tropical storm phase.**





## Tropical Prediction Center

*Continued from Page 46*

**Hurricane Danielle:** A tropical wave over the eastern Atlantic organized into Tropical Depression Four near 14N 37W on 24 August. The cyclone moved steadily west-northwest through 29 August. The depression reached tropical storm strength later on 24 August and hurricane strength the next day. A peak intensity of 90 kt was estimated from satellite imagery on 26 August. Danielle slowly weakened to a minimal hurricane by 30 August due to a combination of unfavorable upper level winds and cold water left in the wake of Bonnie. Later on 30-31 August, Danielle gradually turned from a west-northwest to north-northeast track and re-intensified. At this time the storm was between the southeast United States and Bermuda (Figure 4).

Danielle was a smaller storm than its predecessor Bonnie, and ships generally avoided it during this period. The ship P3ZH4 (HYUNDAI TAKOMA) reported 35 kt winds at 0600 UTC 31 August.

**Hurricane Earl:** A tropical wave that moved off the African coast in mid-August moved into the southwest Gulf of Mexico on 30 August. An associated broad low pressure system organized into Tropical Depression Five near 22N 94W on 31 August, and became Tropical Storm Earl later that day (Figure 4).

*Continued on Page 48*

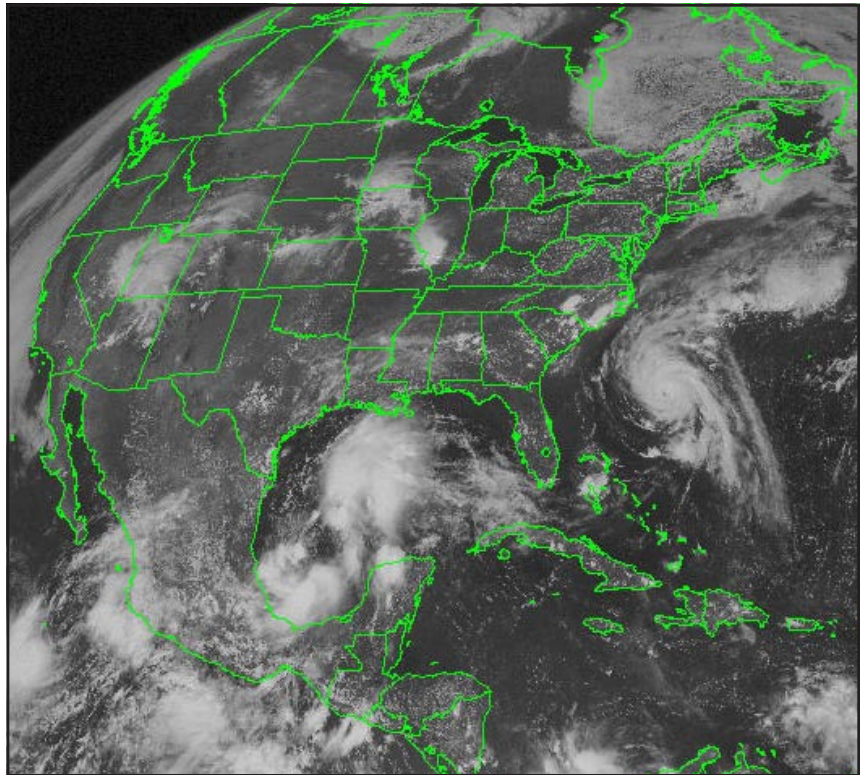


Figure 4. GOES-8 visible image at 1815 UTC 31 August. Hurricane Danielle is off the southeast U.S. coast. Tropical Storm Earl is developing over the Gulf of Mexico. The cyclone forming south of Baja, California, would become Hurricane Isis in September. Image courtesy of the National Climatic Data Center.

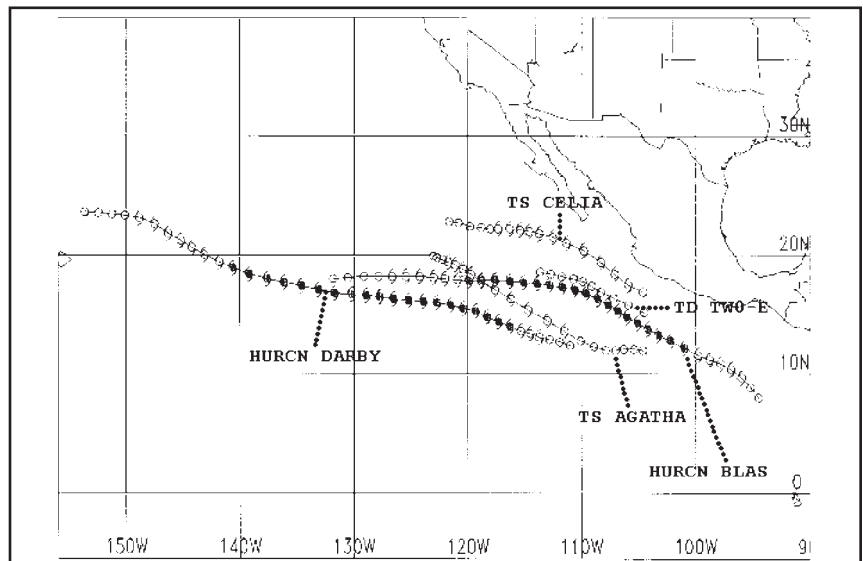


Figure 5. Preliminary tracks for Tropical Storm Agatha, Tropical Depression Two-E, Hurricane Blas, Tropical Storm Celia, and Hurricane Darby. Open circles represent tropical disturbance or tropical depression phase. Open symbols are tropical storm phase, while shaded symbols are hurricane phase.



### Tropical Prediction Center

*Continued from Page 47*

#### 2. Eastern Pacific

**Tropical Storm Agatha:** A tropical wave crossed Central America on 7-8 June. This system slowly organized into Tropical Depression One-E near 12N 105W on 11 June (Figure 5). Further strengthening was slow, and the cyclone did not reach tropical storm strength until 13 June. Agatha reached a peak intensity of 55 kt on 14 June, then steadily weakened until it dissipated near 20N 123W on 16 June.

Agatha was far from land, and no known ships encountered the storm.

**Tropical Depression Two-E:** Tropical Depression Two-E formed near 15N 106W on 19 June (Figure 5). The cyclone followed a general west-northwest track until it dissipated near 19N 114W on 22 June. Maximum sustained winds were estimated at 30 kt.

**Hurricane Blas:** A tropical wave caused increasing convection off the Pacific coast of Central America on 19 June. The activity gradually organized and became Tropical Depression Three-E near 8N 95W early on 22 June (Figure 5). Moving generally west-northwest to northwest, the cyclone reached tropical storm strength later that day and hurricane strength the next day. Blas continued strengthening to a peak intensity of 120 kt on 25 June.

Weakening started on 26 June as Blas turned west, and Blas was downgraded to a tropical storm by 28 June. The cyclone dissipated near 18N 132W on 30 June, with the residual low cloud swirl continuing west to south of the Hawaiian Islands by 5 July.

Ships avoided Blas, so there are no reports of tropical storm-force or greater winds. Blas may have indirectly enhanced rainfall over southern Mexico which led to mudslides that caused four deaths.

**Tropical Storm Celia:** A tropical wave spawned a tropical disturbance south of the Gulf of Tehuantepec on 13 July. The disturbance tracked west-northwest with little development for the next three days. It became better organized on 17 July, and it became a tropical depression near 17N 105W early that day. The cyclone reached tropical storm strength later that day. Celia turned west on 19 July as it reached a peak intensity of 50 kt. Weakening occurred after that, and Celia dissipated near 23N 122W on 21 July.

Several ships were caught between Celia and the Mexican coast. Ship KGTI (GREEN LAKE) reported 45 kt winds at 1200 UTC 17 July, which was the basis for naming Celia. Ship 4XGX (ZIK ISRAEL) reported 50 kt winds at 1700 UTC that day.

**Hurricane Darby:** A tropical wave started showing increased organization south of Acapulco on

19 July. Further development was slow, with the disturbance becoming a tropical depression early on 23 July near 12N 111W. This system would follow a general west to west-northwest track during its lifetime. The cyclone reached tropical storm strength later on 23 July and hurricane strength on 24 July. Darby twice reached a peak intensity of 100 kt, first on 25 July then from 26-28 July. The hurricane weakened to a tropical storm as it crossed into the Central Pacific Hurricane Center's area of responsibility on 29 July. Further weakening occurred, and Darby dissipated on 1 August near 24N 154W.

Darby was far from land and no known ships encountered the storm.

**Hurricane Estelle:** Tropical Depression Six-E formed near 15N 101W on 29 July. The depression moved west and reached tropical storm strength the next day. Estelle reached hurricane strength on 31 July while continuing west through 1 August. A peak intensity of 115 kt and a turn to the west-northwest occurred on 2 August. A turn back to the west took place on 4 August as Estelle weakened to a tropical storm. Estelle weakened to a depression the next day, and the system dissipated over the Central Pacific near 23N 149W on 8 August.

Estelle remained far from land and there are no reports of damage or casualties.

*Continued on Page 49*



### Tropical Prediction Center

*Continued from Page 48*

**Tropical Storm Frank:** A persistent area of disturbed weather associated with a tropical wave organized into a tropical depression near 17N 112W on 6 August. The depression moved generally north and reached tropical storm strength on 8 August. Frank reached a peak intensity of 40 kt early on 9 August just west of Baja California. The storm weakened and turned northwest later that day. It dissipated near 29N 117W on 10 August.

Ship C6LF9 (DOMINICA) reported 30-35 kt winds on 8-9 August, which was the basis for upgrading the depression to a tropical storm. Frank affected southern and central Baja California and the adjacent Gulf of California with locally gusty winds and heavy rains. There are no reports of damage or casualties at this time.

**Hurricane Georgette:** Tropical Depression Eight-E formed near 12N 110W on 11 August. Moving west-northwest, the cyclone reached tropical storm strength later that day. Georgette followed a general west-northwest to northwest track for the rest of its life. The storm reached hurricane strength on 12 August and a peak intensity of 100 kt on 14 August. Steady weakening then developed, with Georgette becoming a tropical storm and then a depression on 16 August. The system dissipated early on 17 August near 25N 127W.

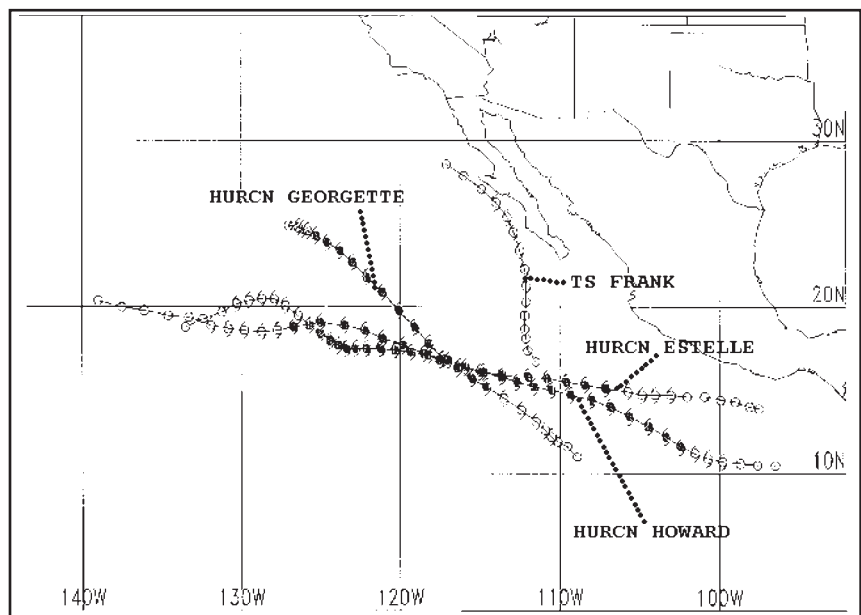
Ship KGTI (GREEN LAKE) reported 35 kt winds at 0600 UTC 14 August. It and several other ships encountered large swells (up to 24 ft) generated by Georgette. There are no reports of damage or casualties at this time.

**Hurricane Howard:** Tropical Depression Nine-E formed near 11N 97W on 20 August. Moving west-northwest, the cyclone reached both tropical storm and hurricane strength the next day. Howard continued west-northwest as it strengthened to a peak intensity of 130 kt on 23 August. After a slight weakening, Howard reached a secondary peak intensity of 115 kt while turning west on 25 August. The hurricane turned

west-northwest and weakened on 27 August. It fell to tropical storm status on 28 August and tropical depression status on 29 August. Howard dissipated on 30 August near 20N 134W.

An unidentified ship reported 40 kt winds and a 1005 mb pressure at 0000 UTC 21 August. There are no reports of damage or casualties at this time.

**B. Other Significant Events:** A complex low pressure system centered north of the TPC area of responsibility affected the Atlantic north of 25N and west of 50W between 9-16 May. The lows produced 20-30 kt winds and 8-13 ft seas across this region.⌵

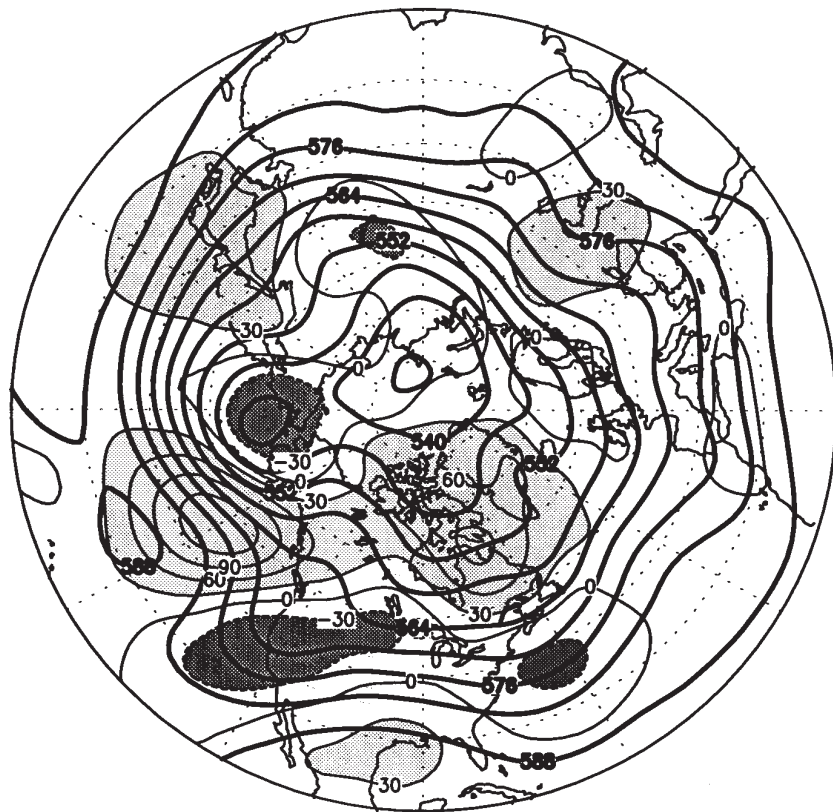


**Figure 6. Preliminary tracks for Hurricane Estelle, Tropical Storm Frank, Hurricane Georgette, and Hurricane Howard. Open circles represent tropical disturbance or tropical depression phase. Open symbols are tropical storm phase, while shaded symbols are hurricane phase.**



May–June 1998

500 mb Height, Anomaly



The chart on the left shows the two-month mean 500-mb height contours at 60 m intervals in solid lines, with alternate contours labeled in decameters (dm). Height anomalies are contoured in dashed lines at 30 m intervals. Areas where the mean height anomaly was greater than 30 m above normal have light shading, and areas where the mean height anomaly was more than 30 m below normal have heavy shading.

Sea Level Pressure, Anomaly

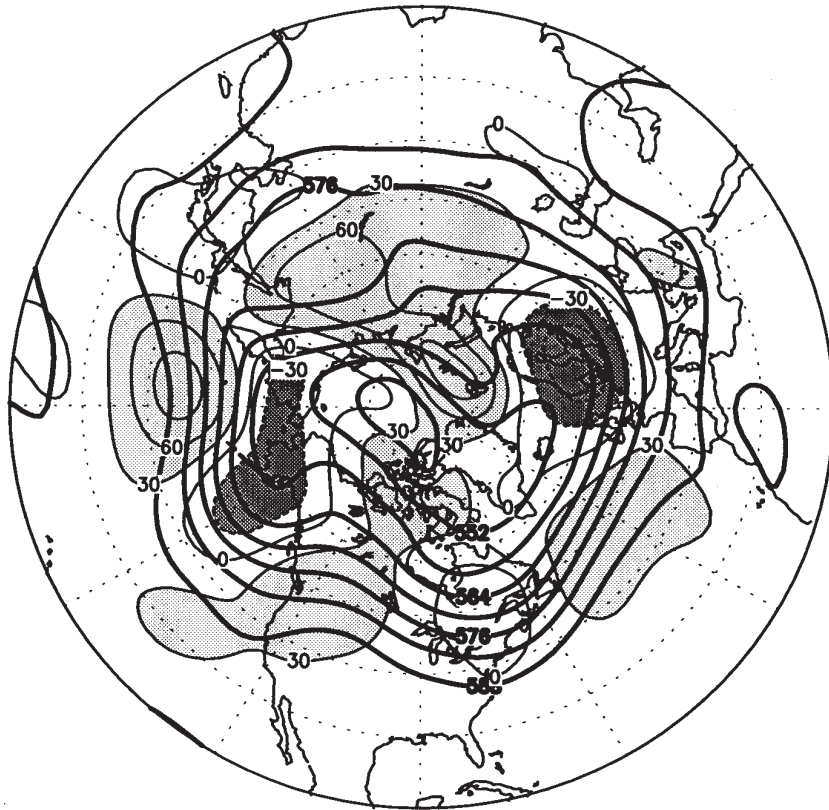


The chart on the right shows the two-month mean sea level pressure at 4-mb intervals in solid lines, labeled in mb. Anomalies of SLP are contoured in dashed lines and labeled at 2-mb intervals, with light shading in areas more than 2 mb above normal, and heavy shading in areas in excess of 2 mb below normal.



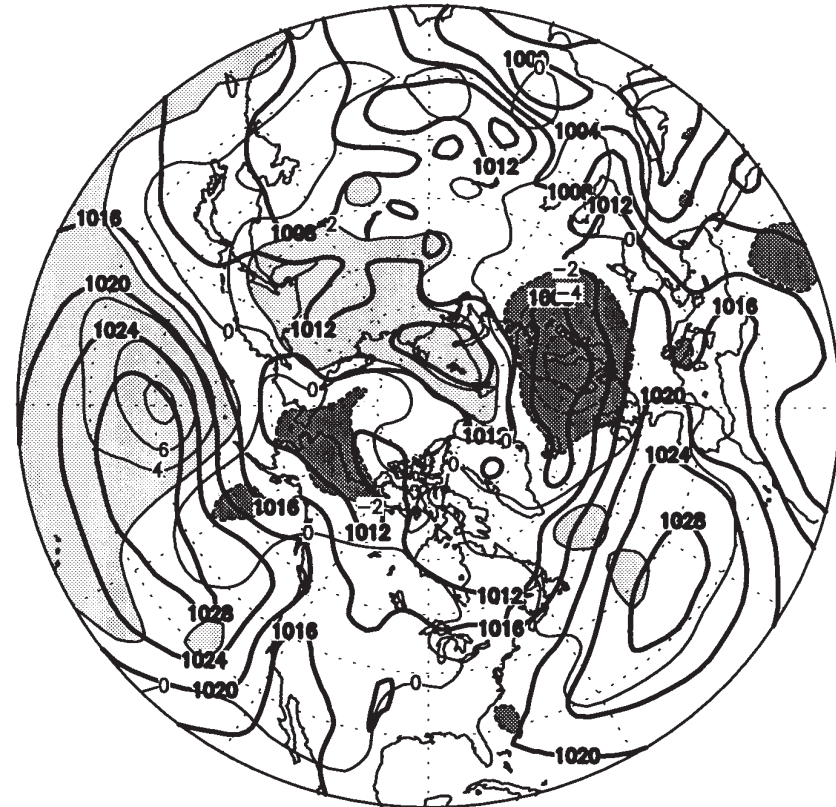
## July–August 1998

### 500 mb Height, Anomaly



The chart on the left shows the two-month mean 500-mb height contours at 60 m intervals in solid lines, with alternate contours labeled in decameters (dm). Height anomalies are contoured in dashed lines at 30 m intervals. Areas where the mean height anomaly was greater than 30 m above normal have light shading, and areas where the mean height anomaly was more than 30 m below normal have heavy shading.

### Sea Level Pressure, Anomaly



The chart on the right shows the two-month mean sea level pressure at 4-mb intervals in solid lines, labeled in mb. Anomalies of SLP are contoured in dashed lines and labeled at 2-mb intervals, with light shading in areas more than 2 mb above normal, and heavy shading in areas in excess of 2 mb below normal.



## Voluntary Observing Ship Program

*Martin S. Baron  
National Weather Service  
Silver Spring, Maryland*

### NWS Observing Handbook No. 1 to be Updated

We are working to update the 1995 edition of NWS Observing Handbook No. 1, Marine Surface Weather Observations. The revised edition should be ready Fall 1999.

While there have been no code changes since the 1995 edition was published, we are making some corrections and adding new material. As a result of GMDSS implementation, there have been many changes to Shipboard communication methods, so we have rewritten Chapter 3, "Transmitting The Observation." Here are highlights of the changes to be incorporated in the new edition.

**Pages 2-7** — We have corrected a mistake here:  $i_w$  is reported as 3 or 4, not as 03 or 04 as indicated in the August 1995 edition. Under How To Code, the new text will be:

U.S. VOS Program vessels report wind speed in knots. Use 3 when estimating wind speed in knots, or 4 when measuring wind speed with an anemometer in knots.

Some vessels in foreign VOS programs report wind speed in meters per second. These vessels should use 0 when estimating wind speed in meters per second, or 1 when measuring wind speed with an anemometer in meters per second.

Code

Figure

- |   |                                                          |
|---|----------------------------------------------------------|
| 0 | Wind speed estimated in meters per second                |
| 1 | Wind speed obtained from anemometer in meters per second |
| 3 | Wind Speed estimated in knots                            |
| 4 | Wind Speed obtained from anemometer in knots             |

**Pages 2-40** — We have added information on how Great Lakes vessels should report sea level pressure. The text being added is:

For Great Lakes vessels: PMOs in Cleveland and Chicago calibrate your barometers to read sea level pressure using the elevation of Lake Erie in the correction factor. From other Great Lakes, to obtain sea level pressure

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**VOS Program**

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you must know the difference in elevation between Lake Erie and the lake your on, and add or subtract a correction.

From Lake Huron or Lake Michigan (both 10 feet above Lake Erie), please add .4 hp to your pressure reading before reporting. For Lake Superior (30 feet above Lake Erie), add 1.1 hp. For Lake Ontario (325 feet below Lake Erie), subtract 12 hp.

**Chapter 3, “Transmitting The Observation”** — We have rewritten the entire chapter. Highlights from the new chapter include:

**STATIONS ACCEPTING VOS WEATHER OBSERVATIONS**

Weather observations sent by ships participating in the VOS program are sent at no cost to the ship except as noted.

The stations listed accept weather observations which enter an automated system at National Weather Service headquarters. This system is not intended for other types of messages. To communicate with NWS personnel, see phone numbers and e-mail addresses at the beginning of this manual.

**INMARSAT**

Follow the instructions with your INMARSAT terminal for sending a telex message. Use the special dialing code 41 (except when using the SEAS/AMVER software in compressed binary format with INMARSAT C), and do not request a confirmation. Here is a typical procedure for using an INMARSAT transceiver:

1. Select appropriate Land Earth Station Identity (LES-ID). See the table below.
2. Select routine priority.
3. Select duplex telex channel.
4. Initiate the call. Wait for the GA+ signal.
5. Select the dial code for meteorological reports, 41+.
6. Upon receipt of our answerback, NWS OBS MHTS, transmit the weather message starting with BBXX and the ship's call sign. The message must be ended with 5 periods. Do not send any preamble.  
GA+  
41+  
NWS OBS MHTS  
BBXX WLXX 29003 99131 70808 41998 60909 10250 2021/ 4011/ 52003 71611 85264 22234  
00261 20201 31100 40803.....

The 5 periods indicate the end of the message, and must be included after each report. Do not request a confirmation.

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### VOS Program

*Continued from Page 53*

#### Land-Earth Station Identify (LES-ID) of the U.S. INMARSAT stations Accepting Ships Weather (BBXX) and Oceanographic (JJYY) Reports

| Operator    | Service        | AOR-W | AOR-E | Station ID |  | POR  |
|-------------|----------------|-------|-------|------------|--|------|
|             |                |       |       | IOR        |  |      |
| COMSAT      | A              | 01    | 01    | 01         |  | 01   |
| COMSAT      | B              | 01    | 01    | 01         |  | 01   |
| COMSAT      | C              | 001   | 101   | 321        |  | 201  |
| COMSAT      | C (AMVER/SEAS) | 001   | 101   | 321        |  | 201  |
| STRATOS/IDB | A (octal ID)   | 13-1  | 13-1  | 13-1       |  | 13-1 |
| STRATOS/IDB | A (decimal ID) | 11-1  | 11-1  | 11-1       |  | 11-1 |
| STRATOS/IDB | B              | 013   | 013   | 013        |  | 013  |

Use abbreviated dialing code 41.

#### **Do not request a confirmation**

If your ship's Inmarsat terminal does not contain a provision for using abbreviated dialing code 41, TELEX address **0023089406** may be used via COMSAT. Please note that the ship will incur telecommunication charges for any messages sent to TELEX address 0023089406 using any Inmarsat earth station other than COMSAT.

Some common mistakes include: (1) failure to end the message with five periods when using INMARSAT A, (2) failure to include BBXX in the message preamble, (3) incorrectly coding the Date, Time, Latitude, Longitude, or quadrant of the globe, (4) requesting a confirmation (which increases cost to NWS).

#### **Using The SEAS/AMVER Software**

The National Oceanic and Atmospheric Administration (NOAA) in cooperation with the U.S. Coast Guard Automated Mutual-assistance Vessel Rescue program (AMVER) and COMSAT, has developed a PC software package known as AMVER/SEAS which simplifies the creation of AMVER and meteorological (BBXX) reports. The U.S. Coast Guard is able to accept, at no cost to the ship, AMVER reports transmitted via Inmarsat-C in a compressed binary format, created using the AMVER/SEAS program. Typically, in the past, the cost of transmission for AMVER messages has been assumed by the vessel. When ships participate in both the SEAS and AMVER programs, the position of ship provided in the meteorological report is forwarded to the Coast Guard as a supplementary AMVER position report to maintain a more accurate plot. To obtain the AMVER/SEAS program contact your U.S. PMO or AMVER/SEAS representative listed at the beginning of this handbook.

If using the NOAA AMVER/SEAS software, follow the instructions outlined in the AMVER/SEAS User's Manual. When using Inmarsat-C, use the compressed binary format and 8-bit X.25 (PSDN) addressing (31102030798481), rather than TELEX if possible when reporting weather.

Common errors when using the AMVER/SEAS include sending the compressed binary message via the code 41 or a plain text message via the X.25 address. Only COMSAT can accept messages in the compressed

*Continued on Page 55*





### VOS Program

*Continued from Page 54*

binary format. Text editors should not be utilized in sending the data in the compressed binary format as this will corrupt the message.

### Telephone (Landline, Cellular, Satphone, Etc.)

The following stations will accept VOS weather observations via telephone. **Please note that the ship will be responsible for the cost of the call in this case.**

|                |              |
|----------------|--------------|
| GLOBE WIRELESS | 650-726-6588 |
| MARITEL        | 228-897-7700 |
| WLO            | 334-666-5110 |

The National Weather Service is developing a dial-in bulletin board to accept weather observations using a simple PC program and modem. **The ship will be responsible for the cost of the call when using this system.** For details contact:

CDR Tim Rulon, NOAA  
W/OM12 SSMC2 Room 14114  
1325 East-West Highway  
Silver Spring, MD 20910 USA  
301-713-1677 Ext. 128  
301-713-1598 (Fax)  
timothy.rulon@noaa.gov  
marine.weather@noaa.gov

### Reporting Through United States Coast Guard Stations

U.S. Coast Guard stations accept SITOR (preferred) or voice radiotelephone weather reports. Begin with the BBXX indicator, followed by the ships call sign and the weather message.

### U.S. Coast Guard High Seas Communication Stations

| Location   | (CALL) | Mode  | SEL<br>CAL | MMSI #    | ITU<br>CH# | Ship<br>Xmit<br>Freq | Ship<br>Rec<br>Freq | Watch              |
|------------|--------|-------|------------|-----------|------------|----------------------|---------------------|--------------------|
| Boston     | (NMF)  | Voice |            | 003669991 | 424        | 4134                 | 4426                | Night <sup>3</sup> |
| Boston     | (NMF)  | Voice |            | 003669991 | 601        | 6200                 | 6501                | 24Hr               |
| Boston     | (NMF)  | Voice |            | 003669991 | 816        | 8240                 | 8764                | 24Hr               |
| Boston     | (NMF)  | Voice |            | 003669991 | 1205       | 12242                | 13089               | Day <sup>3</sup>   |
| Chesapeake | (NMN)  | SITOR | 1097       |           | 604        | 6264.5               | 6316                | Night <sup>2</sup> |
| Chesapeake | (NMN)  | SITOR | 1097       |           | 824        | 8388                 | 8428                | 24Hr               |
| Chesapeake | (NMN)  | SITOR | 1097       |           | 1227       | 12490                | 12592.5             | 24hr               |
| Chesapeake | (NMN)  | SITOR | 1097       |           | 1627       | 16696.5              | 16819.5             | 24Hr               |
| Chesapeake | (NMN)  | SITOR | 1097       |           | 2227       | 22297.5              | 22389.5             | Day <sup>2</sup>   |
| Chesapeake | (NMN)  | Voice |            | 003669995 | 424        | 4134                 | 4426                | Night <sup>2</sup> |

*Continued on Page 56*



## VOS Program

### VOS Program

*Continued from Page 55*

| Location    | (CALL) | Mode  | SEL<br>CAL | MMSI #                 | ITU<br>CH# | Ship<br>Xmit<br>Freq | Ship<br>Rec<br>Freq | Watch              |
|-------------|--------|-------|------------|------------------------|------------|----------------------|---------------------|--------------------|
| Chesapeake  | (NMN)  | Voice |            | 003669995              | 601        | 6200                 | 6501                | 24Hr               |
| Chesapeake  | (NMN)  | Voice |            | 003669995              | 816        | 8240                 | 8764                | 24Hr               |
| Chesapeake  | (NMN)  | Voice |            | 003669995              | 1205       | 12242                | 13089               | Day <sup>2</sup>   |
| Miami       | (NMA)  | Voice |            | 003669997              | 601        | 6200                 | 6501                | 24Hr               |
| Miami       | (NMA)  | Voice |            | 003669997              | 1205       | 12242                | 13089               | 24Hr               |
| Miami       | (NMA)  | Voice |            | 003669997              | 1625       | 16432                | 17314               | 24Hr               |
| New Orleans | (NMG)  | Voice |            | 003669998              | 424        | 4134                 | 4426                | 24Hr               |
| New Orleans | (NMG)  | Voice |            | 003669998              | 601        | 6200                 | 6501                | 24Hr               |
| New Orleans | (NMG)  | Voice |            | 003669998              | 816        | 8240                 | 8764                | 24Hr               |
| New Orleans | (NMG)  | Voice |            | 003669998              | 1205       | 12242                | 13089               | 24Hr               |
| Kodiak      | (NOJ)  | SITOR | 1106       |                        | 407        | 4175.5               | 4213.5              | Night              |
| Kodiak      | (NOJ)  | SITOR | 1106       |                        | 607        | 6266                 | 6317.5              | 24Hr               |
| Kodiak      | (NOJ)  | SITOR | 1106       |                        | 807        | 8379.5               | 8419.5              | Day                |
| Kodiak      | (NOJ)  | Voice |            | 003669899 <sup>1</sup> | ***        | 4125                 | 4125                | 24Hr               |
| Kodiak      | (NOJ)  | Voice |            | 003669899 <sup>1</sup> | 601        | 6200                 | 6501                | 24Hr               |
| Pt. Reyes   | (NMC)  | SITOR | 1096       |                        | 620        | 6272.5               | 6323.5              | Night              |
| Pt. Reyes   | (NMC)  | SITOR | 1096       |                        | 820        | 8386                 | 8426                | 24Hr               |
| Pt. Reyes   | (NMC)  | SITOR | 1096       |                        | 1620       | 16693                | 16816.5             | Day                |
| Pt. Reyes   | (NMC)  | Voice |            | 003669990              | 424        | 4134                 | 4426                | 24Hr               |
| Pt. Reyes   | (NMC)  | Voice |            | 003669990              | 601        | 6200                 | 6501                | 24Hr               |
| Pt. Reyes   | (NMC)  | Voice |            | 003669990              | 816        | 8240                 | 8764                | 24Hr               |
| Pt. Reyes   | (NMC)  | Voice |            | 003669990              | 1205       | 12242                | 13089               | 24Hr               |
| Honolulu    | (NMO)  | SITOR | 1099       |                        | 827        | 8389.5               | 8429.5              | 24hr               |
| Honolulu    | (NMO)  | SITOR | 1099       |                        | 1220       | 12486.5              | 12589               | 24hr               |
| Honolulu    | (NMO)  | SITOR | 1099       |                        | 2227       | 22297.5              | 22389.5             | Day                |
| Honolulu    | (NMO)  | Voice |            | 003669993 <sup>1</sup> | 424        | 4134                 | 4426                | Night <sup>4</sup> |
| Honolulu    | (NMO)  | Voice |            | 003669993 <sup>1</sup> | 601        | 6200                 | 6501                | 24Hr               |
| Honolulu    | (NMO)  | Voice |            | 003669993 <sup>1</sup> | 816        | 8240                 | 8764                | 24Hr               |
| Honolulu    | (NMO)  | Voice |            | 003669993 <sup>1</sup> | 1205       | 12242                | 13089               | Day <sup>4</sup>   |
| Guam        | (NRV)  | SITOR | 1100       |                        | 812        | 8382                 | 8422                | 24hr               |
| Guam        | (NRV)  | SITOR | 1100       |                        | 1212       | 12482.5              | 12585               | Night              |
| Guam        | (NRV)  | SITOR | 1100       |                        | 1612       | 16689                | 16812.5             | 24hr               |
| Guam        | (NRV)  | SITOR | 1100       |                        | 2212       | 22290                | 22382               | Day                |
| Guam        | (NRV)  | Voice |            | 003669994 <sup>1</sup> | 601        | 6200                 | 6501                | Night <sup>5</sup> |
| Guam        | (NRV)  | Voice |            | 003669994 <sup>1</sup> | 1205       | 12242                | 13089               | Day <sup>5</sup>   |

<sup>1</sup> MF/HF DSC has not yet been implemented at these stations.

<sup>2</sup> 2300-1100 UTC Nights, 1100-2300 UTC Days

<sup>3</sup> 2230-1030 UTC Nights, 1030-2230 UTC Days

<sup>4</sup> 0600-1800 UTC Nights, 1800-0600 UTC Days

<sup>5</sup> 0900-2100 UTC Nights, 2100-0900 UTC Days

Stations also maintain an MF/HF DSC watch on the following frequencies: 2187.5 kHz, 4207.5 kHz, 6312 khz, 8414.5 Khz, 12577 kHz and 16804.5 kHz.

Voice frequencies are carrier (dial) frequencies. SITOR and DSC frequencies are assigned frequencies.

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### VOS Program

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Note that some stations share common frequencies.

An automated watch is kept on SITOR. Type "HELP+" for the of instructions or "OBS+" to send the weather report.

For the latest information on Coast Guard frequencies, visit their webpage at: <http://www.navcen.uscg.mil/marcomms>

### U.S. Coast Guard Group Communication Stations

U.S. Coast Guard Group communication stations monitor VHF marine channels 16 and 22A and/or MF radiotelephone frequency 2182 kHz (USB). Great Lakes stations do not have MF installations.

The following stations have MF DSC installations and also monitor 2187.5 kHz DSC. Additional stations are planned. Note that although a station may be listed as having DSC installed, that installation may not have yet been declared operational. The U.S. Coast Guard is not expected to have the MF DSC network installed and declared operational until 2003 or thereafter.

The U.S. Coast Guard is not expected to have an VHF DSC network installed and declared operational until 2005 or thereafter.

| STATION                |       |                     | MMSI #    |
|------------------------|-------|---------------------|-----------|
| CAMSLANT Chesapeake VA | MF/HF | --                  | 003669995 |
| COMMSTA Boston MA      | MF/HF | Remoted to CAMSLANT | 003669991 |
| COMMSTA Miami FL       | MF/HF | Remoted to CAMSLANT | 003669997 |
| COMMSTA New Orleans LA | MF/HF | Remoted to CAMSLANT | 003669998 |
| CAMSPAC Pt Reyes CA    | MF/HF | --                  | 003669990 |
| COMMSTA Honolulu HI    | MF/HF | Remoted to CAMSPAC  | 003669993 |
| COMMSTA Kodiak AK      | MF/HF | --                  | 003669899 |
| Group Atlantic City NJ | MF    |                     | 003669903 |
| Group Cape Hatteras NC | MF    |                     | 003669906 |
| Group Southwest Harbor | MF    |                     | 003669921 |
| Group Eastern Shore VA | MF    |                     | 003669932 |
| Group Mayport FL       | MF    |                     | 003669925 |
| Group Long Island Snd  | MF    |                     | 003669931 |
| Act New York NY        | MF    |                     | 003669929 |
| Group Ft Macon GA      | MF    |                     | 003669920 |
| Group Astoria OR       | MF    |                     | 003669910 |

### Reporting Through Specified U.S. Commercial Radio Stations

If a U.S. Coast Guard station cannot be communicated with, and your ship is not INMARSAT equipped, U.S. commercial radio stations can be used to relay your weather observations to the NWS. When using SITOR, use the command "OBS +", followed by the BBXX indicator and the weather message. **Example:**

OBS + BBXX WLXX 29003 99131 70808 41998 60909 10250 2021/ 40110 52003 71611 85264 22234  
00261 20201 31100 40803

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## VOS Program

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**Commercial stations affiliated with Globe Wireless** (KFS, KPH, WNU, WCC, etc.) accept weather messages via SITOR or morse code (not available at all times).

**Commercial Stations affiliated with Mobile Marine Radio, Inc.** (WLO, KLB, WSC) accept weather messages via SITOR, with Radiotelephone and Morse Code (weekdays from 1300-2100 UTC only) also available as backups.

**MARITEL Marine Communication System** accepts weather messages via VHF marine radiotelephone from near shore (out 50-60 miles), and from the Great Lakes.

**Globe Wireless**

| Location                        | (CALL) | Mode  | SEL<br>CAL | MMSI# | ITU<br>CH# | Freq    | Ship<br>Xmit<br>Freq | Ship<br>Rec<br>Watch |
|---------------------------------|--------|-------|------------|-------|------------|---------|----------------------|----------------------|
| Slidell,<br>Louisiana           | (WNU)  | SITOR |            |       | 401        | 4172.5  | 4210.5               | 24Hr                 |
|                                 | (WNU)  | SITOR |            |       |            | 4200.5  | 4336.4               | 24Hr                 |
|                                 | (WNU)  | SITOR |            |       | 627        | 6281    | 6327                 | 24Hr                 |
|                                 | (WNU)  | SITOR |            |       | 819        | 8385.5  | 8425.5               | 24Hr                 |
|                                 | (WNU)  | SITOR |            |       | 1257       | 12505   | 12607.5              | 24Hr                 |
|                                 | (WNU)  | SITOR |            |       | 1657       | 16711.5 | 16834.5              | 24Hr                 |
| Barbados,                       | (8PO)  | SITOR |            |       | 409        | 4176.5  | 4214.5               | 24Hr                 |
|                                 | (8PO)  | SITOR |            |       | 634        | 6284.5  | 6330.5               | 24Hr                 |
|                                 | (8PO)  | SITOR |            |       | 834        | 8393    | 8433                 | 24Hr                 |
|                                 | (8PO)  | SITOR |            |       | 1273       | 12513   | 12615.5              | 24Hr                 |
|                                 | (8PO)  | SITOR |            |       | 1671       | 16718.5 | 16841.5              | 24Hr                 |
|                                 | (KPH)  | SITOR |            |       | 413        | 4178.5  | 4216                 | 24Hr                 |
| San<br>Francisco,<br>California | (KPH)  | SITOR |            |       | 613        | 6269    | 6320                 | 24Hr                 |
|                                 | (KPH)  | SITOR |            |       | 813        | 8382.5  | 8422.5               | 24Hr                 |
|                                 | (KPH)  | SITOR |            |       | 822        | 8387    | 8427                 | 24Hr                 |
|                                 | (KPH)  | SITOR |            |       | 1213       | 12483   | 12585.5              | 24Hr                 |
|                                 | (KPH)  | SITOR |            |       | 1222       | 12487.5 | 12590                | 24Hr                 |
|                                 | (KPH)  | SITOR |            |       | 1242       | 12497.5 | 12600                | 24Hr                 |
|                                 | (KPH)  | SITOR |            |       | 1622       | 16694   | 16817.5              | 24Hr                 |
|                                 | (KPH)  | SITOR |            |       | 2238       | 22303   | 22395                | 24Hr                 |
|                                 | (KFS)  | SITOR |            |       | 403        | 4173.5  | 4211.5               | 24Hr                 |
|                                 | (KFS)  | SITOR |            |       |            | 6253.5  | 436.4                | 24Hr                 |
|                                 | (KFS)  | SITOR |            |       | 603        | 6264    | 6315.5               | 24Hr                 |
|                                 | (KFS)  | SITOR |            |       |            | 8323.5  | 8526.4               | 24Hr                 |
|                                 | (KFS)  | SITOR |            |       | 803        | 8377.5  | 8417.5               | 24Hr                 |
|                                 | (KFS)  | SITOR |            |       | 1203       | 12478   | 12580.5              | 24Hr                 |
|                                 | (KFS)  | SITOR |            |       | 1247       | 12500   | 12602.5              | 24Hr                 |
|                                 | (KFS)  | SITOR |            |       |            | 16608.5 | 17211.4              | 24Hr                 |
|                                 | (KFS)  | SITOR |            |       | 1647       | 16706.5 | 16829.5              | 24Hr                 |
|                                 | (KFS)  | SITOR |            |       | 2203       | 22285.5 | 22377.5              | 24Hr                 |
| Hawaii                          | (KEJ)  | SITOR |            |       |            | 4154.5  | 4300.4               | 24Hr                 |
|                                 | (KEJ)  | SITOR |            |       | 625        | 6275    | 6326                 | 24Hr                 |
|                                 | (KEJ)  | SITOR |            |       | 830        | 8391    | 8431                 | 24Hr                 |
|                                 | (KEJ)  | SITOR |            |       | 1265       | 12509   | 12611.5              | 24Hr                 |
|                                 | (KEJ)  | SITOR |            |       | 1673       | 16719.5 | 16842.5              | 24Hr                 |
| Delaware,<br>USA                | (WCC)  | SITOR |            |       |            | 6297    | 6334                 | 24Hr                 |
|                                 | (WCC)  | SITOR |            |       | 816        | 8384    | 8424                 | 24Hr                 |

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## VOS Program

### VOS Program

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| Location                   | (CALL)   | Mode  | SEL<br>CAL | MMSI# | ITU<br>CH# | Freq    | Ship<br>Xmit<br>Freq | Ship<br>Rec<br>Watch |
|----------------------------|----------|-------|------------|-------|------------|---------|----------------------|----------------------|
| Argentina                  | (WCC)    | SITOR |            |       | 1221       | 12487   | 12589.5              | 24Hr                 |
|                            | (WCC)    | SITOR |            |       | 1238       | 12495.5 | 12598                | 24Hr                 |
|                            | (WCC)    | SITOR |            |       | 1621       | 16693.5 | 16817                | 24Hr                 |
|                            | (LSD836) | SITOR |            |       |            | 4160.5  | 4326                 | 24Hr                 |
|                            | (LSD836) | SITOR |            |       |            | 8311.5  | 8459                 | 24Hr                 |
|                            | (LSD836) | SITOR |            |       |            | 12379.5 | 12736                | 24Hr                 |
| Guam                       | (LSD836) | SITOR |            |       |            | 16560.5 | 16976                | 24Hr                 |
|                            | (LSD836) | SITOR |            |       |            | 18850.5 | 19706                | 24Hr                 |
|                            | (KHF)    | SITOR |            |       | 605        | 6265    | 316.5                | 24Hr                 |
|                            | (KHF)    | SITOR |            |       | 808        | 8380    | 8420                 | 24Hr                 |
|                            | (KHF)    | SITOR |            |       | 1301       | 12527   | 12629                | 24Hr                 |
|                            | (KHF)    | SITOR |            |       | 1726       | 16751   | 16869                | 24Hr                 |
| Newfoundland,<br>Canada    | (KHF)    | SITOR |            |       | 1813       | 18876.5 | 19687                | 24Hr                 |
|                            | (KHF)    | SITOR |            |       | 2298       | 22333   | 22425                | 24Hr                 |
|                            | (VCT)    | SITOR |            |       | 414        | 4179    | 4216.5               | 24Hr                 |
|                            | (VCT)    | SITOR |            |       | 416        | 4180    | 4217.5               | 24Hr                 |
|                            | (VCT)    | SITOR |            |       | 621        | 6273    | 6324                 | 24Hr                 |
|                            | (VCT)    | SITOR |            |       | 632        | 6283.5  | 6329.5               | 24Hr                 |
| Cape Town,<br>South Africa | (VCT)    | SITOR |            |       | 821        | 8386.5  | 8426.5               | 24Hr                 |
|                            | (VCT)    | SITOR |            |       | 838        | 8395    | 8435                 | 24Hr                 |
|                            | (VCT)    | SITOR |            |       | 1263       | 12508   | 12610.5              | 24Hr                 |
|                            | (VCT)    | SITOR |            |       | 1638       | 16702   | 16825                | 24Hr                 |
|                            | (ZSC)    | SITOR |            |       | 408        | 4176    | 4214                 | 24Hr                 |
|                            | (ZSC)    | SITOR |            |       | 617        | 6271    | 6322                 | 24Hr                 |
| Bahrain,<br>Arabian Gulf   | (ZSC)    | SITOR |            |       | 831        | 8391.5  | 8431.5               | 24Hr                 |
|                            | (ZSC)    | SITOR |            |       | 1244       | 12498.5 | 12601                | 24Hr                 |
|                            | (ZSC)    | SITOR |            |       | 1619       | 16692.5 | 16816                | 24Hr                 |
|                            | (ZSC)    | SITOR |            |       | 1824       | 18882   | 19692.5              | 24Hr                 |
|                            | (A9M)    | SITOR |            |       | 419        | 4181.5  | 4219                 | 24Hr                 |
|                            | (A9M)    | SITOR |            |       |            | 8302.5  | 8541                 | 24Hr                 |
| Gothenburg,<br>Sweden      | (A9M)    | SITOR |            |       |            | 12373.5 | 12668                | 24Hr                 |
|                            | (A9M)    | SITOR |            |       |            | 16557.5 | 17066.5              | 24Hr                 |
|                            | (A9M)    | SITOR |            |       |            | 18853.5 | 19726                | 24Hr                 |
|                            | (SAB)    | SITOR |            |       | 228        | 2155.5  | 1620.5               | 24Hr                 |
|                            | (SAB)    | SITOR |            |       |            | 4166.5  | 4259                 | 24Hr                 |
|                            | (SAB)    | SITOR |            |       | 626        | 6275.5  | 6326.5               | 24Hr                 |
| Norway                     | (SAB)    | SITOR |            |       | 837        | 8394.5  | 8434.5               | 24Hr                 |
|                            | (SAB)    | SITOR |            |       | 1291       | 12522   | 12624                | 24Hr                 |
|                            | (SAB)    | SITOR |            |       | 1691       | 16728.5 | 16851.5              | 24Hr                 |
|                            | (LFI)    | SITOR |            |       |            | 2653    | 1930                 | 24Hr                 |
|                            | (LFI)    | SITOR |            |       |            | 4154.5  | 4339                 | 24Hr                 |
|                            | (LFI)    | SITOR |            |       |            | 6250.5  | 6467                 | 24Hr                 |
| Awanui,<br>New Zealand     | (LFI)    | SITOR |            |       |            | 8326.5  | 8683.5               | 24Hr                 |
|                            | (LFI)    | SITOR |            |       |            | 12415.5 | 12678                | 24Hr                 |
|                            | (LFI)    | SITOR |            |       |            | 16566.5 | 17204                | 24Hr                 |
|                            | (ZLA)    | SITOR |            |       | 402        | 4173    | 4211                 | 24Hr                 |
|                            | (ZLA)    | SITOR |            |       | 602        | 6263.5  | 6315                 | 24Hr                 |
|                            | (ZLA)    | SITOR |            |       | 802        | 8377    | 8417                 | 24Hr                 |
|                            | (ZLA)    | SITOR |            |       | 1202       | 12477.5 | 12580                | 24Hr                 |
|                            | (ZLA)    | SITOR |            |       | 1602       | 16684   | 16807.5              | 24Hr                 |

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## VOS Program

### VOS Program

*Continued from Page 59*

| Location                       | (CALL) | Mode  | SEL<br>CAL | MMSI# | ITU<br>CH# | Freq    | Ship<br>Xmit<br>Freq | Ship<br>Rec<br>Watch |
|--------------------------------|--------|-------|------------|-------|------------|---------|----------------------|----------------------|
| Perth,<br>Western<br>Australia | (ZLA)  | SITOR |            |       |            | 18859.5 | 19736.4              | 24Hr                 |
|                                | (VIP)  | SITOR |            |       | 406        | 4175    | 4213                 | 24Hr                 |
|                                | (VIP)  | SITOR |            |       | 806        | 8379    | 8419                 | 24Hr                 |
|                                | (VIP)  | SITOR |            |       | 1206       | 12479.5 | 12582                | 24Hr                 |
|                                | (VIP)  | SITOR |            |       | 1210       | 12481.5 | 12584                | 24Hr                 |
|                                | (VIP)  | SITOR |            |       | 1606       | 16686   | 16809.5              | 24Hr                 |

The frequencies listed are used by the stations in the Global Radio network for both SITOR and GlobeEmail. Stations listed as being 24hr may not be operational during periods of poor propagation.

For the latest information on Globe Wireless frequencies, visit their webpage at: <http://www.globewireless.com>.

Stations and channels are added regularly. Contact any Globe Wireless station/channel or visit the website for an updated list. Information on Morse frequencies available upon request.

### **Mobile Marine Radio Inc.**

| Location   | (CALL) | Mode  | SEL<br>CAL | MMSI#     | ITU<br>CH# | Ship<br>Xmit<br>Freq | Ship<br>Rec<br>Freq | Watch |
|------------|--------|-------|------------|-----------|------------|----------------------|---------------------|-------|
| Mobile, AL | (WLO)  | SITOR | 1090       | 003660003 | 406        | 4175                 | 4213                | 24Hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 410        | 4177                 | 4215                | 24Hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 417        | 4180.5               | 4218                | 24Hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 606        | 6265.5               | 6317                | 24hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 610        | 6267.5               | 6319                | 24hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 615        | 6270                 | 6321                | 24hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 624        | 6274.5               | 6325.5              | 24Hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 806        | 8379                 | 8419                | 24Hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 810        | 8381                 | 8421                | 24hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 815        | 8383.5               | 8423.5              | 24hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 829        | 8390.5               | 8430.5              | 24Hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 832        | 8392                 | 8432                | 24Hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 836        | 8394                 | 8434                | 24Hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 1205       | 12479                | 12581.5             | 24Hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 1211       | 12482                | 12584.5             | 24Hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 1215       | 12484                | 12586.5             | 24Hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 1234       | 12493.5              | 12596               | 24Hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 1240       | 12496.5              | 12599               | 24Hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 1251       | 12502                | 12604.5             | 24Hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 1254       | 12503.5              | 12606               | 24Hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 1261       | 12507                | 12609.5             | 24hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 1605       | 16685.5              | 16809               | 24hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 1611       | 16688.5              | 16812               | 24Hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 1615       | 16690.5              | 16814               | 24Hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 1625       | 16695.5              | 16818.5             | 24Hr  |
|            | (WLO)  | SITOR | 1090       | 003660003 | 1640       | 16703                | 16826               | 24Hr  |

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## VOS Program

### VOS Program

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| Location         | (CALL) | Mode      | SEL<br>CAL | MMSI#     | ITU<br>CH# | Ship<br>Xmit<br>Freq | Ship<br>Rec<br>Freq | Watch |
|------------------|--------|-----------|------------|-----------|------------|----------------------|---------------------|-------|
|                  | (WLO)  | SITOR     | 1090       | 003660003 | 1644       | 16705                | 16828               | 24Hr  |
|                  | (WLO)  | SITOR     | 1090       | 003660003 | 1661       | 16713.5              | 16836.5             | 24Hr  |
|                  | (WLO)  | SITOR     | 1090       | 003660003 | 1810       | 18875                | 19685.5             | 24Hr  |
|                  | (WLO)  | SITOR     | 1090       | 003660003 | 2210       | 22289                | 22381               | 24Hr  |
|                  | (WLO)  | SITOR     | 1090       | 003660003 | 2215       | 22291.5              | 22383.5             | 24Hr  |
|                  | (WLO)  | SITOR     | 1090       | 003660003 | 2254       | 22311                | 22403               | 24Hr  |
|                  | (WLO)  | SITOR     | 1090       | 003660003 | 2256       | 22312                | 22404               | 24Hr  |
|                  | (WLO)  | SITOR     | 1090       | 003660003 | 2260       | 22314                | 22406               | 24Hr  |
|                  | (WLO)  | SITOR     | 1090       | 003660003 | 2262       | 22315                | 22407               | 24Hr  |
|                  | (WLO)  | SITOR     | 1090       | 003660003 | 2272       | 22320                | 22412               | 24Hr  |
|                  | (WLO)  | SITOR     | 1090       | 003660003 | 2284       | 22326                | 22418               | 24Hr  |
|                  | (WLO)  | SITOR     | 1090       | 003660003 | 2510       | 25177.5              | 26105.5             | 24Hr  |
|                  | (WLO)  | SITOR     | 1090       | 003660003 | 2515       | 25180                | 26108               | 24Hr  |
|                  | (WLO)  | DSC       |            | 003660003 |            | 4208                 | 4219                | 24Hr  |
|                  | (WLO)  | DSC       |            | 003660003 |            | 6312.5               | 6331.0              | 24Hr  |
|                  | (WLO)  | DSC       |            | 003660003 |            | 8415                 | 8436.5              | 24Hr  |
|                  | (WLO)  | DSC       |            | 003660003 |            | 12577.5              | 12657               | 24Hr  |
|                  | (WLO)  | DSC       |            | 003660003 |            | 16805                | 16903               | 24Hr  |
|                  | (WLO)  | Voice     |            | 003660003 | 405        | 4077                 | 4369                | 24Hr  |
|                  | (WLO)  | Voice     |            |           | 414        | 4104                 | 4396                | 24Hr  |
|                  | (WLO)  | Voice     |            |           | 419        | 4119                 | 4411                | 24Hr  |
|                  | (WLO)  | Voice     |            | 003660003 | 607        | 6218                 | 6519                | 24Hr  |
|                  | (WLO)  | Voice     |            | 003660003 | 824        | 8264                 | 8788                | 24Hr  |
|                  | (WLO)  | Voice     |            |           | 829        | 8279                 | 8803                | 24Hr  |
|                  | (WLO)  | Voice     |            |           | 830        | 8282                 | 8806                | 24Hr  |
|                  | (WLO)  | Voice     |            | 003660003 | 1212       | 12263                | 13110               | 24Hr  |
|                  | (WLO)  | Voice     |            |           | 1226       | 12305                | 13152               | 24Hr  |
|                  | (WLO)  | Voice     |            |           | 1607       | 16378                | 17260               | 24Hr  |
|                  | (WLO)  | Voice     |            |           | 1641       | 16480                | 17362               | 24Hr  |
|                  | (WLO)  | VHF Voice |            |           | CH 25,84   |                      |                     | 24Hr  |
|                  | (WLO)  | DSC Call  |            | 003660003 | CH 70      |                      |                     | 24Hr  |
|                  | (WLO)  | DSC Work  |            | 003660003 | CH 84      |                      |                     | 24Hr  |
|                  | (WLO)  | CW        |            |           |            | 434                  | 434                 | Day   |
|                  | (WLO)  | CW        |            |           |            | 4250                 | 4250                | Day   |
|                  | (WLO)  | CW        |            |           |            | 6446.5               | 6446.5              | Day   |
|                  | (WLO)  | CW        |            |           |            | 8445                 | 8445                | Day   |
|                  | (WLO)  | CW        |            |           |            | 8472                 | 8472                | Day   |
|                  | (WLO)  | CW        |            |           |            | 8534                 | 8534                | Day   |
|                  | (WLO)  | CW        |            |           |            | 8658                 | 8658                | Day   |
|                  | (WLO)  | CW        |            |           |            | 12660                | 12660               | Day   |
|                  | (WLO)  | CW        |            |           |            | 12704.5              | 12704.5             | Day   |
|                  | (WLO)  | CW        |            |           |            | 13024.9              | 13024.9             | Day   |
|                  | (WLO)  | CW        |            |           |            | 16969                | 16969               | Day   |
|                  | (WLO)  | CW        |            |           |            | 17173.5              | 17173.5             | Day   |
|                  | (WLO)  | CW        |            |           |            | 22686.5              | 22686.5             | Day   |
| Tuckerton,<br>NJ | (WSC)  | SITOR     | 1108       |           | 419        | 4181.5               | 4219                | 24Hr  |
|                  | (WSC)  | SITOR     | 1108       |           | 832        | 8392                 | 8432                | 24Hr  |
|                  | (WSC)  | SITOR     | 1108       |           | 1283       | 12518                | 12620.5             | 24Hr  |
|                  | (WSC)  | SITOR     | 1108       |           | 1688       | 16727                | 16850               | 24Hr  |
|                  | (WSC)  | SITOR     | 1108       |           | 1805       | 18872.5              | 19683               | 24Hr  |

*Continued on Page 62*



## VOS Program

*Continued from Page 61*

| Location    | (CALL) | Mode  | SEL<br>CAL | MMSI# | ITU<br>CH# | Ship<br>Xmit<br>Freq | Ship<br>Rec<br>Freq | Watch |
|-------------|--------|-------|------------|-------|------------|----------------------|---------------------|-------|
| Seattle, WA | (WSC)  | SITOR | 1108       |       | 2295       | 22331.5              | 22423.5             | 24Hr  |
|             | (WSC)  | CW    |            |       |            | 482                  | 482                 | 24Hr  |
|             | (WSC)  | CW    |            |       |            | 4316                 | 4316                | 24Hr  |
|             | (WSC)  | CW    |            |       |            | 6484.5               | 6484.5              | 24Hr  |
|             | (WSC)  | CW    |            |       |            | 8680                 | 8680                | 24Hr  |
|             | (WSC)  | CW    |            |       |            | 12789.5              | 12789.5             | 24Hr  |
|             | (WSC)  | CW    |            |       |            | 16916.5              | 16916.5             | 24Hr  |
|             | (KLB)  | SITOR | 1113       |       | 408        | 4176                 | 4214                | 24Hr  |
|             | (KLB)  | SITOR | 1113       |       | 608        | 6266.5               | 6318                | 24Hr  |
|             | (KLB)  | SITOR | 1113       |       | 818        | 8385                 | 8425                | 24Hr  |
|             | (KLB)  | SITOR | 1113       |       | 1223       | 12488                | 12590.5             | 24Hr  |
|             | (KLB)  | SITOR | 1113       |       | 1604       | 16685                | 16808.5             | 24Hr  |
|             | (KLB)  | SITOR | 1113       |       | 2240       | 22304                | 22396               | 24Hr  |
|             | (KLB)  | CW    |            |       |            | 488                  | 488                 | 24Hr  |
|             | (KLB)  | CW    |            |       |            | 4348.5               | 4348.5              | 24Hr  |
|             | (KLB)  | CW    |            |       |            | 8582.5               | 8582.5              | 24Hr  |
|             | (KLB)  | CW    |            |       |            | 12917                | 12917               | 24Hr  |
|             | (KLB)  | CW    |            |       |            | 17007.7              | 17007.7             | 24Hr  |
|             | (KLB)  | CW    |            |       |            | 22539                | 22539               | 24Hr  |

WLO Radio is equipped with an operational Thrane & Thrane TT-6200A DSC system for VHF and MF/HF general purpose digital selective calling communications.

To call a Mobile Marine Radio Inc. coast station facility on Morse Code 'CW', use a frequency from the worldwide channels listed below.

CW Calling Frequencies: 4184.0, 6276.0, 8368.0, 12552.0, 16736.0, 22280.5, 25172.0 4184.5, 6276.5, 8369.0, 12553.5, 16738.0, 22281.0

## Ship Telex Automatic System Computer Commands and Guidelines for Contacting Mobile Marine Radio Stations

### Ship Station Response

1) INITIATE ARQ CALL

4) SHIP'S ANSWERBACK IDENTITY

6) Send Command

OBS+ (Weather Observations)

OPR+ (Operator Assistance)

HELP+ (Operator Procedure)

### Land Station Response

2) RTTY CHANNEL

3) "WHO ARE YOU"

(Requests Ship Answerback)

5) GA+?

7) MOM

*Continued on Page 63*



**VOS Program***Continued from Page 62*

- 8) MSG+?
- 9) SEND MESSAGE
- 10) KKKK (End of Message Indicator,  
WAIT for System Response  
DO NOT DISCONNECT)
- 11) RTTY CHANNEL
- 12) SHIP'S ANSWERBACK
- 13) SYSTEM REFERENCE, INFORMATION,  
TIME, DURATION
- 14) GA+?
- 15) GO TO STEP 6, or
- 16) BRK+? Clear Radio Circuit)

Stations listed as being 24-hr may not be operational during periods of poor propagation.

For the latest information on Mobile Marine Radio frequencies, visit their webpage at: <http://www.wloradio.com>.

**MARITEL STATIONS****INSTRUCTIONS FOR MARITEL**

Key the mike for five seconds on the working channel for that station. You should then get a recording telling you that you have reached the MARITEL system, and if you wish to place a call, key your mike for an additional five seconds. A MARITEL operator will then come on frequency. Tell them that you want to pass a marine weather observation.

For the latest information on MARITEL frequencies, visit their webpage at: <http://www.maritelinc.com>.

| <b>STATIONS</b>   | <b>VHF CHANNEL(S)</b> | <b>HAWAII</b>              |    |                         |          |
|-------------------|-----------------------|----------------------------|----|-------------------------|----------|
|                   |                       |                            |    | Cleveland, OH (Erie)    | 86       |
|                   |                       | Haleakala, HI (Maui)       | 26 | Buffalo, NY (Erie)      | 28       |
|                   |                       | Palehua, HI (Oahu)         | 27 |                         |          |
| <b>WEST COAST</b> |                       | <b>GREAT LAKES</b>         |    | <b>NORTH EAST COAST</b> |          |
| Bellingham, WA    | 28,85                 | Duluth, MN (Superior)      | 84 | Portland, ME            | 24,28,87 |
| Port Angeles, WA  | 25                    | Ontonagon, MI (Superior)   | 86 | Gloucester, MA          | 25       |
| Camano Island, WA | 24                    | Copper Harbor (Superior)   | 87 | Boston, MA              | 26       |
| Seattle, WA       | 26                    | Grand Marias (Superior)    | 84 | Hyannisport, MA         | 28       |
| Tacoma, WA        | 28                    | Sault Ste Marie (Superior) | 86 | Nantucket, MA           | 85       |
| Tumwater, WA      | 85                    | Port Washington, WI (Mich) | 85 | New Bedford, MA         | 24,26    |
| Astoria, OR       | 24,26                 | Charlevoix (Michigan)      | 84 | Providence, RI          | 27       |
| Rainier, OR       | 28                    | Chicago, IL (Michigan)     | 27 | Narragansett, RI        | 84       |
| Portland, OR      | 26                    | Roger City (Huron)         | 28 | New London, CT          | 26,86    |
| Newport, OR       | 28                    | Alpena, MI (Huron)         | 84 | Bridgeport, CT          | 27       |
| Coos Bay, OR      | 25                    | Tawas City, MI (Huron)     | 87 | Staten Island, NY       | 28       |
| Santa Cruz, CA    | 27                    | Port Huron, MI (Huron)     | 25 | Sandy Hook, NJ          | 24       |
| Santa Barbara, CA | 86                    | Detroit, MI (Erie)         | 28 | Toms River, NJ          | 27       |
| Redondo Bch, CA   | 27,85,87              |                            |    | Ship Bottom, NJ         | 28       |

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## VOS Program

*Continued from Page 63*

|                         |       |                    |       |                   |          |
|-------------------------|-------|--------------------|-------|-------------------|----------|
| Beach Haven, NJ         | 25    | Jacksonville, FL   | 26    | Port Arthur, TX   | 27       |
| Atlantic City, NJ       | 26    | Daytona Bch, FL    | 28    | Lake Charles, LA  | 28,84    |
| Cape May, NJ            | 24    | Cocoa Bch, FL      | 26    | Erath, LA         | 87       |
| Philadelphia, PA        | 26    | Vero Bch, FL       | 27    | Morgan City, LA   | 24,26    |
| Delaware WW Odessa, DE  | 28    | St Lucie, FL       | 26    | Houma, LA         | 86       |
| Delaware WW Lewes, DE   | 27    | W Palm Bch, FL     | 28    | Venice, LA        | 27,28,86 |
| Bethany Beach, DE       | 86    | Ft Lauderdale, FL  | 84    | New Orleans, LA   | 24,26,87 |
| Ocean City, MD          | 26    | Miami, FL          | 24,25 | Hammond, LA       | 85       |
| North Bay, MD           | 24    | Key Largo, FL      | 27,28 | Hopedale, LA      | 85       |
| Virginia Bch, VA        | 26,27 | Marathon, FL       | 27    | Gulfport, MS      | 28       |
|                         |       | Key West, FL       | 26,84 | Pascagoula, MS    | 27       |
| <b>CHESAPEAKE BAY</b>   |       |                    |       | Pensacola, FL     | 26       |
| Baltimore, MD           | 25,26 | <b>GULF COAST</b>  |       | Ft Walton Bch, FL | 28       |
| Cambridge, MD           | 28    | Port Mansfield, TX | 25    | Panama City, FL   | 26       |
| Point Lookout, MD       | 26    | Corpus Christi, TX | 26,28 | Apalachicola, FL  | 28       |
| Belle Haven, VA         | 25    | Port O'Conner, TX  | 24    | Crystal River, FL | 28       |
|                         |       | Matagorda, TX      | 84    | Port Richie, FL   | 25       |
| <b>SOUTH EAST COAST</b> |       | Freeport, TX       | 25,27 | Clearwater, FL    | 26       |
| Morehead City, NC       | 28    | Galveston, TX      | 24    | Tampa Bay, FL     | 24       |
| Wilmington, NC          | 26    | Arcadia, TX        | 87    | Venice, FL        | 27       |
| Georgetown, SC          | 24    | Houston, TX        | 26    | Ft Myers, FL      | 26       |
| Charleston, SC          | 26    | High Island, TX    | 85    | Naples, FL        | 25       |
| Savannah, GA            | 27    |                    |       |                   |          |

## Military Communications Circuits

Navy, Naval, and U.S. Coast Guard ships wishing to participate in the VOS program may do so by sending unclassified weather observations in synoptic code (BBXX format) to the following Plain Language Address (PLAD):

SHIP OBS NWS SILVER SPRING MD

As weather observations received by NWS are public data, vessels should check with their local command before participating in the VOS Program.

## New Recruits — May through August 1998

During the four-month period ending August 31, 1998, PMOs recruited 33 vessels as weather observers/reporters in the National Weather Service (NWS) Voluntary Observing Ship (VOS) Program. Thank you for joining the program.

All Voluntary Observing Ships are asked to follow the worldwide weather reporting schedule—by reporting weather four times daily at 0000, 0600, 1200, and 1800 UTC. The United States and Canada have a three-hourly weather reporting schedule from coastal waters out 200 miles from shore, and from anywhere on the Great Lakes. From these coastal areas, please report weather at 0000, 0300, 0600, 0900, 1200, 1500, 1800, and 2100 ZULU or UTC, whenever possible.

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## VOS Program

*Continued from Page 64*

### PMOs attend SEAS/AMVER Training

National Weather Service PMOs attended one of two SEAS/AMVER training sessions held at COMSAT headquarters in Bethesda, Maryland, near Washington, D.C., September 15-16, 1998, and November 3-4, 1998. The purpose of the training was for the PMOs to become familiar with the software and help them provide training to ship's officers. Also present at the meetings were Vince Zegowitz (Marine Observations Program Leader), Martin Baron (Assistant Program Leader, Marine Observations), Tim Rulon (GMDSS Program Manager), Bill Woodward (head of the SEAS Program Office, who led the effort to develop the software), and SEAS Field Representatives Jim Farrington (Norfolk) and Warren Krug (Miami).

The SEAS/AMVER software has been developed to simplify preparation of weather and Automated Mutual Assistance Vessel Rescue (AMVER) messages. When COMSAT receives your weather message as formatted by this software, your call sign and position is forwarded to the AMVER center (other INMARSAT stations do not currently perform this service). Please contact any United States PMO to obtain this free software.✂

## National Weather Service Voluntary Observing Ship Program

### New Recruits from May 1 to August 31, 1998

| NAME OF SHIP        | CALL    | AGENT NAME                                   | RECRUITING PMO    |
|---------------------|---------|----------------------------------------------|-------------------|
| ALEGRIA             | ZCCK5   | MAX FONVIELLE                                | MIAMI, FL         |
| APOLLOGRACHT        | PCSV    | C.V. SCHEEPVAARTONDERNEMING APOLLOGRACHT     | BALTIMORE, MD     |
| ATLANTIC NOVA       | 3FWT4   | BARBER INTERNATIONAL LTD                     | SEATTLE, WA       |
| BUNGA SAGA EMPAT    | 9MBM9   | MAYAYSIAN INTERNATIONAL SHIPPING CO., INC    | SEATTLE, WA       |
| CAMARINA            | MVGY5   | DENHOLM SHIP MGMT. LTD.                      | NEW ORLEANS, LA   |
| CAPE JACOB          | WJBA    | CAPE JACOB @ AMERICAN OVERSEAS MARINE CORP   | NEW ORLEANS, LA   |
| CHARLOTTE SCHULTE   | P3WE4   | TRANSCO AGENCIES                             | NORFOLK, VA       |
| EASTERN BRIDGE      | C6JY9   | ROPNER SHIP MANAGEMENT LIMITED               | BALTIMORE, MD     |
| ENDEAVOR            | WCE5063 | FARRELL LINES                                | NORFOLK, VA       |
| ETERNAL WIND        | 3FIX7   | WORLD MARINE COMPANY, LTD                    | BALTIMORE, MD     |
| EVER APEX           | 3FCX7   | THE WORLD TRADE CENTER                       | BALTIMORE, MD     |
| EVER DIADEM         | 3FOF8   | EVERGREEN AMERICA CORP                       | NEW YORK CITY, NY |
| GULF STAR           | 3FQY7   | STAR MARITIME                                | NEW ORLEANS, LA   |
| HYUNDAI EXPLORER    | 3FTG4   | HYUNDAI AMERICA SHIPPING AGENCY, INC         | SEATTLE, WA       |
| KANIN               | ELEO2   | SPLOSNA PLOVBA                               | NEW ORLEANS, LA   |
| KENNICOTT           | WCY2920 | ALASKA MARINE HIGHWAY SYSTEM D.O.T.          | SEATTLE, WA       |
| LEISE MAERSK        | OXGR2   | MAERSK LINE                                  | SAN FRANCISCO, CA |
| LIBRA SANTOS        | V2AF1   | INCHAPE SHIPPING SERVICES                    | NORFOLK, VA       |
| MAERSK GENOA        | DGUC    | MAERSK INC., GIELADA FARMS                   | NEW YORK CITY, NY |
| MAERSK TAIKI        | 9VIG    | A. P. MOLLER SINGAPORE PTE. LTD.             | BALTIMORE, MD     |
| MEKHANIK KALYUZHNIY | UFLO    | FESCO AGENCIES N.A., INC                     | SEATTLE, WA       |
| NOAAS GORDON GUNTER | WTEO    | NMFS FACILITY                                | NEW ORLEANS, LA   |
| OCEAN PALM          | 3FDO7   | FUYOKAIUN SHIPMANAGEMENT CORP.               | SEATTLE, WA       |
| ORIENTAL ROAD       | 3FXT6   | PORT METEOROLOGICAL OFFICER                  | HOUSTON, TX       |
| PRESIDENT HOOVER    | WCY2883 | AMERICAN SHIP MANAGEMENT                     | SAN FRANCISCO, CA |
| REGINA MAERSK       | OZIN2   | MAERSK INC., GIRALDA FARMS                   | NEW YORK CITY, NY |
| RUBIN PHOENIX       | 3FFT7   | INCHAPE SHIPPING SERVICES                    | NORFOLK, VA       |
| STAR TRONDANGER     | LAQQ2   | WESTFAL-LARSEN MANAGEMENT A/S                | BALTIMORE, MD     |
| SUCO DO BRASIL      | ELAQ5   | MARITIME SERVICES ALEUROP GMBH               | BALTIMORE, MD     |
| TASCO               | LAON2   | WILHELMSSEN LINES, REFLECTIONS II, SUITE 480 | NORFOLK, VA       |
| USCGC HEALY WAGB-20 | NZZZ    | USCGC HEALY WAGB-20                          | SEATTLE, WA       |
| VISAYAS VICTORY     | DZVP    | STAR SHIPPING (NY) INC                       | BALTIMORE, MD     |
| WESTERN BRIDGE      | C6JQ9   | ROPNER SHIP MANAGEMENT LIMITED               | BALTIMORE, MD     |



## VOS Program Awards and Presentations Gallery



*PMO Jim Saunders of Baltimore presenting award to Captain Scribner of the **ITB JACKSONVILLE**.*



*PMO Jim Saunders of Baltimore presenting award to Second Officer Peter Q. Merka of the **M/V AGULHAS**.*





A 1997 VOS Plaque was awarded to the **WESTWARD VENTURE** for the high quality of surface weather observations. Pictured with PMO Pat Bradow of Seattle from the left are Second Mate Mick Richie and Captain Don Charland.



The **WESTWOOD HALLA** was one of the ships recognized in 1997 by PMO Pat Bradow. Pictured is Captain Hans Joachim Kruschka.



**OCEAN CLIPPER** receiving 1997 outstanding VOS Program support award from PMO Jack Warrelman. Standing rear: L - Mark Buyes R - Jody Elfert; Standing L-R Ch. Mate Marshall Perez, DPOs David Fazioli, Don Vandelinder, Mike Billings, Ch. Mate Jonathon Samual; Sitting: DPO Michelle Gorman; Kneeling: DPO Fred Blackden; Not Shown: DPOs Ted Agon, Darin Hilton, Chris Serrano.



## VOS Program



The **GOLDEN GATE BRIDGE** comes through once again with one of the top honors for 1997 in the VOS awards program. Pictured from left to right are Third Mate Arjun Ravikant, Chief Mate C.S. Batibrolu, Seattle PMO Pat Brandow, Captain T. Yamamoto, and Radio Officer S. Sarkar.



PMO Bob Drummond of Miami presents a 1997 VOS award to Captain James V. Sieler of the **R/V SEWARD JOHNSON**



PMO George Smith of Cleveland presents a 1997 award to Captain James Van Dongen of the **INDIANA HARBOR**. The vessel is 1000 feet long and 150 feet wide.



## VOS Coop Ship Reports — May through August 1998

The National Climatic Data Center compiles the tables for the VOS Cooperative Ship Report from radio messages. The values under the monthly columns represent the number of weather reports received. Port Meteorological Officers supply ship names to the NCDC. Comments or questions regarding this report should be directed to NCDC, Operations Support Division, 151 Patton Avenue, Asheville, NC 28801, Attn: Dimitri Chappas (828-271-4055 or [dchappas@ncdc.noaa.gov](mailto:dchappas@ncdc.noaa.gov)).

| SHIP NAME              | CALL    | PORT          | MAY | JUN | JUL | AUG | TOTAL |
|------------------------|---------|---------------|-----|-----|-----|-----|-------|
| 1ST LT ALEX BONNYMAN   | WMFZ    | New York City | 0   | 8   | 0   | 120 | 128   |
| 1ST LT BALDOMERO LOPEZ | WJKV    | Jacksonville  | 0   | 0   | 43  | 0   | 43    |
| A. V. KASTNER          | ZCAM9   | Jacksonville  | 0   | 41  | 74  | 65  | 180   |
| AALSMEERGRACHT         | PCAM    | Long Beach    | 42  | 30  | 35  | 40  | 147   |
| ACADIA FOREST          | D5DI    | New Orleans   | 0   | 87  | 55  | 56  | 198   |
| ACT 7                  | GWAN    | Newark        | 17  | 57  | 65  | 73  | 212   |
| ACT I                  | GYXG    | Newark        | 87  | 57  | 45  | 63  | 252   |
| ADAM E. CORNELIUS      | WCF7451 | Chicago       | 38  | 78  | 18  | 0   | 134   |
| ADVANTAGE              | WPP0    | Norfolk       | 1   | 52  | 80  | 0   | 133   |
| AGDLEK                 | OUGV    | Miami         | 33  | 28  | 42  | 43  | 146   |
| AGULHAS                | 3ELE9   | Baltimore     | 59  | 101 | 56  | 48  | 264   |
| AL AWDAAH              | 9KWA    | Houston       | 127 | 63  | 356 | 65  | 611   |
| AL FUNTAS              | 9KKX    | Miami         | 34  | 12  | 21  | 3   | 70    |
| AL SAMID00N            | 9KKF    | Houston       | 61  | 0   | 9   | 27  | 97    |
| AL SHUHADAA            | 9KKH    | Houston       | 15  | 11  | 51  | 3   | 80    |
| ALBEMARLE ISLAND       | C6LU3   | Newark        | 73  | 16  | 72  | 103 | 264   |
| ALBERNI DAWN           | ELAC5   | Houston       | 58  | 496 | 73  | 10  | 637   |
| ALDEN W. CLAUSEN       | ELBM4   | Norfolk       | 25  | 0   | 53  | 36  | 114   |
| ALEXANDER VON HUMBOLDT | Y3CW    | Miami         | 728 | 656 | 293 | 242 | 1919  |
| ALKMAN                 | C6OG4   | Houston       | 56  | 43  | 23  | 54  | 176   |
| ALLEGIANCE             | WSKD    | Norfolk       | 7   | 52  | 49  | 34  | 142   |
| ALLIGATOR AMERICA      | JPAL    | Seattle       | 48  | 33  | 63  | 31  | 175   |
| ALLIGATOR BRAVERY      | 3FXX4   | Oakland       | 51  | 54  | 104 | 44  | 253   |
| ALLIGATOR COLUMBUS     | 3ETV8   | Seattle       | 32  | 10  | 20  | 77  | 139   |
| ALLIGATOR FORTUNE      | ELFK7   | Seattle       | 35  | 0   | 0   | 0   | 35    |
| ALLIGATOR GLORY        | ELJP2   | Seattle       | 14  | 6   | 14  | 12  | 46    |
| ALLIGATOR HOPE         | ELFN8   | Seattle       | 1   | 0   | 0   | 0   | 1     |
| ALLIGATOR LIBERTY      | JFUG    | Seattle       | 48  | 28  | 67  | 18  | 161   |
| ALLIGATOR STRENGTH     | 3FAK5   | Oakland       | 41  | 47  | 48  | 58  | 194   |
| ALMERIA LYKES          | WGMJ    | Houston       | 36  | 24  | 30  | 48  | 138   |
| ALPENA                 | WAV4647 | Cleveland     | 87  | 72  | 28  | 58  | 245   |
| ALTAIR                 | DBBI    | Miami         | 593 | 685 | 576 | 671 | 2525  |
| AMAZON                 | S6BJ    | Norfolk       | 35  | 43  | 49  | 21  | 148   |
| AMBASSADOR BRIDGE      | 3ETH9   | Oakland       | 62  | 129 | 57  | 61  | 309   |
| AMERICA STAR           | C6JZ2   | Houston       | 23  | 64  | 100 | 52  | 239   |
| AMERICAN CONDOR        | WJRG    | Newark        | 0   | 105 | 70  | 93  | 268   |
| AMERICAN CORMORANT     | KGOP    | Jacksonville  | 5   | 0   | 99  | 0   | 104   |
| AMERICAN FALCON        | KMJA    | Jacksonville  | 0   | 0   | 72  | 24  | 96    |
| AMERICAN MERLIN        | WRGY    | Norfolk       | 3   | 0   | 55  | 0   | 58    |
| AMERICANA              | LADX2   | New Orleans   | 0   | 24  | 15  | 12  | 51    |
| AMERIGO VESPUCCI       | ICBA    | Norfolk       | 8   | 19  | 22  | 0   | 49    |
| ANAHUAC                | ELFV3   | Long Beach    | 5   | 26  | 17  | 22  | 70    |
| ANASTASIS              | 9HOZ    | Miami         | 0   | 15  | 3   | 1   | 19    |
| ANATOLIY KOLESNICHENKO | UINM    | Seattle       | 19  | 8   | 12  | 17  | 56    |
| ANDERS MAERSK          | OXIT2   | Long Beach    | 62  | 70  | 72  | 37  | 241   |
| ANKERGRACHT            | PCQL    | Baltimore     | 31  | 48  | 20  | 15  | 114   |
| ANNA MAERSK            | OYKS2   | Long Beach    | 5   | 45  | 35  | 55  | 140   |
| APL CHINA              | V7AL5   | Seattle       | 18  | 52  | 38  | 55  | 163   |
| APL JAPAN              | V7AL7   | Seattle       | 35  | 29  | 171 | 71  | 306   |
| APL KOREA              | WCX8883 | Seattle       | 29  | 0   | 0   | 0   | 29    |
| APL SINGAPORE          | WCX8812 | Seattle       | 101 | 0   | 0   | 0   | 101   |
| APL THAILAND           | WCX8882 | Seattle       | 83  | 0   | 0   | 0   | 83    |
| APOLLOGRACHT           | PCSV    | Baltimore     | 34  | 3   | 0   | 1   | 38    |
| ARABIAN SEA            | C6QS    | Miami         | 0   | 12  | 15  | 21  | 48    |
| ARCO ALASKA            | KSBK    | Long Beach    | 6   | 34  | 10  | 0   | 50    |
| ARCO ANCHORAGE         | WCIO    | Long Beach    | 0   | 12  | 3   | 0   | 15    |

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## VOS Cooperative Ship Reports

*Continued from Page 69*

| SHIP NAME           | CALL    | PORT          | MAY | JUN | JUL | AUG | TOTAL |
|---------------------|---------|---------------|-----|-----|-----|-----|-------|
| ARCO CALIFORNIA     | WMCV    | Long Beach    | 1   | 0   | 9   | 24  | 34    |
| ARCO FAIRBANKS      | WGWB    | Long Beach    | 12  | 12  | 8   | 14  | 46    |
| ARCO INDEPENDENCE   | KLHV    | Long Beach    | 17  | 24  | 19  | 6   | 66    |
| ARCO JUNEAU         | KSBG    | Long Beach    | 0   | 12  | 10  | 3   | 25    |
| ARCO PRUDHOE BAY    | KPFD    | Long Beach    | 1   | 0   | 4   | 0   | 5     |
| ARCO SAG RIVER      | WLDF    | Long Beach    | 8   | 18  | 11  | 4   | 41    |
| ARCO SPIRIT         | KHLD    | Long Beach    | 19  | 14  | 14  | 2   | 49    |
| ARCO TEXAS          | KNFD    | Long Beach    | 12  | 0   | 7   | 19  | 38    |
| ARCTIC SUN          | ELQB8   | Long Beach    | 14  | 14  | 57  | 36  | 121   |
| ARCTIC UNIVERSAL    | 4QUL    | Baltimore     | 75  | 63  | 46  | 61  | 245   |
| ARGONAUT            | KFDV    | Newark        | 15  | 26  | 54  | 44  | 139   |
| ARIES               | KGBD    | New York City | 0   | 0   | 94  | 37  | 131   |
| ARINA ARCTICA       | OVYA2   | Miami         | 137 | 42  | 77  | 84  | 340   |
| ARKTIS LIGHT        | OZBL2   | Miami         | 0   | 73  | 18  | 108 | 199   |
| ARKTIS SPRING       | OWVD2   | Miami         | 0   | 59  | 42  | 48  | 149   |
| ARMCO               | WE6279  | Cleveland     | 53  | 50  | 74  | 72  | 249   |
| ARTHUR M. ANDERSON  | WE4805  | Chicago       | 67  | 58  | 75  | 76  | 276   |
| ARTHUR MAERSK       | OXRS2   | Long Beach    | 40  | 59  | 49  | 6   | 154   |
| ASPHALT COMMANDER   | WFJN    | New Orleans   | 0   | 18  | 19  | 2   | 39    |
| ATLANTIC            | 3FYT    | Miami         | 230 | 219 | 207 | 226 | 882   |
| ATLANTIC BULKER     | 3FSQ4   | Miami         | 4   | 44  | 0   | 58  | 106   |
| ATLANTIC CARTIER    | C6MS4   | Norfolk       | 24  | 0   | 18  | 10  | 52    |
| ATLANTIC COMPANION  | SKPE    | Newark        | 22  | 17  | 25  | 32  | 96    |
| ATLANTIC COMPASS    | SKUN    | Norfolk       | 37  | 16  | 37  | 16  | 106   |
| ATLANTIC CONCERT    | SKOZ    | Norfolk       | 17  | 40  | 9   | 0   | 66    |
| ATLANTIC CONVEYOR   | C6NI3   | Norfolk       | 5   | 9   | 7   | 3   | 24    |
| ATLANTIC ERIE       | VCQM    | Baltimore     | 12  | 11  | 19  | 16  | 58    |
| ATLANTIC NOVA       | 3FWT4   | Seattle       | 13  | 0   | 0   | 0   | 13    |
| ATLANTIC OCEAN      | C6T2064 | Newark        | 15  | 0   | 0   | 51  | 66    |
| ATLANTIC SUPERIOR   | C6BT8   | Baltimore     | 0   | 32  | 23  | 22  | 77    |
| ATLANTIS            | KAQP    | New Orleans   | 30  | 0   | 15  | 11  | 56    |
| AUCKLAND STAR       | C6KV2   | Baltimore     | 39  | 54  | 52  | 58  | 203   |
| AUSTRAL RAINBOW     | WEZP    | New Orleans   | 6   | 12  | 64  | 27  | 109   |
| AUTHOR              | GBSA    | Houston       | 35  | 54  | 27  | 39  | 155   |
| AXEL MAERSK         | OXSF2   | Oakland       | 0   | 26  | 52  | 83  | 161   |
| B. T. ALASKA        | WFQE    | Long Beach    | 8   | 104 | 20  | 31  | 163   |
| BARBARA ANDRIE      | WTC9407 | Chicago       | 10  | 23  | 12  | 32  | 77    |
| BARBICAN SPIRIT     | DVFS    | Miami         | 44  | 102 | 29  | 42  | 217   |
| BARRINGTON ISLAND   | C6QK    | Miami         | 68  | 38  | 84  | 71  | 261   |
| BAY BRIDGE          | ELES7   | Seattle       | 31  | 17  | 25  | 14  | 87    |
| BELGRANO            | P3HR2   | Houston       | 0   | 45  | 51  | 88  | 184   |
| BELLONA             | 3FEA4   | Jacksonville  | 3   | 0   | 0   | 0   | 3     |
| BERING SEA          | C6YY    | Miami         | 39  | 94  | 0   | 0   | 133   |
| BERNARDO QUINTANA A | C6KJ5   | New Orleans   | 43  | 41  | 2   | 24  | 110   |
| BLEST FUTURE        | DUHE    | Seattle       | 1   | 0   | 0   | 0   | 1     |
| BLOSSOM FOREVER     | DZSL    | Seattle       | 0   | 30  | 64  | 119 | 213   |
| BLUE GEMINI         | 3FPA6   | Seattle       | 79  | 34  | 24  | 8   | 145   |
| BLUE HAWK           | D5HZ    | Norfolk       | 32  | 0   | 0   | 0   | 32    |
| BLUE NOVA           | 3FDV6   | Seattle       | 21  | 66  | 56  | 10  | 153   |
| BLUE RIDGE          | KNJD    | Oakland       | 3   | 0   | 0   | 0   | 3     |
| BONN EXPRESS        | DGNB    | Houston       | 666 | 676 | 138 | 178 | 1658  |
| BOSPORUS BRIDGE     | 3FMV3   | Oakland       | 72  | 73  | 72  | 48  | 265   |
| BOW TRIGGER         | 3FOT3   | New York City | 0   | 42  | 65  | 34  | 141   |
| BP ADMIRAL          | ZCAK2   | Houston       | 0   | 17  | 8   | 1   | 26    |
| BREMEN EXPRESS      | 9VUM    | Norfolk       | 0   | 308 | 659 | 613 | 1580  |
| BRIGHT PHOENIX      | DXNG    | Seattle       | 80  | 56  | 77  | 51  | 264   |
| BRIGHT STATE        | DXAC    | Seattle       | 44  | 0   | 0   | 0   | 44    |
| BRIGIT MAERSK       | OXVW4   | Oakland       | 28  | 53  | 58  | 45  | 184   |
| BRISBANE STAR       | C6LY4   | Seattle       | 64  | 31  | 9   | 24  | 128   |
| BRITISH ADVENTURE   | ZCAK3   | Seattle       | 16  | 2   | 19  | 56  | 93    |
| BRITISH RANGER      | ZCAS6   | Houston       | 90  | 65  | 55  | 94  | 304   |
| BROOKLYN BRIDGE     | 3EZJ9   | Oakland       | 55  | 61  | 64  | 54  | 234   |
| BRUCE SMART         | ELOF4   | Oakland       | 63  | 25  | 61  | 0   | 149   |
| BT NAVIGATOR        | VRIU    | New Orleans   | 0   | 21  | 0   | 10  | 31    |
| BT NESTOR           | ZCBL4   | New York City | 0   | 0   | 0   | 4   | 4     |
| BUCKEYE             | WAQ3520 | Cleveland     | 0   | 105 | 46  | 58  | 209   |
| BUNGA ORKID DUA     | 9MBQ4   | Seattle       | 21  | 0   | 47  | 18  | 86    |
| BUNGA ORKID SATU    | 9MBQ3   | Seattle       | 24  | 0   | 0   | 0   | 24    |
| BUNGA SAGA TIGA     | 9MBM8   | Seattle       | 0   | 49  | 104 | 83  | 236   |
| BURNS HARBOR        | WQZ7049 | Chicago       | 170 | 120 | 178 | 150 | 618   |
| CABO TAMAR          | ELMV3   | Oakland       | 0   | 22  | 5   | 46  | 73    |
| CALCITE II          | WB4520  | Chicago       | 9   | 41  | 74  | 113 | 237   |

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| SHIP NAME              | CALL    | PORT          | MAY | JUN | JUL | AUG | TOTAL |
|------------------------|---------|---------------|-----|-----|-----|-----|-------|
| CALIFORNIA CURRENT     | ELMG2   | New Orleans   | 40  | 30  | 67  | 18  | 155   |
| CALIFORNIA HIGHWAY     | 3FHQ4   | Seattle       | 7   | 0   | 0   | 0   | 7     |
| CALIFORNIA JUPITER     | ELKU8   | Long Beach    | 44  | 58  | 25  | 49  | 176   |
| CALIFORNIA LUNA        | 3EYX5   | Seattle       | 0   | 31  | 31  | 27  | 89    |
| CALIFORNIA MERCURY     | JGPN    | Seattle       | 41  | 0   | 37  | 1   | 79    |
| CALIFORNIA PEGASUS     | 3EPB6   | Oakland       | 18  | 19  | 12  | 17  | 66    |
| CALIFORNIA SATURN      | ELKU9   | Norfolk       | 0   | 8   | 15  | 6   | 29    |
| CALIFORNIA TRITON      | S6DB    | Long Beach    | 0   | 8   | 0   | 0   | 8     |
| CALIFORNIA ZEUS        | ELJP8   | Oakland       | 0   | 24  | 35  | 151 | 210   |
| CANBERRA               | GBVC    | Miami         | 0   | 8   | 6   | 9   | 23    |
| CAPE BREEZE            | DUGK    | Seattle       | 0   | 12  | 2   | 15  | 29    |
| CAPE CHARLES           | 3EFX5   | Seattle       | 16  | 15  | 12  | 15  | 58    |
| CAPE HENRY             | 3ENQ9   | Norfolk       | 16  | 21  | 16  | 22  | 75    |
| CAPE HENRY             | KNJH    | Norfolk       | 16  | 0   | 0   | 0   | 16    |
| CAPE MAY               | JBCN    | Norfolk       | 30  | 10  | 11  | 10  | 61    |
| CAPE RISE              | KAFG    | Norfolk       | 0   | 1   | 0   | 0   | 1     |
| CAPE WASHINGTON        | WRGH    | Baltimore     | 0   | 48  | 0   | 0   | 48    |
| CAPT STEVEN L BENNETT  | KAXO    | New Orleans   | 24  | 0   | 0   | 0   | 24    |
| CARDIGAN BAY           | ZCBF5   | New York City | 61  | 45  | 58  | 50  | 214   |
| CARIBBEAN BULKER       | C6PL3   | New Orleans   | 52  | 0   | 0   | 0   | 52    |
| CARLA A. HILLS         | ELBG9   | Oakland       | 80  | 31  | 103 | 27  | 241   |
| CAROLINA               | WYBI    | Jacksonville  | 24  | 0   | 0   | 0   | 24    |
| CASON J. CALLAWAY      | WE4879  | Chicago       | 29  | 96  | 63  | 112 | 300   |
| CELEBRATION            | ELFT8   | Miami         | 2   | 0   | 25  | 43  | 70    |
| CENTURY                | ELQX6   | Miami         | 4   | 14  | 15  | 7   | 40    |
| CENTURY HIGHWAY #2     | 3EJB9   | Long Beach    | 20  | 11  | 5   | 19  | 55    |
| CENTURY HIGHWAY NO. 1  | 3FFJ4   | Houston       | 9   | 3   | 22  | 0   | 34    |
| CENTURY HIGHWAY_NO. 3  | 8JNP    | Houston       | 11  | 16  | 13  | 20  | 60    |
| CENTURY LEADER NO. 1   | 3FBi6   | Houston       | 24  | 36  | 15  | 40  | 115   |
| CGM PROVENCE           | DEGM    | Houston       | 0   | 20  | 10  | 12  | 42    |
| CHARLES E. WILSON      | WZE4539 | Cleveland     | 0   | 58  | 30  | 22  | 110   |
| CHARLES ISLAND         | C6JT    | Miami         | 64  | 62  | 12  | 42  | 180   |
| CHARLES LYKES          | 3EJT9   | Baltimore     | 33  | 12  | 60  | 37  | 142   |
| CHARLES M. BEEGHLEY    | WL3108  | Cleveland     | 5   | 120 | 106 | 37  | 268   |
| CHARLES PIGOTT         | 5LPA    | Oakland       | 0   | 0   | 84  | 32  | 116   |
| CHASTINE MAERSK        | OWNJ2   | New York City | 0   | 44  | 27  | 34  | 105   |
| CHELSEA                | KNCX    | New York City | 0   | 25  | 75  | 44  | 144   |
| CHEMBULK FORTITUDE     | 3ESF7   | Norfolk       | 0   | 0   | 33  | 55  | 88    |
| CHEMICAL PIONEER       | KAFO    | Houston       | 24  | 20  | 58  | 142 | 244   |
| CHESAPEAKE TRADER      | WGZK    | Houston       | 43  | 9   | 77  | 54  | 183   |
| CHEVRON ARIZONA        | KGBE    | Miami         | 23  | 20  | 2   | 0   | 45    |
| CHEVRON ATLANTIC       | C6KY3   | New Orleans   | 66  | 89  | 47  | 0   | 202   |
| CHEVRON COLORADO       | KLHZ    | Oakland       | 0   | 40  | 100 | 35  | 175   |
| CHEVRON EDINBURGH      | VSBZ5   | Oakland       | 105 | 38  | 3   | 166 | 312   |
| CHEVRON EMPLOYEE PRIDE | C6MC5   | Baltimore     | 54  | 47  | 14  | 0   | 115   |
| CHEVRON FELUY          | ELIN    | Houston       | 0   | 0   | 77  | 0   | 77    |
| CHEVRON MARINER        | ELRC4   | New Orleans   | 0   | 0   | 0   | 17  | 17    |
| CHEVRON MISSISSIPPI    | WXBR    | Oakland       | 42  | 26  | 41  | 32  | 141   |
| CHEVRON NAGASAKI       | A8BK    | Oakland       | 91  | 0   | 74  | 50  | 215   |
| CHEVRON PERTH          | C6KQ8   | Oakland       | 63  | 0   | 0   | 0   | 63    |
| CHEVRON SOUTH AMERICA  | ZCAA2   | New Orleans   | 73  | 101 | 20  | 46  | 240   |
| CHIEF GADAO            | WEZD    | Oakland       | 37  | 10  | 78  | 66  | 191   |
| CHILEAN EXPRESS        | 3EME7   | Norfolk       | 0   | 1   | 0   | 5   | 6     |
| CHINA HOPE             | ELQF5   | Seattle       | 0   | 0   | 0   | 2   | 2     |
| CHIQUITA BARU          | ZCAY7   | Jacksonville  | 44  | 44  | 31  | 56  | 175   |
| CHIQUITA BELGIE        | C6KD7   | Baltimore     | 50  | 36  | 47  | 34  | 167   |
| CHIQUITA BREMEN        | ZCBC5   | Miami         | 36  | 30  | 33  | 38  | 137   |
| CHIQUITA BRENDA        | ZCBE9   | Miami         | 58  | 47  | 72  | 78  | 255   |
| CHIQUITA DEUTSCHLAND   | C6KD8   | Baltimore     | 40  | 62  | 56  | 27  | 185   |
| CHIQUITA ELKESCHLAND   | ZCBB9   | Miami         | 22  | 72  | 67  | 55  | 216   |
| CHIQUITA FRANCES       | ZCBD9   | Miami         | 60  | 52  | 51  | 60  | 223   |
| CHIQUITA ITALIA        | C6KD5   | Baltimore     | 38  | 36  | 27  | 19  | 120   |
| CHIQUITA JEAN          | ZCBB7   | Jacksonville  | 50  | 41  | 20  | 30  | 141   |
| CHIQUITA JOY           | ZCBC2   | Miami         | 56  | 58  | 26  | 19  | 159   |
| CHIQUITA NEDERLAND     | C6KD6   | Baltimore     | 51  | 8   | 19  | 12  | 90    |
| CHIQUITA ROSTOCK       | ZCBD2   | Miami         | 65  | 43  | 53  | 41  | 202   |
| CHIQUITA SCANDINAVIA   | C6KD4   | Baltimore     | 62  | 32  | 28  | 23  | 145   |
| CHIQUITA SCHWEIZ       | C6KD9   | Baltimore     | 39  | 76  | 38  | 48  | 201   |
| CHITTINAD TRADITION    | VTRX    | New Orleans   | 5   | 0   | 0   | 0   | 5     |
| CHO YANG ATLAS         | DQVH    | Seattle       | 48  | 0   | 0   | 0   | 48    |
| CHOYANG VISION         | 9VOQ    | Seattle       | 21  | 23  | 82  | 80  | 206   |
| CIELO DI FIRENZE       | V2SM    | Long Beach    | 0   | 158 | 24  | 48  | 230   |

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| SHIP NAME            | CALL    | PORT          | MAY | JUN | JUL | AUG | TOTAL |
|----------------------|---------|---------------|-----|-----|-----|-----|-------|
| CITY OF DURBAN       | GXIC    | Long Beach    | 88  | 62  | 84  | 53  | 287   |
| CLEVELAND            | KGXA    | Houston       | 17  | 64  | 40  | 97  | 218   |
| CLIFFORD MAERSK      | OXME2   | Newark        | 0   | 0   | 0   | 11  | 11    |
| CMS ISLAND EXPRESS   | J8NX    | Miami         | 10  | 12  | 17  | 9   | 48    |
| COASTAL EAGLE POINT  | WHMK    | Houston       | 0   | 1   | 0   | 0   | 1     |
| COLUMBIA BAY         | WRB4008 | Houston       | 7   | 0   | 0   | 0   | 7     |
| COLUMBIA STAR        | WSB2018 | Cleveland     | 133 | 163 | 90  | 63  | 449   |
| COLUMBIA STAR        | C6HL8   | Long Beach    | 79  | 63  | 52  | 72  | 266   |
| COLUMBINE            | 3ELQ9   | Baltimore     | 24  | 6   | 51  | 96  | 177   |
| COLUMBUS AMERICA     | ELSX2   | Norfolk       | 56  | 3   | 30  | 54  | 143   |
| COLUMBUS AUSTRALIA   | ELSX3   | Houston       | 48  | 38  | 48  | 37  | 171   |
| COLUMBUS CALIFORNIA  | ELUB7   | Long Beach    | 48  | 29  | 43  | 45  | 165   |
| COLUMBUS CANADA      | ELQN3   | Seattle       | 0   | 34  | 83  | 75  | 192   |
| COLUMBUS NEW ZEALAND | ELSX4   | Newark        | 0   | 23  | 20  | 11  | 54    |
| COLUMBUS QUEENSLAND  | ELUB9   | Norfolk       | 7   | 13  | 23  | 20  | 63    |
| COLUMBUS VICTORIA    | ELUB6   | Long Beach    | 101 | 46  | 50  | 57  | 254   |
| CONDOLEZZA RICE      | C6OK    | Baltimore     | 57  | 0   | 0   | 0   | 57    |
| CONTSHIP AMERICA     | 3EIP3   | Houston       | 66  | 13  | 11  | 21  | 111   |
| COPACABANA           | PPXI    | Norfolk       | 22  | 0   | 34  | 23  | 79    |
| CORAL HIGHWAY        | 3FEB5   | Jacksonville  | 0   | 16  | 0   | 1   | 17    |
| CORDELIA             | 3ESJ3   | Long Beach    | 8   | 20  | 38  | 10  | 76    |
| CORMORANT ARROW      | C6IO9   | Seattle       | 5   | 7   | 3   | 2   | 17    |
| CORNELIA MAERSK      | OXIF2   | Norfolk       | 0   | 29  | 0   | 0   | 29    |
| CORNUCOPIA           | KPJC    | Oakland       | 13  | 1   | 2   | 9   | 25    |
| CORPUS CHRISTI       | WMRU    | Houston       | 0   | 13  | 180 | 3   | 196   |
| CORWITH CRAMER       | WTF3319 | Norfolk       | 39  | 0   | 71  | 0   | 110   |
| COSMOWAY             | 3EVO3   | Seattle       | 12  | 0   | 0   | 5   | 17    |
| COURIER              | KCBK    | Houston       | 0   | 20  | 32  | 15  | 67    |
| COURTNEY BURTON      | WE6970  | Cleveland     | 111 | 169 | 83  | 77  | 440   |
| COURTNEY L           | ZCAQ8   | Baltimore     | 53  | 8   | 36  | 0   | 97    |
| CRISTOFORO COLOMBO   | ICYS    | Norfolk       | 0   | 8   | 0   | 6   | 14    |
| CROATIA EXPRESS      | 9HZC3   | New York City | 0   | 1   | 2   | 3   | 6     |
| CROWN OF SCANDINAVIA | OXRA6   | Miami         | 85  | 87  | 100 | 98  | 370   |
| CROWN PRINCESS       | ELGH5   | Miami         | 0   | 188 | 36  | 3   | 227   |
| CSK UNITY            | 9VPU    | Seattle       | 0   | 62  | 13  | 24  | 99    |
| CSL ATLAS            | C6IL3   | Baltimore     | 13  | 0   | 0   | 0   | 13    |
| CSL CABO             | D5XH    | Seattle       | 1   | 20  | 4   | 11  | 36    |
| CSS HUDSON           | CGDG    | Norfolk       | 49  | 49  | 49  | 42  | 189   |
| DAGMAR MAERSK        | DHAF    | New York City | 53  | 9   | 0   | 0   | 62    |
| DAISHIN MARU         | 3FPS6   | Seattle       | 82  | 0   | 0   | 22  | 104   |
| DANIA PORTLAND       | OXEH2   | Miami         | 58  | 50  | 2   | 33  | 143   |
| DARYA PREETH         | VRUX8   | Long Beach    | 0   | 25  | 0   | 0   | 25    |
| DAWN PRINCESS        | ELTO4   | Miami         | 11  | 0   | 0   | 0   | 11    |
| DELAWARE TRADER      | WXWL    | Long Beach    | 73  | 22  | 0   | 55  | 150   |
| DENALI               | WSVR    | Long Beach    | 27  | 90  | 67  | 40  | 224   |
| DESTINY              | 3FKZ3   | Miami         | 92  | 46  | 128 | 161 | 427   |
| DG COLUMBIA          | PPSL    | Norfolk       | 43  | 78  | 156 | 64  | 341   |
| DIAMOND STAR         | VCBW    | New Orleans   | 0   | 2   | 0   | 5   | 7     |
| DIRCH MAERSK         | OXQP2   | Long Beach    | 34  | 51  | 40  | 32  | 157   |
| DIRECT CONDOR        | DQEB    | Long Beach    | 0   | 51  | 58  | 43  | 152   |
| DIRECT EAGLE         | C6BJ9   | Long Beach    | 0   | 57  | 18  | 29  | 104   |
| DIRECT FALCON        | C6MP7   | Long Beach    | 0   | 48  | 67  | 41  | 156   |
| DIRECT KEA           | C6MP8   | Long Beach    | 46  | 57  | 30  | 52  | 185   |
| DIRECT KIWI          | C6MP9   | Long Beach    | 29  | 69  | 48  | 26  | 172   |
| DIRECT KOOKABURRA    | C6MQ2   | Long Beach    | 41  | 19  | 25  | 34  | 119   |
| DOCK EXPRESS 10      | PJRO    | Baltimore     | 55  | 32  | 29  | 1   | 117   |
| DOCK EXPRESS 20      | PJRF    | Baltimore     | 1   | 61  | 0   | 40  | 102   |
| DOCTOR LYKES         | 3ELF9   | Baltimore     | 25  | 29  | 87  | 25  | 166   |
| DORTHE MAERSK        | DHPD    | New York City | 0   | 37  | 28  | 18  | 83    |
| DORTHE OLDENDORFF    | ELQJ6   | Seattle       | 8   | 24  | 92  | 8   | 132   |
| DRAGOR MAERSK        | XPW2    | Long Beach    | 7   | 0   | 0   | 0   | 7     |
| DUBROVNIK EXPRESS    | 9HOO3   | Norfolk       | 0   | 29  | 21  | 24  | 74    |
| DUCHESS              | KRCJ    | Newark        | 0   | 6   | 1   | 0   | 7     |
| DUHALLOW             | ZCBH9   | Baltimore     | 70  | 72  | 95  | 58  | 295   |
| DUNCAN ISLAND        | C6JS    | Miami         | 47  | 108 | 79  | 46  | 280   |
| DUSSELDORF EXPRESS   | S6IG    | Long Beach    | 381 | 667 | 209 | 8   | 1265  |
| E.P. LE QUEBECOIS    | CG3130  | Norfolk       | 40  | 220 | 231 | 236 | 727   |
| EAGLE BEAUMONT       | S6JO    | New York City | 2   | 0   | 0   | 0   | 2     |
| EARL W. OGLEBAY      | WZE7718 | Cleveland     | 0   | 5   | 0   | 0   | 5     |
| EASTERN BRIDGE       | C6JY9   | Baltimore     | 0   | 0   | 0   | 84  | 84    |
| ECSTASY              | ELNC5   | Miami         | 0   | 39  | 20  | 82  | 141   |
| EDELWISS             | VRUM3   | Seattle       | 39  | 0   | 22  | 47  | 108   |

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| SHIP NAME                | CALL    | PORT          | MAY | JUN | JUL | AUG | TOTAL |
|--------------------------|---------|---------------|-----|-----|-----|-----|-------|
| EDGAR B. SPEER           | WQZ9670 | Chicago       | 147 | 69  | 93  | 76  | 385   |
| EDWARD L. RYERSON        | WM5464  | Chicago       | 16  | 0   | 0   | 0   | 16    |
| EDWIN H. GOTT            | WXQ4511 | Chicago       | 90  | 142 | 0   | 305 | 537   |
| EDYTH L                  | C6YC    | Baltimore     | 23  | 11  | 12  | 8   | 54    |
| EIDELWEISS               | 3FGE2   | Seattle       | 5   | 0   | 0   | 0   | 5     |
| ELATION                  | 3FOC5   | Miami         | 31  | 0   | 0   | 0   | 31    |
| ELISE SHULTE             | P3NP4   | Miami         | 0   | 23  | 58  | 2   | 83    |
| ELLEN KNUDSEN            | LAKZ4   | Norfolk       | 0   | 0   | 1   | 0   | 1     |
| ELLIOTT BAY              | DZFF    | Seattle       | 53  | 64  | 130 | 50  | 297   |
| ELSBERG                  | J8PG    | Miami         | 8   | 0   | 0   | 0   | 8     |
| ELTON HOYT II            | WE3993  | Cleveland     | 0   | 58  | 41  | 2   | 101   |
| EMPIRE STATE             | KKFW    | New York City | 11  | 63  | 44  | 0   | 118   |
| ENCHANTMENT OF THE SEAS  | LAXA4   | Miami         | 2   | 0   | 0   | 0   | 2     |
| ENDEAVOR                 | WAUW    | New York City | 8   | 0   | 0   | 0   | 8     |
| ENDURANCE                | WAUU    | New York City | 16  | 0   | 0   | 0   | 16    |
| ENERGY ENTERPRISE        | WBJF    | Baltimore     | 1   | 0   | 0   | 0   | 1     |
| ENGLISH STAR             | C6KU7   | Long Beach    | 66  | 79  | 83  | 71  | 299   |
| EQUINOX                  | DPSC    | Baltimore     | 0   | 37  | 36  | 19  | 92    |
| EUROPA                   | DLAL    | Miami         | 0   | 0   | 4   | 8   | 12    |
| EVER DELUXE              | 3FBE8   | Norfolk       | 14  | 0   | 0   | 0   | 14    |
| EVER GAINING             | BKJO    | Norfolk       | 0   | 0   | 0   | 5   | 5     |
| EVER GARDEN              | BKHB    | Norfolk       | 0   | 0   | 0   | 7   | 7     |
| EVER GATHER              | BKHA    | Newark        | 0   | 0   | 11  | 6   | 17    |
| EVER GENERAL             | BKHY    | Baltimore     | 7   | 4   | 0   | 0   | 11    |
| EVER GIVEN               | BKJJ    | Long Beach    | 0   | 1   | 0   | 0   | 1     |
| EVER GLEEFUL             | BKJY    | Long Beach    | 0   | 12  | 0   | 0   | 12    |
| EVER GUARD               | 3ESL2   | Seattle       | 0   | 2   | 0   | 0   | 2     |
| EVER GUEST               | BKJH    | Norfolk       | 2   | 2   | 0   | 8   | 12    |
| EVER LAUREL              | BKHH    | Long Beach    | 4   | 0   | 0   | 0   | 4     |
| EVER LEVEL               | BKHJ    | Miami         | 0   | 15  | 25  | 1   | 41    |
| EVER RACER               | 3FJL4   | Norfolk       | 0   | 0   | 6   | 11  | 17    |
| EVER REPUTE              | 3FRZ4   | New York City | 0   | 0   | 0   | 4   | 4     |
| EVER RESULT              | 3FSA4   | Norfolk       | 0   | 9   | 15  | 0   | 24    |
| EVER RIGHT               | 3FML3   | Long Beach    | 0   | 4   | 0   | 0   | 4     |
| EVER ROUND               | 3FQN3   | Long Beach    | 4   | 1   | 0   | 0   | 5     |
| EVER ULTRA               | 3FEJ6   | Seattle       | 0   | 36  | 43  | 42  | 121   |
| EVER UNION               | 3FFG7   | Seattle       | 6   | 0   | 35  | 27  | 68    |
| EVER UNIQUE              | 3FXQ6   | Seattle       | 3   | 0   | 0   | 8   | 11    |
| EVER UNISON              | 3FTL6   | Long Beach    | 0   | 1   | 62  | 43  | 106   |
| EVER UNITED              | 3FMQ6   | Seattle       | 0   | 1   | 0   | 2   | 3     |
| EXCELSIOR                | V7AZ2   | Baltimore     | 32  | 107 | 20  | 44  | 203   |
| EXEMPLAR                 | V7AZ3   | Baltimore     | 0   | 48  | 62  | 60  | 170   |
| EXPORT PATRIOT           | WCJY    | Newark        | 0   | 10  | 72  | 88  | 170   |
| FAIRLIFT                 | PEBM    | Norfolk       | 35  | 54  | 39  | 43  | 171   |
| FAIRMAST                 | PJLC    | Norfolk       | 31  | 0   | 2   | 0   | 33    |
| FANAL TRADER             | VRUY4   | Seattle       | 64  | 25  | 92  | 84  | 265   |
| FANTASY                  | ELKI6   | Miami         | 19  | 22  | 18  | 9   | 68    |
| FARALLON ISLAND          | FARIS   | Oakland       | 109 | 88  | 54  | 549 | 800   |
| FASCINATION              | 3EWK9   | Miami         | 8   | 30  | 33  | 25  | 96    |
| FAUST                    | WRYX    | Jacksonville  | 45  | 26  | 58  | 36  | 165   |
| FERNCROFT                | LLEJ3   | Long Beach    | 0   | 10  | 40  | 8   | 58    |
| FIDELIO                  | WQVY    | Jacksonville  | 31  | 55  | 106 | 34  | 226   |
| FLAMENGO                 | PPXU    | Norfolk       | 0   | 0   | 118 | 77  | 195   |
| FLORAL LAKE              | 3FFA5   | Seattle       | 0   | 3   | 0   | 0   | 3     |
| FOREST CHAMPION          | 3FSH3   | Seattle       | 0   | 37  | 0   | 0   | 37    |
| FOREST TRADER            | A8GJ    | Seattle       | 0   | 0   | 12  | 22  | 34    |
| FRANCES HAMMER           | KRGJ    | Jacksonville  | 0   | 23  | 47  | 42  | 112   |
| FRANCES L                | C6YE    | Baltimore     | 1   | 216 | 37  | 17  | 271   |
| FRANKFURT EXPRESS        | 9VPP    | New York City | 21  | 25  | 22  | 5   | 73    |
| FRED R. WHITE JR         | WAR7324 | Cleveland     | 35  | 37  | 0   | 0   | 72    |
| FREEPORT EXPRESS         | V2AJ5   | New York City | 0   | 24  | 49  | 32  | 105   |
| G AND C PARANA           | LADC2   | Long Beach    | 17  | 0   | 0   | 0   | 17    |
| GALAXY ACE               | VRUI2   | Jacksonville  | 0   | 0   | 0   | 19  | 19    |
| GALVESTON BAY            | WPKD    | Houston       | 51  | 20  | 119 | 71  | 261   |
| GEETA                    | VRUL7   | New Orleans   | 0   | 0   | 0   | 1   | 1     |
| GEORGE A. SLOAN          | WA5307  | Chicago       | 73  | 81  | 64  | 87  | 305   |
| GEORGE A. STINSON        | WCX2417 | Cleveland     | 119 | 142 | 38  | 36  | 335   |
| GEORGE H. WEYERHAEUSER   | C6FA7   | Oakland       | 50  | 114 | 59  | 26  | 249   |
| GEORGE SCHULTZ           | ELPG9   | Baltimore     | 47  | 53  | 49  | 47  | 196   |
| GEORGE WASHINGTON BRIDGE | JKCF    | Long Beach    | 80  | 46  | 101 | 57  | 284   |
| GEORGIA RAINBOW II       | 3ERJ8   | Jacksonville  | 49  | 8   | 37  | 0   | 94    |
| GERMAN SENATOR           | P3ZZ6   | Norfolk       | 0   | 0   | 2   | 2   | 4     |

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| SHIP NAME            | CALL    | PORT          | MAY | JUN | JUL | AUG | TOTAL |
|----------------------|---------|---------------|-----|-----|-----|-----|-------|
| GINGA MARU           | JFKC    | Long Beach    | 0   | 0   | 98  | 88  | 186   |
| GLOBAL MARINER       | WWXA    | Baltimore     | 24  | 7   | 33  | 0   | 64    |
| GLOBAL NEXTAGE       | XYLV    | Seattle       | 0   | 1   | 0   | 0   | 1     |
| GLORIOUS SUCCESS     | DUHN    | Seattle       | 10  | 46  | 28  | 18  | 102   |
| GLORIOUS SUN         | DVTR    | Seattle       | 0   | 0   | 71  | 61  | 132   |
| GOLDEN BEAR          | NMRY    | Oakland       | 65  | 170 | 0   | 0   | 235   |
| GOLDEN GATE          | KIOH    | Long Beach    | 82  | 52  | 5   | 184 | 323   |
| GOLDEN GATE BRIDGE   | 3FWM4   | Seattle       | 51  | 51  | 55  | 55  | 212   |
| GOPHER STATE         | WCJV    | Norfolk       | 0   | 0   | 0   | 1   | 1     |
| GRANDEUR OF THE SEAS | ELTQ9   | Miami         | 24  | 0   | 0   | 0   | 24    |
| GREAT LAND           | WFDP    | Seattle       | 64  | 31  | 25  | 61  | 181   |
| GREEN BAY            | KGTH    | Long Beach    | 0   | 91  | 24  | 9   | 124   |
| GREEN ISLAND         | KIBK    | New Orleans   | 0   | 34  | 33  | 9   | 76    |
| GREEN LAKE           | KGTI    | Baltimore     | 74  | 158 | 65  | 86  | 383   |
| GREEN MAYA           | 3ETA5   | Seattle       | 0   | 13  | 15  | 12  | 40    |
| GREEN RAINIER        | 3ENI3   | Seattle       | 1   | 8   | 3   | 7   | 19    |
| GREEN RIDGE          | WRYL    | Seattle       | 10  | 0   | 13  | 79  | 102   |
| GREEN SASEBO         | 3EUT5   | Seattle       | 1   | 24  | 47  | 31  | 103   |
| GRETKE OLDENDORFF    | ELQJ7   | Seattle       | 0   | 166 | 0   | 36  | 202   |
| GROTON               | KMJL    | Newark        | 42  | 37  | 62  | 12  | 153   |
| GROWTH RING          | 3ECN7   | Seattle       | 0   | 67  | 0   | 0   | 67    |
| GUANAJUATO           | ELMH8   | Jacksonville  | 12  | 33  | 134 | 35  | 214   |
| GUAYAMA              | WZJG    | Jacksonville  | 25  | 43  | 148 | 142 | 358   |
| GULF CURRENT         | ELMF9   | New Orleans   | 0   | 191 | 17  | 0   | 208   |
| GULF SPIRIT          | ELIH8   | Houston       | 0   | 0   | 0   | 16  | 16    |
| GULL ARROW           | C6KB4   | Baltimore     | 0   | 1   | 10  | 0   | 11    |
| GYPSUM BARON         | ZCAN3   | Norfolk       | 0   | 31  | 44  | 44  | 119   |
| GYPSUM KING          | ZCAN2   | Miami         | 0   | 49  | 48  | 44  | 141   |
| H. LEE WHITE         | WZD2465 | Cleveland     | 0   | 37  | 0   | 0   | 37    |
| HADERA               | ELBX4   | Baltimore     | 0   | 2   | 0   | 2   | 4     |
| HANJIN BARCELONA     | 3EXX9   | Long Beach    | 0   | 11  | 12  | 0   | 23    |
| HANJIN BREMEN        | D7YG    | Seattle       | 10  | 0   | 1   | 3   | 14    |
| HANJIN FELIXSTOWE    | D9TJ    | Seattle       | 11  | 2   | 0   | 3   | 16    |
| HANJIN HAMBURG       | D9TP    | Long Beach    | 0   | 4   | 0   | 0   | 4     |
| HANJIN KAOHSIUNG     | D9TW    | Seattle       | 9   | 5   | 5   | 0   | 19    |
| HANJIN LE HAVRE      | D9SY    | Seattle       | 0   | 5   | 8   | 7   | 20    |
| HANJIN OAKLAND       | D9SG    | Long Beach    | 0   | 0   | 0   | 7   | 7     |
| HANJIN PORTLAND      | 3FSB3   | Newark        | 8   | 4   | 6   | 1   | 19    |
| HANJIN SEATTLE       | D9SF    | Seattle       | 9   | 0   | 0   | 0   | 9     |
| HANJIN SHANGHAI      | 3FGI5   | Newark        | 0   | 11  | 5   | 12  | 28    |
| HANJIN SINGAPORE     | D9TX    | Long Beach    | 0   | 0   | 0   | 3   | 3     |
| HANJIN TOKYO         | 3FZJ3   | New York City | 1   | 5   | 4   | 0   | 10    |
| HANJIN VANCOUVER     | D9TK    | Long Beach    | 13  | 0   | 0   | 0   | 13    |
| HANSA CARRIER        | ELTY7   | Norfolk       | 0   | 22  | 22  | 0   | 44    |
| HARBOUR BRIDGE       | ELJH9   | Seattle       | 43  | 19  | 20  | 24  | 106   |
| HEICON               | P3TA4   | Norfolk       | 3   | 37  | 11  | 0   | 51    |
| HEIDELBERG EXPRESS   | DEDI    | Houston       | 690 | 475 | 360 | 677 | 2202  |
| HEKABE               | C6OU2   | New Orleans   | 0   | 11  | 30  | 33  | 74    |
| HELVETIA             | OXRO2   | Jacksonville  | 0   | 26  | 52  | 7   | 85    |
| HENRY HUDSON BRIDGE  | JKLS    | Long Beach    | 0   | 60  | 46  | 85  | 191   |
| HERBERT C. JACKSON   | WL3972  | Cleveland     | 0   | 41  | 26  | 29  | 96    |
| HOEGH CLIPPER        | C6IM8   | Seattle       | 0   | 3   | 1   | 0   | 4     |
| HOEGH DRAKE          | ZHEN7   | Norfolk       | 0   | 31  | 0   | 0   | 31    |
| HOEGH DYKE           | C6OX2   | Long Beach    | 26  | 11  | 9   | 19  | 65    |
| HOEGH MERIT          | C6IN3   | Seattle       | 0   | 12  | 6   | 0   | 18    |
| HOEGH MINERVA        | C6IM6   | Seattle       | 0   | 54  | 18  | 0   | 72    |
| HOLCK LARSEN         | VTFJ    | Cleveland     | 2   | 2   | 2   | 0   | 6     |
| HONSHU SILVIA        | 3EST7   | Seattle       | 63  | 92  | 30  | 43  | 228   |
| HOOD ISLAND          | C6LU4   | Newark        | 45  | 12  | 21  | 30  | 108   |
| HOUSTON              | FNXB    | Houston       | 14  | 42  | 44  | 49  | 149   |
| HOUSTON EXPRESS      | DLBB    | Houston       | 40  | 29  | 32  | 63  | 164   |
| HUAL INGRITA         | LAUX2   | Jacksonville  | 0   | 6   | 2   | 0   | 8     |
| HUAL ROLITA          | LAVG4   | Jacksonville  | 0   | 0   | 14  | 0   | 14    |
| HUMACAO              | WZJB    | Norfolk       | 33  | 29  | 141 | 78  | 281   |
| HUMBERGRACHT         | PEUQ    | Houston       | 30  | 33  | 36  | 18  | 117   |
| HUME HIGHWAY         | 3EJO6   | Jacksonville  | 4   | 25  | 27  | 19  | 75    |
| HYUNDAI DISCOVERY    | 3FFR6   | Seattle       | 35  | 39  | 45  | 48  | 167   |
| HYUNDAI DYNASTY      | P3BA7   | Long Beach    | 0   | 54  | 48  | 40  | 142   |
| HYUNDAI FIDELITY     | DNAG    | Long Beach    | 0   | 59  | 29  | 97  | 185   |
| HYUNDAI FORTUNE      | 3FLG6   | Seattle       | 11  | 11  | 31  | 23  | 76    |
| HYUNDAI FREEDOM      | 3FFS6   | Seattle       | 5   | 60  | 11  | 13  | 89    |
| HYUNDAI INDEPENDENCE | 3FDY6   | Seattle       | 31  | 90  | 39  | 38  | 198   |

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| SHIP NAME            | CALL    | PORT          | MAY | JUN | JUL | AUG | TOTAL |
|----------------------|---------|---------------|-----|-----|-----|-----|-------|
| HYUNDAI LIBERTY      | 3FFT6   | Seattle       | 14  | 6   | 23  | 0   | 43    |
| IMAGINATION          | 3EWJ9   | Miami         | 21  | 19  | 26  | 36  | 102   |
| INDIAN OCEAN         | C6T2063 | New York City | 31  | 0   | 0   | 0   | 31    |
| INDIANA HARBOR       | WXN3191 | Cleveland     | 185 | 123 | 95  | 100 | 503   |
| INLAND SEAS          | WCJ6214 | Chicago       | 2   | 13  | 10  | 7   | 32    |
| INSPIRATION          | 3FOA5   | Miami         | 19  | 111 | 46  | 29  | 205   |
| IOWA TRADER          | KNDM    | Houston       | 0   | 3   | 0   | 17  | 20    |
| IRENA ARCTICA        | OXTS2   | Miami         | 57  | 98  | 97  | 127 | 379   |
| ISLA DE CEDROS       | 3FOA6   | Seattle       | 76  | 6   | 10  | 9   | 101   |
| ISLA GRAN MALVINA    | LQOK    | Newark        | 0   | 18  | 2   | 0   | 20    |
| ISLAND BREEZE        | C6KP    | Miami         | 4   | 32  | 29  | 0   | 65    |
| ISLAND PRINCESS      | GBBM    | Long Beach    | 4   | 1   | 3   | 26  | 34    |
| ITB BALTIMORE        | WXKM    | Baltimore     | 41  | 13  | 39  | 13  | 106   |
| ITB MOBILE           | KXDB    | New York City | 8   | 36  | 9   | 48  | 101   |
| ITB NEW YORK         | WVDG    | Newark        | 0   | 17  | 24  | 6   | 47    |
| IVER EXPLORER        | PEXV    | Houston       | 22  | 0   | 4   | 7   | 33    |
| IVER EXPRESS         | PEXX    | Houston       | 23  | 10  | 8   | 17  | 58    |
| IWANUMA MARU         | 3ESU8   | Seattle       | 121 | 83  | 19  | 211 | 434   |
| J. DENNIS BONNEY     | ELLE2   | Baltimore     | 0   | 28  | 15  | 93  | 136   |
| J.A.W. IGLEHART      | WTP4966 | Cleveland     | 65  | 19  | 0   | 0   | 84    |
| JACKLYN M.           | WCV7620 | Chicago       | 127 | 61  | 19  | 18  | 225   |
| JACKSONVILLE         | WNDG    | Baltimore     | 51  | 122 | 29  | 65  | 267   |
| JADE ORIENT          | ELRY6   | Seattle       | 12  | 10  | 4   | 0   | 26    |
| JADE PACIFIC         | ELRY5   | Seattle       | 0   | 8   | 15  | 0   | 23    |
| JAHRE SPIRIT         | LAWS2   | Houston       | 5   | 0   | 0   | 0   | 5     |
| JAMES                | ELRR6   | New Orleans   | 15  | 36  | 46  | 40  | 137   |
| JAMES N. SULLIVAN    | ELPG8   | Baltimore     | 0   | 19  | 6   | 0   | 25    |
| JAMES R. BARKER      | WYP8657 | Cleveland     | 126 | 168 | 48  | 88  | 430   |
| JAPAN SENATOR        | DNJS    | Norfolk       | 0   | 65  | 67  | 52  | 184   |
| JEAN LYKES           | WUBV    | Houston       | 0   | 58  | 0   | 0   | 58    |
| JEB STUART           | WRGQ    | Oakland       | 0   | 117 | 6   | 5   | 128   |
| JO CLIPPER           | PFEZ    | Baltimore     | 26  | 35  | 21  | 26  | 108   |
| JO ELM               | PFFD    | Baltimore     | 0   | 32  | 20  | 18  | 70    |
| JOHN G. MUNSON       | WE3806  | Chicago       | 58  | 124 | 114 | 113 | 409   |
| JOHN J. BOLAND       | WF2560  | Cleveland     | 0   | 69  | 21  | 61  | 151   |
| JOHN PURVES          | WCB5820 | Chicago       | 25  | 0   | 0   | 0   | 25    |
| JOHN YOUNG           | ELNG9   | Oakland       | 71  | 0   | 84  | 0   | 155   |
| JOIDES RESOLUTION    | D5BC    | Norfolk       | 1   | 225 | 81  | 58  | 365   |
| JOSEPH H. FRANTZ     | WA6575  | Cleveland     | 0   | 78  | 24  | 28  | 130   |
| JOSEPH L. BLOCK      | WXY6216 | Chicago       | 37  | 51  | 37  | 68  | 193   |
| JOSEPH LYKES         | ELRZ8   | Houston       | 0   | 1   | 0   | 0   | 1     |
| JUBILANT             | ELKA7   | Jacksonville  | 1   | 0   | 0   | 11  | 12    |
| JUBILEE              | 3FPM5   | Long Beach    | 8   | 10  | 0   | 0   | 18    |
| JULIUS HAMMER        | KRGJ    | Jacksonville  | 24  | 32  | 68  | 23  | 147   |
| JUNO ISLAND          | 3FRF7   | Seattle       | 35  | 0   | 0   | 0   | 35    |
| KAHO                 | WZ2043  | Chicago       | 0   | 11  | 0   | 0   | 11    |
| KAIJIN               | 3FWI3   | Seattle       | 123 | 6   | 0   | 0   | 129   |
| KANSAS TRADER        | KSDF    | Houston       | 0   | 23  | 48  | 141 | 212   |
| KAPITAN BYANKIN      | UAGK    | Seattle       | 33  | 115 | 42  | 42  | 232   |
| KAPITAN GNEZPILOV    | UQMF    | Seattle       | 0   | 15  | 15  | 3   | 33    |
| KAPITAN KONEV        | UAHV    | Seattle       | 30  | 49  | 117 | 66  | 262   |
| KAPITAN MAN          | UJCQ    | Seattle       | 9   | 1   | 9   | 13  | 32    |
| KAPITAN SERYKH       | UGOZ    | Seattle       | 0   | 42  | 55  | 45  | 142   |
| KAREN ANDRIE         | WBS5272 | Chicago       | 18  | 0   | 42  | 24  | 84    |
| KAUAI                | WSRH    | Long Beach    | 20  | 55  | 57  | 61  | 193   |
| KAYE E. BARKER       | WCF3012 | Cleveland     | 162 | 198 | 58  | 72  | 490   |
| KAZIMAH              | 9KKL    | Houston       | 88  | 54  | 79  | 57  | 278   |
| KELLIE CHOUEST       | KUS1038 | Norfolk       | 0   | 0   | 0   | 2   | 2     |
| KEN KOKU             | 3FMN6   | Seattle       | 38  | 0   | 0   | 26  | 64    |
| KEN SHIN             | YJQS2   | Seattle       | 23  | 57  | 50  | 47  | 177   |
| KENAI                | WSNB    | Houston       | 36  | 19  | 8   | 35  | 98    |
| KENNETH E. HILL      | C6FA6   | Newark        | 43  | 26  | 47  | 60  | 176   |
| KENNETH T. DERR      | C6FA3   | Newark        | 47  | 7   | 81  | 18  | 153   |
| KENTUCKY HIGHWAY     | JKPP    | Norfolk       | 0   | 0   | 0   | 7   | 7     |
| KHALEEJ BAY          | DHSB    | Houston       | 0   | 0   | 0   | 1   | 1     |
| KINSMAN INDEPENDENT  | WUZ7811 | Cleveland     | 141 | 189 | 96  | 119 | 545   |
| KNOCK ALLAN          | ELOI6   | Houston       | 71  | 0   | 5   | 7   | 83    |
| KOELN EXPRESS        | 9VBL    | New York City | 206 | 665 | 697 | 168 | 1736  |
| KOMET                | V2SA    | Miami         | 31  | 37  | 37  | 37  | 142   |
| KOMSOMOLETS PRIMORYA | EMEK    | Seattle       | 0   | 37  | 52  | 35  | 124   |
| KURAMA               | 3EOF7   | Newark        | 0   | 3   | 6   | 2   | 11    |
| KURE                 | 3FGN3   | Seattle       | 15  | 0   | 74  | 35  | 124   |

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| SHIP NAME                | CALL    | PORT          | MAY | JUN | JUL | AUG | TOTAL |
|--------------------------|---------|---------------|-----|-----|-----|-----|-------|
| LA ESPERANZA             | 3EQV8   | Baltimore     | 3   | 0   | 34  | 26  | 63    |
| LAKE CHARLES             | KPTB    | New Orleans   | 0   | 9   | 91  | 17  | 117   |
| LAWRENCE H. GIANELLA     | WLBX    | Norfolk       | 26  | 31  | 15  | 12  | 84    |
| LEE A. TREGURTHA         | WUR8857 | Cleveland     | 33  | 62  | 16  | 11  | 122   |
| LEGEND OF THE SEAS       | ELRR5   | New Orleans   | 17  | 0   | 0   | 0   | 17    |
| LEONARD J. COWLEY        | CG2959  | Norfolk       | 0   | 16  | 0   | 0   | 16    |
| LEOPARDI                 | V7AV8   | Baltimore     | 0   | 3   | 0   | 24  | 27    |
| LIBERTY SEA              | KPZH    | New Orleans   | 41  | 0   | 0   | 0   | 41    |
| LIBERTY STAR             | WCBP    | New Orleans   | 54  | 16  | 50  | 108 | 228   |
| LIBERTY SUN              | WCOB    | Houston       | 0   | 15  | 3   | 40  | 58    |
| LIBERTY WAVE             | KRHZ    | Norfolk       | 2   | 0   | 0   | 1   | 3     |
| LIHUE                    | WTST    | Seattle       | 14  | 46  | 105 | 30  | 195   |
| LILAC ACE                | 3FDL4   | Long Beach    | 0   | 134 | 19  | 13  | 166   |
| LINDA OLDENDORF          | ELRR2   | Baltimore     | 12  | 50  | 45  | 9   | 116   |
| LIRCAY                   | ELEV8   | Houston       | 3   | 10  | 9   | 3   | 25    |
| LNG AQUARIUS             | WSKJ    | Oakland       | 118 | 35  | 76  | 86  | 315   |
| LNG CAPRICORN            | KHLN    | New York City | 64  | 11  | 22  | 0   | 97    |
| LNG LEO                  | WDZB    | New York City | 13  | 20  | 47  | 28  | 108   |
| LNG LIBRA                | WDZG    | New York City | 0   | 0   | 0   | 36  | 36    |
| LNG TAURUS               | WDZW    | New York City | 63  | 13  | 51  | 84  | 211   |
| LNG VIRGO                | WDZX    | New York City | 0   | 0   | 36  | 112 | 148   |
| LOA                      | ELOF7   | Long Beach    | 2   | 0   | 0   | 0   | 2     |
| LONDON SPIRIT            | GCCB    | Baltimore     | 0   | 36  | 2   | 44  | 82    |
| LONDON VICTORY           | GCCB    | New York City | 0   | 62  | 42  | 62  | 166   |
| LONG BEACH               | 3FOU3   | Seattle       | 4   | 26  | 5   | 144 | 179   |
| LONG LINES               | WATF    | Baltimore     | 57  | 0   | 0   | 0   | 57    |
| LOOTSGRACHT              | PFPT    | Houston       | 8   | 1   | 19  | 10  | 38    |
| LOUIS MAERSK             | OXMA2   | Baltimore     | 2   | 0   | 0   | 22  | 24    |
| LT ARGOSY                | VTKG    | Cleveland     | 5   | 0   | 0   | 0   | 5     |
| LT PRAGATI               | VVDX    | Seattle       | 206 | 0   | 0   | 0   | 206   |
| LT. ODYSSEY              | VTKB    | Cleveland     | 0   | 0   | 0   | 3   | 3     |
| LTC CALVIN P. TITUS      | KAKG    | Baltimore     | 0   | 41  | 0   | 0   | 41    |
| LUCY OLDENDORFF          | ELPA2   | Long Beach    | 15  | 20  | 0   | 2   | 37    |
| LUISE OLDENDORFF         | 3FOW4   | Seattle       | 67  | 22  | 47  | 94  | 230   |
| LUTJENBURG               | DGLU    | Long Beach    | 0   | 43  | 74  | 70  | 187   |
| LUTJENBURG               | ELVF6   | Long Beach    | 56  | 0   | 0   | 0   | 56    |
| LYKES EXPLORER           | WGLA    | Houston       | 4   | 10  | 113 | 41  | 168   |
| M/V FRANCOIS L.D.        | FNEQ    | Norfolk       | 17  | 0   | 0   | 0   | 17    |
| MACKINAC BRIDGE          | JKES    | Long Beach    | 62  | 54  | 91  | 48  | 255   |
| MADISON MAERSK           | OVJB2   | Oakland       | 24  | 20  | 57  | 5   | 106   |
| MAERSK CALIFORNIA        | WCX5083 | Houston       | 0   | 0   | 0   | 107 | 107   |
| MAERSK CONSTELLATION     | WRYJ    | Oakland       | 33  | 0   | 37  | 284 | 354   |
| MAERSK ENDEAVOUR         | XP4210  | Miami         | 0   | 195 | 194 | 186 | 575   |
| MAERSK EXPLORER          | XP3344  | Miami         | 1   | 129 | 172 | 162 | 464   |
| MAERSK GANNET            | GJLK    | Miami         | 0   | 21  | 7   | 58  | 86    |
| MAERSK GIANT             | OU2465  | Miami         | 235 | 219 | 233 | 235 | 922   |
| MAERSK QUITO             | OXWF2   | Norfolk       | 0   | 0   | 1   | 0   | 1     |
| MAERSK SHETLAND          | MSQK3   | Miami         | 0   | 20  | 50  | 49  | 119   |
| MAERSK SOMERSET          | MQVF8   | New Orleans   | 68  | 37  | 79  | 28  | 212   |
| MAERSK STAFFORD          | MRSS9   | Miami         | 0   | 19  | 8   | 36  | 63    |
| MAERSK SUN               | S6ES    | Seattle       | 71  | 88  | 36  | 0   | 195   |
| MAERSK SURREY            | MRS68   | Houston       | 0   | 0   | 15  | 16  | 31    |
| MAERSK TEXAS             | WCX3249 | Houston       | 7   | 0   | 0   | 0   | 7     |
| MAGLEBY MAERSK           | OU5H2   | Newark        | 26  | 14  | 14  | 20  | 74    |
| MAHARASHTRA              | VT5Q    | Seattle       | 0   | 86  | 0   | 15  | 101   |
| MAHIMAH                  | WHRN    | Oakland       | 48  | 53  | 67  | 60  | 228   |
| MAIRANGI BAY             | GXEW    | Long Beach    | 67  | 70  | 80  | 59  | 276   |
| MAJ STEPHEN W PLESS MPS1 | WHAU    | Norfolk       | 0   | 26  | 92  | 11  | 129   |
| MAJESTIC MAERSK          | OUJH2   | Newark        | 11  | 46  | 49  | 43  | 149   |
| MANGAL DESAI             | VTJS    | Cleveland     | 21  | 7   | 7   | 1   | 36    |
| MANHATTAN BRIDGE         | 3FWL4   | Long Beach    | 30  | 25  | 68  | 42  | 165   |
| MANOA                    | KDBG    | Oakland       | 41  | 71  | 66  | 81  | 259   |
| MANUKAI                  | KNLO    | Oakland       | 19  | 58  | 53  | 67  | 197   |
| MANULANI                 | KNIJ    | Oakland       | 0   | 44  | 30  | 61  | 135   |
| MARCARRIER               | V2VM    | Newark        | 243 | 0   | 0   | 1   | 244   |
| MARCHEN MAERSK           | OWDQ2   | Long Beach    | 22  | 11  | 54  | 30  | 117   |
| MAREN MAERSK             | OWZU2   | Long Beach    | 1   | 5   | 51  | 1   | 58    |
| MARGARET LYKES           | WG50    | Houston       | 51  | 19  | 79  | 28  | 177   |
| MARGRETHE MAERSK         | OYSN2   | Long Beach    | 12  | 35  | 30  | 47  | 124   |
| MARI BETH ANDRIE         | WUY3362 | Chicago       | 0   | 0   | 15  | 37  | 52    |
| MARIE MAERSK             | OULL2   | Newark        | 30  | 46  | 26  | 106 | 208   |
| MARIT MAERSK             | OZFC2   | Oakland       | 31  | 26  | 35  | 47  | 139   |

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| SHIP NAME               | CALL    | PORT          | MAY | JUN | JUL | AUG | TOTAL |
|-------------------------|---------|---------------|-----|-----|-----|-----|-------|
| MARK HANNAH             | WYZ5243 | Chicago       | 7   | 47  | 48  | 15  | 117   |
| MARLIN                  | 6ZXG    | New Orleans   | 0   | 0   | 0   | 67  | 67    |
| MARSTA MAERSK           | OUNO5   | Norfolk       | 5   | 11  | 22  | 49  | 87    |
| MATHILDE MAERSK         | OOUU2   | Long Beach    | 19  | 17  | 69  | 34  | 139   |
| MATSONIA                | KHRC    | Oakland       | 90  | 73  | 52  | 90  | 305   |
| MAUI                    | WSLH    | Long Beach    | 43  | 30  | 109 | 90  | 272   |
| MAURICE EWING           | WLDZ    | Newark        | 28  | 26  | 20  | 47  | 121   |
| MAYAGUEZ                | WZJE    | Jacksonville  | 0   | 35  | 201 | 87  | 323   |
| MAYVIEW MAERSK          | OWEB2   | Oakland       | 18  | 102 | 40  | 19  | 179   |
| MC-KINNEY MAERSK        | OOUW2   | Newark        | 19  | 17  | 48  | 31  | 115   |
| MEDALLION               | OYEK2   | Jacksonville  | 0   | 0   | 4   | 14  | 18    |
| MEDUSA CHALLENGER       | WA4659  | Cleveland     | 92  | 108 | 132 | 117 | 449   |
| MEKHANIK MOLDOVANOV     | UIKI    | Seattle       | 22  | 0   | 0   | 0   | 22    |
| MELBOURNE HIGHWAY       | 3ERW2   | Long Beach    | 0   | 0   | 0   | 4   | 4     |
| MELBOURNE STAR          | C6JY6   | Newark        | 39  | 81  | 200 | 35  | 355   |
| MELVILLE                | WECB    | Long Beach    | 98  | 230 | 19  | 0   | 347   |
| MERCHANT PREMIER        | VROP    | Houston       | 31  | 30  | 10  | 38  | 109   |
| MERCHANT PRINCE         | C6HQ8   | Houston       | 30  | 16  | 12  | 69  | 127   |
| MERIDIAN                | C6IP3   | Miami         | 0   | 14  | 34  | 18  | 66    |
| MERLION ACE             | 9VHJ    | Long Beach    | 0   | 16  | 15  | 16  | 47    |
| MESABI MINER            | WYQ4356 | Cleveland     | 164 | 0   | 0   | 197 | 361   |
| METEOR                  | DBBH    | Houston       | 210 | 207 | 200 | 214 | 831   |
| METTE MAERSK            | OXKT2   | Long Beach    | 15  | 21  | 19  | 85  | 140   |
| MICHIGAN                | WRB4141 | Chicago       | 11  | 89  | 197 | 0   | 297   |
| MIDDLETOWN              | WR3225  | Cleveland     | 44  | 51  | 24  | 38  | 157   |
| MING ASIA               | BDEA    | New York City | 11  | 0   | 0   | 6   | 17    |
| MING PLEASURE           | BLII    | Long Beach    | 0   | 38  | 17  | 39  | 94    |
| MOANA PACIFIC           | P3EK7   | Long Beach    | 0   | 4   | 2   | 0   | 6     |
| MOKIHANA                | WNRD    | Oakland       | 56  | 61  | 46  | 73  | 236   |
| MOKU PAHU               | WBWK    | Oakland       | 74  | 54  | 18  | 5   | 151   |
| MORELOS                 | PGBB    | Houston       | 47  | 52  | 58  | 172 | 329   |
| MORMACSKY               | WMBQ    | New York City | 0   | 0   | 3   | 11  | 14    |
| MORMACSTAR              | KGDF    | Houston       | 0   | 30  | 217 | 42  | 289   |
| MORMACSUN               | WMBK    | Norfolk       | 28  | 10  | 8   | 9   | 55    |
| MOSEL ORE               | ELRE5   | Norfolk       | 66  | 61  | 251 | 59  | 437   |
| MSC BOSTON              | 9HGP4   | New York City | 8   | 0   | 0   | 0   | 8     |
| MSC JESSICA             | C6BK6   | Newark        | 78  | 12  | 34  | 0   | 124   |
| MSC NEW YORK            | 9HIG4   | New York City | 3   | 0   | 0   | 0   | 3     |
| MUNKEBO MAERSK          | OUNI5   | New York City | 17  | 14  | 138 | 25  | 194   |
| MV MIRANDA              | 3FRO4   | Norfolk       | 44  | 0   | 0   | 0   | 44    |
| MYRON C. TAYLOR         | WA8463  | Chicago       | 27  | 84  | 104 | 105 | 320   |
| MYSTIC                  | PCCQ    | Long Beach    | 0   | 9   | 37  | 45  | 91    |
| NADA II                 | ELAV2   | Seattle       | 16  | 0   | 0   | 0   | 16    |
| NAJA ARCTICA            | OXVH2   | Miami         | 77  | 62  | 120 | 102 | 361   |
| NATIONAL DIGNITY        | DZRG    | Long Beach    | 8   | 7   | 14  | 9   | 38    |
| NATIONAL HONOR          | DZDI    | Long Beach    | 9   | 16  | 3   | 3   | 31    |
| NATIONAL PRIDE          | DZPK    | Long Beach    | 0   | 18  | 9   | 11  | 38    |
| NAUTICAS MEXICO         | XCMM    | Houston       | 0   | 0   | 0   | 21  | 21    |
| NEDLLOYD ABIDJAN        | S6BP    | Long Beach    | 18  | 52  | 136 | 12  | 218   |
| NEDLLOYD DELFT          | PGDD    | Houston       | 56  | 57  | 51  | 64  | 228   |
| NEDLLOYD HOLLAND        | KRHX    | Houston       | 32  | 148 | 52  | 121 | 353   |
| NEDLLOYD MONTEVIDEO     | PGAF    | Long Beach    | 32  | 22  | 1   | 44  | 99    |
| NEDLLOYD RALEIGH BAY    | PHKG    | Houston       | 21  | 34  | 36  | 38  | 129   |
| NEDLLOYD ROTTERDAM      | PGEI    | Newark        | 1   | 0   | 0   | 0   | 1     |
| NEDLLOYD VAN DAJIMA     | PGDB    | Houston       | 43  | 64  | 50  | 68  | 225   |
| NEDLLOYD VAN DIEMEN     | PGFE    | Houston       | 39  | 47  | 46  | 45  | 177   |
| NEGO LOMBOK             | DXQC    | Seattle       | 0   | 62  | 31  | 21  | 114   |
| NELVANA                 | YJWZ7   | Baltimore     | 16  | 67  | 70  | 22  | 175   |
| NEPTUNE ACE             | JFLX    | Long Beach    | 15  | 66  | 13  | 55  | 149   |
| NEPTUNE JADE            | 9VNQ    | Norfolk       | 0   | 9   | 6   | 4   | 19    |
| NEPTUNE RHODONITE       | ELJP4   | Long Beach    | 19  | 39  | 32  | 21  | 111   |
| NEW CARISSA             | 3ELY7   | Seattle       | 243 | 33  | 24  | 43  | 343   |
| NEW HORIZON             | WKWB    | Long Beach    | 52  | 29  | 0   | 6   | 87    |
| NEW NIKKI               | 3FHG5   | Seattle       | 81  | 39  | 47  | 74  | 241   |
| NEWARK BAY              | WPKS    | Houston       | 26  | 56  | 35  | 144 | 261   |
| NEWPORT BRIDGE          | 3FGH3   | Oakland       | 17  | 13  | 18  | 17  | 65    |
| NOAA DAVID STARR JORDAN | WTDK    | Seattle       | 42  | 7   | 8   | 26  | 83    |
| NOAA SHIP ALBATROSS IV  | WMVF    | Norfolk       | 91  | 97  | 304 | 73  | 565   |
| NOAA SHIP CHAPMAN       | WTED    | New Orleans   | 175 | 147 | 169 | 106 | 597   |
| NOAA SHIP DELAWARE II   | KNBD    | New York City | 142 | 69  | 205 | 55  | 471   |
| NOAA SHIP FERREL        | WTEZ    | Norfolk       | 54  | 66  | 125 | 255 | 500   |
| NOAA SHIP KA'IMIMOANA   | WTEU    | Seattle       | 141 | 472 | 106 | 224 | 943   |

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| SHIP NAME                | CALL    | PORT          | MAY | JUN | JUL | AUG | TOTAL |
|--------------------------|---------|---------------|-----|-----|-----|-----|-------|
| NOAA SHIP MCARTHUR       | WTEJ    | Seattle       | 36  | 99  | 105 | 33  | 273   |
| NOAA SHIP MILLER FREEMAN | WTDMM   | Seattle       | 197 | 381 | 136 | 229 | 943   |
| NOAA SHIP OREGON II      | WTDO    | New Orleans   | 0   | 190 | 160 | 162 | 512   |
| NOAA SHIP RAINIER        | WTEF    | Seattle       | 60  | 97  | 78  | 81  | 316   |
| NOAA SHIP T. CROMWELL    | WTDF    | Seattle       | 82  | 413 | 177 | 130 | 802   |
| NOAA SHIP WHITING        | WTEW    | Baltimore     | 148 | 65  | 212 | 197 | 622   |
| NOBEL STAR               | KRPP    | Houston       | 0   | 8   | 21  | 6   | 35    |
| NOL AMBER                | S6CY    | Seattle       | 0   | 2   | 11  | 0   | 13    |
| NOL DELPHI               | ZCBF6   | Houston       | 63  | 0   | 48  | 58  | 169   |
| NOL DIAMOND              | 9VYT    | Long Beach    | 0   | 0   | 2   | 5   | 7     |
| NOL LAGENO               | ZCBF2   | New York City | 0   | 58  | 59  | 46  | 163   |
| NOL RISSO                | ZCBE6   | New York City | 32  | 50  | 35  | 24  | 141   |
| NOL RUBY                 | 9VOP    | Seattle       | 0   | 6   | 0   | 0   | 6     |
| NOL STENO                | ZCBD4   | New York City | 14  | 13  | 23  | 29  | 79    |
| NOL STENO                | ZCBF4   | New York City | 16  | 44  | 38  | 57  | 155   |
| NOL TOPAZ                | 9VOW    | Seattle       | 0   | 7   | 9   | 8   | 24    |
| NOL ZIRCON               | 9VOS    | Long Beach    | 0   | 29  | 17  | 13  | 59    |
| NOLIZWE                  | MLN7    | New York City | 241 | 45  | 72  | 128 | 486   |
| NOMZI                    | MTQU3   | Baltimore     | 131 | 105 | 239 | 81  | 556   |
| NOORDAM                  | PGHT    | Miami         | 1   | 0   | 0   | 0   | 1     |
| NORASIA SHANGHAI         | DNHS    | New York City | 26  | 4   | 29  | 29  | 88    |
| NORD JAHRE TRANSPORTER   | LACF4   | Baltimore     | 0   | 15  | 8   | 0   | 23    |
| NORD PARTNER             | P3XC5   | New York City | 0   | 39  | 35  | 61  | 135   |
| NORDMAX                  | P3YS5   | Seattle       | 64  | 11  | 335 | 82  | 492   |
| NORDMORITZ               | P3YR5   | Seattle       | 93  | 33  | 79  | 54  | 259   |
| NORDSTRAND               | P3NV5   | Norfolk       | 6   | 0   | 0   | 0   | 6     |
| NORTHERN LIGHTS          | WFJK    | New Orleans   | 56  | 116 | 154 | 54  | 380   |
| NORTHERN LION            | A8IE    | Long Beach    | 0   | 142 | 67  | 0   | 209   |
| NORWAY                   | C6CM7   | Miami         | 0   | 10  | 3   | 3   | 16    |
| NTABENI                  | 3EGR6   | Houston       | 45  | 56  | 68  | 80  | 249   |
| NUERNBERG EXPRESS        | 9VBK    | Houston       | 730 | 689 | 729 | 718 | 2866  |
| NUEVO LEON               | XCKX    | Houston       | 47  | 62  | 35  | 31  | 175   |
| NUEVO SAN JUAN           | KEOD    | Norfolk       | 32  | 77  | 74  | 70  | 253   |
| NYK SEABREEZE            | ELNJ3   | Seattle       | 6   | 32  | 24  | 18  | 80    |
| NYK SPRINGTIDE           | S6CZ    | Houston       | 7   | 6   | 12  | 15  | 40    |
| NYK STARLIGHT            | 3FUX6   | Long Beach    | 10  | 31  | 41  | 52  | 134   |
| NYK SUNRISE              | 3FYZ6   | Seattle       | 58  | 26  | 27  | 34  | 145   |
| NYK SURFWIND             | ELOT3   | Seattle       | 4   | 1   | 0   | 0   | 5     |
| OCEAN BELUGA             | 3FEI6   | Jacksonville  | 56  | 8   | 2   | 6   | 72    |
| OCEAN CAMELLIA           | 3FTR6   | Seattle       | 68  | 51  | 188 | 58  | 365   |
| OCEAN CITY               | WCYR    | Houston       | 0   | 11  | 18  | 105 | 134   |
| OCEAN CLIPPER            | 3EXI7   | New Orleans   | 65  | 0   | 63  | 119 | 247   |
| OCEAN HARMONY            | 3FRX6   | Seattle       | 0   | 40  | 30  | 15  | 85    |
| OCEAN LAUREL             | 3FLX4   | Seattle       | 6   | 1   | 4   | 32  | 43    |
| OCEAN LILY               | 3EQS7   | Seattle       | 8   | 0   | 0   | 0   | 8     |
| OCEAN ORCHID             | 3ECQ9   | Seattle       | 0   | 11  | 9   | 0   | 20    |
| OCEAN SERENE             | DURY    | Seattle       | 71  | 78  | 51  | 11  | 211   |
| OGLEBAY NORTON           | WAQ3521 | Cleveland     | 83  | 21  | 8   | 11  | 123   |
| OLEANDER                 | PJJU    | Newark        | 5   | 46  | 39  | 136 | 226   |
| OLIVEBANK                | 3ETQ5   | Baltimore     | 17  | 4   | 27  | 37  | 85    |
| OLYMPIAN HIGHWAY         | 3FSH4   | Seattle       | 0   | 0   | 0   | 11  | 11    |
| OMI COLUMBIA             | KLKZ    | Oakland       | 63  | 11  | 10  | 15  | 99    |
| OOCL AMERICA             | ELSM7   | Oakland       | 20  | 12  | 44  | 53  | 129   |
| OOCL CALIFORNIA          | ELSA4   | Seattle       | 28  | 13  | 12  | 23  | 76    |
| OOCL CHINA               | ELSU8   | Long Beach    | 54  | 121 | 56  | 47  | 278   |
| OOCL ENVOY               | ELNV7   | Seattle       | 31  | 27  | 22  | 17  | 97    |
| OOCL FAIR                | ELFV2   | Long Beach    | 29  | 19  | 34  | 33  | 115   |
| OOCL FAME                | ELRO3   | Seattle       | 0   | 42  | 14  | 12  | 68    |
| OOCL FIDELITY            | ELFV8   | Long Beach    | 32  | 219 | 25  | 25  | 301   |
| OOCL FORTUNE             | ELFU8   | Norfolk       | 105 | 31  | 20  | 47  | 203   |
| OOCL FREEDOM             | VRCV    | Norfolk       | 22  | 39  | 54  | 45  | 160   |
| OOCL FRONTIER            | VRUC6   | Seattle       | 0   | 22  | 17  | 14  | 53    |
| OOCL HONG KONG           | VRVA5   | Oakland       | 11  | 40  | 39  | 31  | 121   |
| OOCL INNOVATION          | WPWH    | Houston       | 130 | 54  | 40  | 266 | 490   |
| OOCL INSPIRATION         | KRPB    | Houston       | 38  | 146 | 51  | 140 | 375   |
| OOCL JAPAN               | ELSU6   | Long Beach    | 64  | 70  | 57  | 46  | 237   |
| ORANGE BLOSSOM           | ELEI6   | Newark        | 5   | 0   | 0   | 0   | 5     |
| ORANGE WAVE              | ELPX7   | Newark        | 0   | 0   | 8   | 3   | 11    |
| ORIANA                   | GVSN    | Miami         | 43  | 34  | 22  | 37  | 136   |
| ORIENTE GRACE            | 3FHT4   | Seattle       | 33  | 21  | 19  | 14  | 87    |
| ORIENTE HOPE             | 3ETH4   | Seattle       | 53  | 33  | 67  | 46  | 199   |
| ORIENTE NOBLE            | 3FVF5   | Seattle       | 26  | 18  | 5   | 22  | 71    |

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| SHIP NAME               | CALL    | PORT          | MAY | JUN | JUL | AUG | TOTAL |
|-------------------------|---------|---------------|-----|-----|-----|-----|-------|
| ORIENTE PRIME           | 3FOU4   | Seattle       | 0   | 20  | 23  | 17  | 60    |
| OURO DO BRASIL          | ELPP9   | Baltimore     | 15  | 26  | 42  | 41  | 124   |
| OVERSEAS ALASKA         | WEHV    | Seattle       | 0   | 12  | 7   | 19  | 38    |
| OVERSEAS ARCTIC         | KLEZ    | New Orleans   | 0   | 14  | 23  | 36  | 73    |
| OVERSEAS CHICAGO        | KBCF    | Oakland       | 5   | 11  | 131 | 7   | 154   |
| OVERSEAS HARRIET        | WRFJ    | Houston       | 0   | 23  | 12  | 30  | 65    |
| OVERSEAS JOYCE          | WUQL    | Jacksonville  | 60  | 24  | 46  | 33  | 163   |
| OVERSEAS JUNEAU         | WWND    | Seattle       | 10  | 46  | 0   | 11  | 67    |
| OVERSEAS MARILYN        | WFQB    | Houston       | 0   | 21  | 33  | 12  | 66    |
| OVERSEAS NEW ORLEANS    | WFKW    | Houston       | 26  | 5   | 18  | 68  | 117   |
| OVERSEAS NEW YORK       | WMCK    | Houston       | 16  | 1   | 11  | 17  | 45    |
| OVERSEAS OHIO           | WJBG    | Oakland       | 47  | 62  | 74  | 53  | 236   |
| OVERSEAS VIVIAN         | KAAZ    | Norfolk       | 0   | 0   | 1   | 1   | 2     |
| OVERSEAS WASHINGTON     | WFGV    | Houston       | 0   | 3   | 44  | 79  | 126   |
| P&O NEDLLOYD CHILE      | DVRA    | New York City | 20  | 0   | 3   | 0   | 23    |
| PACASIA                 | ELKM7   | Seattle       | 0   | 27  | 18  | 27  | 72    |
| PACDUKE                 | A8SL    | Seattle       | 8   | 24  | 33  | 8   | 73    |
| PACIFIC ARIES           | ELJQ2   | Seattle       | 7   | 23  | 0   | 0   | 30    |
| PACIFIC HIRO            | 3FOY5   | Seattle       | 0   | 0   | 0   | 42  | 42    |
| PACIFIC HOPE            | 3EOK8   | Seattle       | 0   | 21  | 36  | 0   | 57    |
| PACIFIC RAINBOW II      | 3FCY5   | Seattle       | 0   | 14  | 5   | 7   | 26    |
| PACIFIC SANDPIPER       | GDRJ    | Miami         | 63  | 83  | 53  | 29  | 228   |
| PACIFIC SELESA          | DVCK    | Seattle       | 27  | 0   | 0   | 0   | 27    |
| PACIFIC SENATOR         | ELTY6   | Long Beach    | 0   | 47  | 20  | 37  | 104   |
| PACIFIC WAVE            | 3EXQ9   | Long Beach    | 0   | 1   | 17  | 18  | 36    |
| PACMERCHANT             | 5MCB    | Seattle       | 0   | 10  | 11  | 6   | 27    |
| PACOCEAN                | XYLA    | Seattle       | 2   | 2   | 0   | 0   | 4     |
| PACROSE                 | YJQK2   | Seattle       | 2   | 14  | 10  | 92  | 118   |
| PACSEA                  | XYKX    | Seattle       | 8   | 15  | 0   | 17  | 40    |
| PACSTAR                 | XYLB    | Seattle       | 23  | 50  | 77  | 20  | 170   |
| PARIS                   | ELTY4   | Houston       | 1   | 0   | 0   | 0   | 1     |
| PAUL BUCK               | KDGR    | Houston       | 0   | 0   | 0   | 103 | 103   |
| PAUL H. TOWNSEND        | WF9016  | Cleveland     | 0   | 35  | 0   | 0   | 35    |
| PAUL R. TREGURTHA       | WYR4481 | Cleveland     | 69  | 99  | 172 | 75  | 415   |
| PEGASUS HIGHWAY         | 3FMA4   | New York City | 13  | 18  | 15  | 22  | 68    |
| PEGGY DOW               | PJOY    | Long Beach    | 70  | 46  | 30  | 63  | 209   |
| PFC EUGENE A. OBREGON   | WHAQ    | Norfolk       | 0   | 0   | 5   | 80  | 85    |
| PFC JAMES ANDERSON JR   | WJXG    | Newark        | 24  | 0   | 0   | 23  | 47    |
| PHILADELPHIA            | KSYP    | Baltimore     | 26  | 47  | 47  | 54  | 174   |
| PHILIP R. CLARKE        | WE3592  | Chicago       | 38  | 104 | 92  | 39  | 273   |
| PHOENIX DIAMOND         | 3EGS6   | Norfolk       | 0   | 10  | 34  | 33  | 77    |
| PIERRE FORTIN           | CG2678  | Norfolk       | 223 | 226 | 225 | 235 | 909   |
| PINO GLORIA             | 3EZW7   | Seattle       | 15  | 14  | 34  | 41  | 104   |
| PISCES EXPLORER         | MWQD5   | Long Beach    | 21  | 21  | 34  | 28  | 104   |
| PISCES PIONEER          | MWQE5   | Long Beach    | 40  | 61  | 20  | 30  | 151   |
| POLAR EAGLE             | ELPT3   | Long Beach    | 51  | 36  | 53  | 53  | 193   |
| POLYNESIA               | D5NZ    | Long Beach    | 92  | 192 | 104 | 93  | 481   |
| POROS                   | P3DX6   | New Orleans   | 0   | 0   | 2   | 0   | 2     |
| POTOMAC TRADER          | WXBZ    | Houston       | 43  | 12  | 17  | 48  | 120   |
| POYANG                  | ELAX2   | Long Beach    | 3   | 43  | 55  | 60  | 161   |
| PRESIDENT ADAMS         | WRYW    | Oakland       | 55  | 58  | 69  | 72  | 254   |
| PRESIDENT EISENHOWER    | KRJG    | Long Beach    | 2   | 50  | 98  | 56  | 206   |
| PRESIDENT F. ROOSEVELT  | KRJF    | Long Beach    | 0   | 77  | 73  | 39  | 189   |
| PRESIDENT HOOVER        | WCY2883 | Oakland       | 54  | 0   | 0   | 0   | 54    |
| PRESIDENT JACKSON       | WRYC    | Oakland       | 71  | 20  | 82  | 28  | 201   |
| PRESIDENT KENNEDY       | WRYE    | Oakland       | 33  | 32  | 17  | 46  | 128   |
| PRESIDENT POLK          | WRYD    | Oakland       | 62  | 58  | 49  | 60  | 229   |
| PRESIDENT TRUMAN        | WNDP    | Oakland       | 18  | 44  | 24  | 39  | 125   |
| PRESQUE ISLE            | WZE4928 | Chicago       | 144 | 203 | 81  | 89  | 517   |
| PRIDE OF BALTIMORE II   | WUW2120 | Baltimore     | 74  | 0   | 0   | 168 | 242   |
| PRINCE OF OCEAN         | 3ECO9   | Seattle       | 62  | 0   | 58  | 57  | 177   |
| PRINCE OF TOKYO 2       | 3EUU6   | Seattle       | 0   | 43  | 283 | 35  | 361   |
| PRINCE WILLIAM SOUND    | WSDX    | Long Beach    | 18  | 64  | 13  | 54  | 149   |
| PRINCESS CLIPPER        | VRUC4   | Norfolk       | 27  | 0   | 0   | 0   | 27    |
| PRINCESS OF SCANDINAVIA | OWEN2   | Miami         | 129 | 49  | 64  | 104 | 346   |
| PROJECT ARABIA          | PJKP    | Miami         | 20  | 26  | 48  | 57  | 151   |
| PROJECT ORIENT          | PJAG    | Baltimore     | 15  | 32  | 10  | 9   | 66    |
| PUDONG SENATOR          | DQV1    | Seattle       | 55  | 0   | 0   | 58  | 113   |
| PUERTO CORTES           | C6IM2   | Jacksonville  | 0   | 0   | 1   | 23  | 24    |
| PUSAN SENATOR           | DQVG    | Seattle       | 25  | 22  | 7   | 0   | 54    |
| QUEEN ELIZABETH 2       | GBTT    | New York City | 50  | 20  | 49  | 55  | 174   |
| QUEEN OF SCANDINAVIA    | OUSE6   | Miami         | 52  | 78  | 58  | 48  | 236   |

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| SHIP NAME            | CALL    | PORT          | MAY | JUN | JUL | AUG | TOTAL |
|----------------------|---------|---------------|-----|-----|-----|-----|-------|
| QUEENSLAND STAR      | C6JZ3   | Houston       | 122 | 73  | 203 | 77  | 475   |
| R. HAL DEAN          | C6JN    | Long Beach    | 0   | 0   | 7   | 0   | 7     |
| R.J. PFEIFFER        | WRJP    | Long Beach    | 65  | 23  | 52  | 22  | 162   |
| RANI PADMINI         | ATSR    | Norfolk       | 0   | 15  | 5   | 15  | 35    |
| RAYMOND E. GALVIN    | ELCO5   | Oakland       | 0   | 41  | 9   | 9   | 59    |
| REBECCA LYNN         | WCW7977 | Chicago       | 3   | 0   | 0   | 60  | 63    |
| REGINA J             | V2AC3   | Miami         | 0   | 29  | 10  | 0   | 39    |
| REPULSE BAY          | MQYA3   | Houston       | 0   | 59  | 46  | 47  | 152   |
| RESERVE              | WE7207  | Cleveland     | 50  | 144 | 85  | 75  | 354   |
| RESOLUTE             | KFDZ    | Norfolk       | 53  | 11  | 38  | 57  | 159   |
| RHAPSODY OF THE SEAS | LAZK4   | Miami         | 4   | 0   | 0   | 0   | 4     |
| RHINE FOREST         | ELFO3   | New Orleans   | 0   | 82  | 39  | 47  | 168   |
| RICHARD G MATTHIESEN | WLBV    | Jacksonville  | 0   | 0   | 3   | 4   | 7     |
| RICHARD REISS        | WBF2376 | Cleveland     | 6   | 17  | 0   | 0   | 23    |
| RIO ENCO             | CBRE    | New York City | 4   | 0   | 0   | 0   | 4     |
| ROGER BLOUGH         | WZP8164 | Chicago       | 103 | 103 | 79  | 89  | 374   |
| ROGER REVELLE        | KAOU    | New Orleans   | 55  | 0   | 0   | 46  | 101   |
| RONALD H. BROWN      | WTEC    | New Orleans   | 83  | 0   | 48  | 251 | 382   |
| ROSITA               | LATL2   | Miami         | 0   | 35  | 0   | 4   | 39    |
| ROSSEL CURRENT       | J8F16   | Houston       | 11  | 210 | 188 | 44  | 453   |
| ROVER                | KCBH    | Houston       | 0   | 0   | 4   | 0   | 4     |
| ROYAL ETERNITY       | DUXW    | Norfolk       | 56  | 0   | 0   | 0   | 56    |
| ROYAL MAJESTY        | 3ETG9   | Miami         | 0   | 7   | 13  | 2   | 22    |
| ROYAL PRINCESS       | GBRP    | Long Beach    | 27  | 17  | 29  | 11  | 84    |
| RUBIN BONANZA        | 3FNV5   | Seattle       | 10  | 0   | 28  | 27  | 65    |
| RUBIN KOBE           | DYZM    | Seattle       | 52  | 59  | 55  | 63  | 229   |
| RUBIN PEARL          | YJQA8   | Seattle       | 0   | 53  | 13  | 9   | 75    |
| RUBIN STAR           | 3FIA5   | Seattle       | 0   | 12  | 2   | 0   | 14    |
| RUBIN STELLA         | 3FAP5   | Seattle       | 25  | 159 | 14  | 24  | 222   |
| SAGA CREST           | LATH4   | Miami         | 0   | 16  | 7   | 0   | 23    |
| SALOME               | S6CL    | Newark        | 0   | 5   | 85  | 29  | 119   |
| SAM HOUSTON          | KDGA    | Houston       | 28  | 0   | 23  | 145 | 196   |
| SAMUEL GINN          | C6OB    | Oakland       | 49  | 0   | 0   | 0   | 49    |
| SAMUEL H. ARMACOST   | C6FA2   | Oakland       | 10  | 7   | 5   | 32  | 54    |
| SAMUEL L. COBB       | KCDJ    | Oakland       | 0   | 0   | 24  | 0   | 24    |
| SAMUEL RISLEY        | CG2960  | Norfolk       | 151 | 86  | 14  | 76  | 327   |
| SAN ANTONIO          | LATN4   | New Orleans   | 44  | 62  | 50  | 56  | 212   |
| SAN FELIPE           | DNEN    | Houston       | 15  | 3   | 0   | 0   | 18    |
| SAN FERNANDO         | DGGD    | Houston       | 37  | 7   | 15  | 24  | 83    |
| SAN FRANCISCO        | DIGF    | New York City | 33  | 17  | 22  | 40  | 112   |
| SAN ISIDRO           | ELVG8   | Norfolk       | 24  | 0   | 0   | 0   | 24    |
| SAN MARCOS           | ELND4   | Jacksonville  | 48  | 19  | 289 | 0   | 356   |
| SAN VINCENTE         | DNGV    | Norfolk       | 0   | 29  | 31  | 60  | 120   |
| SANKO LAUREL         | 3EXQ3   | Seattle       | 0   | 0   | 52  | 60  | 112   |
| SANKO MOON           | 3FKE2   | Seattle       | 0   | 13  | 5   | 9   | 27    |
| SANTA CHRISTINA      | 3FAE6   | Seattle       | 80  | 148 | 55  | 34  | 317   |
| SANTA ISABELLA LOON  | DPSI    | Long Beach    | 0   | 0   | 0   | 5   | 5     |
| SANTORIN 2           | P3ZL4   | Seattle       | 0   | 112 | 46  | 263 | 421   |
| SARAMATI             | 9VIW    | Baltimore     | 3   | 0   | 1   | 21  | 25    |
| SC HORIZON           | ELOC8   | New York City | 76  | 174 | 64  | 67  | 381   |
| SCHACKENBORG         | OYUY4   | Houston       | 0   | 2   | 5   | 19  | 26    |
| SEA COMMERCE         | ELGH7   | Miami         | 0   | 29  | 33  | 31  | 93    |
| SEA FLORIDA          | 3EKI3   | New Orleans   | 0   | 41  | 61  | 41  | 143   |
| SEA FOX              | KBGK    | Jacksonville  | 32  | 40  | 191 | 74  | 337   |
| SEA INITIATIVE       | DEBB    | Houston       | 4   | 3   | 7   | 49  | 63    |
| SEA ISLE CITY        | WCYQ    | Houston       | 0   | 15  | 28  | 30  | 73    |
| SEA LION             | KJLV    | Jacksonville  | 150 | 0   | 62  | 110 | 322   |
| SEA LYNX             | DGOO    | Jacksonville  | 49  | 0   | 0   | 59  | 108   |
| SEA MAJESTY          | DYAA    | Seattle       | 0   | 50  | 91  | 45  | 186   |
| SEA MARINER          | J8FF9   | Miami         | 68  | 0   | 1   | 0   | 69    |
| SEA NOVIA            | ELRV2   | Miami         | 0   | 13  | 15  | 0   | 28    |
| SEA PRINCESS         | KRCP    | New Orleans   | 6   | 50  | 26  | 15  | 97    |
| SEA RACER            | ELQJ8   | Jacksonville  | 21  | 15  | 13  | 7   | 56    |
| SEA SPRAY            | WRXN    | Newark        | 0   | 4   | 9   | 8   | 21    |
| SEA TRADE            | ELGH4   | Norfolk       | 0   | 14  | 0   | 0   | 14    |
| SEA VIGOR            | P3ZH4   | Miami         | 13  | 0   | 0   | 0   | 13    |
| SEA WISDOM           | 3FUO6   | Seattle       | 35  | 14  | 0   | 45  | 94    |
| SEA WOLF             | KNFG    | Jacksonville  | 4   | 52  | 147 | 92  | 295   |
| SEA-LAND CHARGER     | V7AY2   | Long Beach    | 0   | 42  | 64  | 51  | 157   |
| SEA-LAND EAGLE       | V7AZ8   | Long Beach    | 58  | 0   | 34  | 30  | 122   |
| SEA/LAND VICTORY     | DIDY    | New York City | 3   | 38  | 32  | 25  | 98    |
| SEABOARD SUN         | ELRV6   | Jacksonville  | 4   | 35  | 17  | 18  | 74    |

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| SHIP NAME              | CALL    | PORT          | MAY | JUN | JUL | AUG | TOTAL |
|------------------------|---------|---------------|-----|-----|-----|-----|-------|
| SEABOARD UNIVERSE      | ELRU3   | Miami         | 15  | 25  | 65  | 29  | 134   |
| SEABREEZE I            | 3FGV2   | Miami         | 11  | 14  | 13  | 9   | 47    |
| SEALAND ANCHORAGE      | KGTIX   | Seattle       | 50  | 44  | 47  | 44  | 185   |
| SEALAND ARGENTINA      | DGVN    | Jacksonville  | 9   | 0   | 0   | 0   | 9     |
| SEALAND ATLANTIC       | KRLZ    | Norfolk       | 24  | 12  | 1   | 33  | 70    |
| SEALAND CHALLENGER     | WZJC    | Newark        | 74  | 56  | 63  | 35  | 228   |
| SEALAND CHAMPION       | V7AM9   | Oakland       | 37  | 23  | 75  | 51  | 186   |
| SEALAND COMET          | V7AP3   | Oakland       | 12  | 16  | 7   | 86  | 121   |
| SEALAND CONSUMER       | WCHF    | Long Beach    | 47  | 7   | 40  | 18  | 112   |
| SEALAND CRUSADER       | WZJF    | Jacksonville  | 81  | 89  | 120 | 29  | 319   |
| SEALAND DEFENDER       | KGJB    | Oakland       | 41  | 34  | 29  | 105 | 209   |
| SEALAND DEVELOPER      | KHRH    | Long Beach    | 29  | 58  | 48  | 52  | 187   |
| SEALAND DISCOVERY      | WZJD    | Jacksonville  | 72  | 63  | 50  | 62  | 247   |
| SEALAND ENDURANCE      | KGJX    | Long Beach    | 21  | 60  | 8   | 35  | 124   |
| SEALAND ENTERPRISE     | KRGB    | Oakland       | 74  | 103 | 162 | 68  | 407   |
| SEALAND EXPEDITION     | WPGJ    | Jacksonville  | 64  | 5   | 175 | 25  | 269   |
| SEALAND EXPLORER       | WGJF    | Long Beach    | 46  | 21  | 47  | 106 | 220   |
| SEALAND EXPRESS        | KGJD    | Long Beach    | 24  | 377 | 10  | 45  | 456   |
| SEALAND FREEDOM        | V7AM3   | Seattle       | 23  | 80  | 35  | 51  | 189   |
| SEALAND HAWAII         | KIRF    | Houston       | 63  | 42  | 48  | 33  | 186   |
| SEALAND INDEPENDENCE   | WGJC    | Long Beach    | 0   | 25  | 126 | 67  | 218   |
| SEALAND INNOVATOR      | WGKF    | Oakland       | 90  | 41  | 60  | 31  | 222   |
| SEALAND INTEGRITY      | WPVD    | Houston       | 111 | 165 | 87  | 148 | 511   |
| SEALAND INTREPID       | V7BA2   | Norfolk       | 33  | 0   | 0   | 0   | 33    |
| SEALAND KODIAK         | KGTZ    | Seattle       | 21  | 1   | 19  | 20  | 61    |
| SEALAND LIBERATOR      | KHRP    | Oakland       | 63  | 25  | 19  | 18  | 125   |
| SEALAND MARINER        | V7AM5   | Seattle       | 0   | 72  | 57  | 5   | 134   |
| SEALAND MERCURY        | V7AP6   | Oakland       | 31  | 25  | 87  | 65  | 208   |
| SEALAND METEOR         | V7AP7   | Long Beach    | 8   | 43  | 27  | 80  | 158   |
| SEALAND NAVIGATOR      | WPGK    | Long Beach    | 44  | 82  | 93  | 79  | 298   |
| SEALAND PACER          | KSLB    | Newark        | 18  | 12  | 10  | 15  | 55    |
| SEALAND PACIFIC        | WSRL    | Long Beach    | 68  | 71  | 99  | 54  | 292   |
| SEALAND PATRIOT        | KHRF    | Oakland       | 61  | 16  | 95  | 52  | 224   |
| SEALAND PERFORMANCE    | KRPD    | Norfolk       | 82  | 229 | 57  | 47  | 415   |
| SEALAND PRODUCER       | WJBJ    | Long Beach    | 94  | 78  | 98  | 58  | 328   |
| SEALAND QUALITY        | KRNJ    | Jacksonville  | 9   | 25  | 204 | 22  | 260   |
| SEALAND RACER          | V7AP8   | Long Beach    | 17  | 43  | 24  | 26  | 110   |
| SEALAND RELIANCE       | WFLH    | Long Beach    | 87  | 61  | 80  | 84  | 312   |
| SEALAND SPIRIT         | WFLG    | Oakland       | 36  | 0   | 11  | 50  | 97    |
| SEALAND TACOMA         | KGTY    | Seattle       | 45  | 63  | 24  | 58  | 190   |
| SEALAND TRADER         | KIRH    | Oakland       | 89  | 47  | 96  | 82  | 314   |
| SEALAND VOYAGER        | KHRK    | Seattle       | 57  | 35  | 105 | 59  | 256   |
| SEARIVER BATON ROUGE   | WAFB    | Oakland       | 14  | 9   | 0   | 6   | 29    |
| SEARIVER BAYTOWN       | KFPM    | Oakland       | 0   | 0   | 10  | 5   | 15    |
| SEARIVER BENICIA       | KPKL    | Long Beach    | 1   | 2   | 8   | 20  | 31    |
| SEARIVER LONG BEACH    | WHCA    | Long Beach    | 13  | 0   | 0   | 14  | 27    |
| SEARIVER NORTH SLOPE   | KHLQ    | Oakland       | 8   | 1   | 0   | 0   | 9     |
| SEARIVER SAN FRANCISCO | KAAC    | Oakland       | 9   | 10  | 13  | 26  | 58    |
| SEAWIND CROWN          | 3EY6    | Miami         | 0   | 51  | 57  | 31  | 139   |
| SEILLEAN               | 3FPF6   | Long Beach    | 0   | 108 | 112 | 117 | 337   |
| SENSATION              | 3ESE9   | Miami         | 16  | 48  | 37  | 44  | 145   |
| SETO BRIDGE            | JMQY    | Oakland       | 0   | 43  | 59  | 65  | 167   |
| SEVEN OCEAN            | DULR    | Seattle       | 0   | 1   | 15  | 7   | 23    |
| SEWARD JOHNSON         | WST9756 | Miami         | 96  | 0   | 0   | 339 | 435   |
| SGT WILLIAM A BUTTON   | WJLX    | Norfolk       | 0   | 0   | 31  | 19  | 50    |
| SGT. METEJ KOCAC       | WHAC    | Norfolk       | 10  | 13  | 12  | 34  | 69    |
| SHELLY BAY             | 3EKH3   | Miami         | 18  | 73  | 59  | 59  | 209   |
| SHIRAOI MARU           | 3ECM7   | Seattle       | 82  | 76  | 77  | 52  | 287   |
| SIBOHELLE              | LAQN4   | Norfolk       | 0   | 10  | 7   | 18  | 35    |
| SIDNEY STAR            | C6JY7   | Houston       | 59  | 64  | 30  | 56  | 209   |
| SIETE OCEANOS          | DYBX    | Seattle       | 0   | 57  | 0   | 0   | 57    |
| SINCERE GEMINI         | 3FFG3   | Seattle       | 0   | 5   | 0   | 1   | 6     |
| SINCERE SUCCESS        | VRUC5   | Seattle       | 0   | 2   | 22  | 9   | 33    |
| SKAUBRYN               | LJIV4   | Seattle       | 24  | 21  | 27  | 15  | 87    |
| SKAUGRAN               | LADB2   | Seattle       | 61  | 9   | 3   | 2   | 75    |
| SKOGAFOSS              | V2QT    | Norfolk       | 0   | 44  | 29  | 40  | 113   |
| SKY PRINCESS           | GYYP    | Miami         | 0   | 26  | 114 | 24  | 164   |
| SNOW CRYSTAL           | C6ID8   | New York City | 0   | 42  | 43  | 58  | 143   |
| SOKOLICA               | ELIG5   | Baltimore     | 2   | 8   | 28  | 35  | 73    |
| SOL DO BRASIL          | ELQQ4   | Baltimore     | 0   | 18  | 13  | 5   | 36    |
| SOLAR WING             | ELJS7   | Jacksonville  | 42  | 37  | 40  | 29  | 148   |
| SONG OF AMERICA        | LENA3   | Miami         | 7   | 20  | 16  | 6   | 49    |

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| SHIP NAME             | CALL    | PORT          | MAY | JUN | JUL | AUG | TOTAL |
|-----------------------|---------|---------------|-----|-----|-----|-----|-------|
| SONORA                | XCTJ    | Houston       | 39  | 309 | 37  | 32  | 417   |
| SOREN TOUBRO          | VTFM    | Cleveland     | 1   | 167 | 34  | 7   | 209   |
| SOUTH FORTUNE         | 3FJC6   | Seattle       | 61  | 0   | 0   | 0   | 61    |
| SOUTHERN LION         | V7AW8   | Long Beach    | 38  | 7   | 19  | 8   | 72    |
| SPERO                 | LAON4   | Seattle       | 80  | 46  | 47  | 74  | 247   |
| SPRING GANNET         | 3EVB3   | Seattle       | 92  | 43  | 5   | 22  | 162   |
| SPRING WAVE           | 9VXB    | Seattle       | 19  | 25  | 23  | 48  | 115   |
| ST BLAIZE             | J8FO    | Norfolk       | 52  | 0   | 44  | 38  | 134   |
| ST. CLAIR             | WZA4027 | Cleveland     | 0   | 118 | 0   | 0   | 118   |
| STAR ALABAMA          | LAVU4   | Long Beach    | 10  | 2   | 7   | 5   | 24    |
| STAR AMERICA          | LAVV4   | Jacksonville  | 37  | 30  | 132 | 7   | 206   |
| STAR DOVER            | LAEP4   | Seattle       | 6   | 0   | 0   | 0   | 6     |
| STAR EAGLE            | LAWO2   | Houston       | 30  | 12  | 14  | 25  | 81    |
| STAR EVVIVA           | LAHE2   | Jacksonville  | 9   | 42  | 29  | 14  | 94    |
| STAR FLORIDA          | LAVW4   | Houston       | 43  | 24  | 32  | 52  | 151   |
| STAR FUJI             | LAVX4   | Seattle       | 14  | 35  | 19  | 22  | 90    |
| STAR GRAN             | LADR4   | Long Beach    | 33  | 14  | 18  | 0   | 65    |
| STAR GRINDANGER       | ELFT9   | Norfolk       | 4   | 0   | 0   | 0   | 4     |
| STAR HANSA            | LAXP4   | Jacksonville  | 1   | 0   | 0   | 0   | 1     |
| STAR HARDANGER        | LAXD4   | Baltimore     | 5   | 119 | 45  | 79  | 248   |
| STAR HERDLA           | LAVD4   | Baltimore     | 34  | 16  | 30  | 22  | 102   |
| STAR HOYANGER         | LAXG4   | Long Beach    | 0   | 0   | 1   | 0   | 1     |
| STAR SKARVEN          | LAJY2   | Miami         | 36  | 33  | 28  | 41  | 138   |
| STAR SKOGANGER        | LASS2   | Houston       | 12  | 7   | 5   | 12  | 36    |
| STAR STRONEN          | LAHG2   | Houston       | 22  | 0   | 4   | 62  | 88    |
| STATENDAM             | PHSG    | Miami         | 12  | 0   | 0   | 0   | 12    |
| STELLA LYKES          | WGXX    | Houston       | 27  | 17  | 14  | 131 | 189   |
| STEPAN KRASHENINNIKOV | UYPO    | Seattle       | 5   | 2   | 5   | 8   | 20    |
| STEPHAN J             | V2JN    | Miami         | 95  | 145 | 133 | 131 | 504   |
| STEWART J. CORT       | WYZ3931 | Chicago       | 33  | 5   | 23  | 81  | 142   |
| STOLT CONDOR          | D5VF    | Newark        | 9   | 0   | 2   | 0   | 11    |
| STOLT HELLULAND       | ELJZ7   | New York City | 0   | 3   | 0   | 0   | 3     |
| STONEWALL JACKSON     | KDDW    | New Orleans   | 68  | 11  | 75  | 33  | 187   |
| STRONG CAJUN          | KALK    | Norfolk       | 25  | 0   | 0   | 0   | 25    |
| STRONG VIRGINIAN      | KSPH    | Oakland       | 0   | 50  | 33  | 15  | 98    |
| SUGAR ISLANDER        | KCKB    | Houston       | 0   | 1   | 0   | 0   | 1     |
| SUMMER BREEZE         | ZCBB4   | Miami         | 2   | 45  | 42  | 22  | 111   |
| SUMMER MEADOW         | ZCAY8   | Long Beach    | 0   | 10  | 13  | 7   | 30    |
| SUN DANCE             | 3ETQ8   | Seattle       | 12  | 14  | 23  | 14  | 63    |
| SUN PRINCESS          | ELSJ2   | Miami         | 0   | 0   | 4   | 2   | 6     |
| SUNBELT DIXIE         | D5BU    | Baltimore     | 16  | 17  | 15  | 49  | 97    |
| SUNDA                 | ELPB8   | Houston       | 64  | 43  | 54  | 58  | 219   |
| SUSAN W. HANNAH       | WAH9146 | Chicago       | 11  | 209 | 0   | 0   | 220   |
| SVEN OLTMANN          | V2JP    | Miami         | 32  | 27  | 22  | 29  | 110   |
| SWAN ARROW            | C6CN8   | Baltimore     | 4   | 0   | 0   | 0   | 4     |
| T/V STATE OF MAINE    | NTNR    | Norfolk       | 12  | 44  | 3   | 0   | 59    |
| TADEUSZ OCIOSZYNSKI   | SQGI    | Houston       | 0   | 0   | 7   | 0   | 7     |
| TAI CHUNG             | BHFL    | Seattle       | 0   | 0   | 29  | 19  | 48    |
| TAI HE                | BOAB    | Long Beach    | 53  | 42  | 34  | 90  | 219   |
| TAI SHING             | BHFR    | Seattle       | 0   | 11  | 37  | 13  | 61    |
| TAIHO MARU            | 3FMP6   | Seattle       | 114 | 32  | 27  | 21  | 194   |
| TAIKO                 | LAQT4   | New York City | 9   | 2   | 3   | 1   | 15    |
| TAKAYAMA              | LACQ5   | New York City | 5   | 35  | 68  | 120 | 228   |
| TALABOT               | LAQU4   | Miami         | 4   | 53  | 3   | 63  | 123   |
| TALLAHASSEE BAY       | WRA4829 | Houston       | 0   | 45  | 0   | 0   | 45    |
| TANABATA              | LAZO4   | Baltimore     | 18  | 21  | 16  | 0   | 55    |
| TAPIOLA               | LAOQ2   | Norfolk       | 3   | 0   | 0   | 0   | 3     |
| TARAGO                | C6LS7   | Long Beach    | 0   | 0   | 18  | 0   | 18    |
| TARONGA               | LACU5   | Jacksonville  | 0   | 0   | 38  | 0   | 38    |
| TELLUS                | WRYG    | Baltimore     | 56  | 35  | 24  | 34  | 149   |
| TEPOZTECO II          | ZCAZ7   | Seattle       | 0   | 11  | 3   | 24  | 38    |
| TEQUI                 | 3FDZ5   | Seattle       | 19  | 32  | 15  | 0   | 66    |
| TEXAS                 | LMWR3   | Baltimore     | 0   | 0   | 21  | 43  | 64    |
| TEXAS CLIPPER         | KVWA    | Houston       | 0   | 37  | 35  | 0   | 72    |
| TILLIE LYKES          | WMLH    | Houston       | 73  | 136 | 42  | 58  | 309   |
| TMM MEXICO            | XCMG    | Houston       | 15  | 59  | 37  | 306 | 417   |
| TMM OAXACA            | ELUA5   | Houston       | 60  | 44  | 19  | 0   | 123   |
| TMM VERACRUZ          | ELFU9   | Norfolk       | 24  | 20  | 30  | 15  | 89    |
| TOBIAS MAERSK         | MSJY8   | Long Beach    | 22  | 25  | 3   | 0   | 50    |
| TOKIO EXPRESS         | 9VUY    | Long Beach    | 357 | 6   | 118 | 603 | 1084  |
| TOLUCA                | 3EFY7   | Long Beach    | 0   | 9   | 5   | 4   | 18    |
| TONSINA               | KJDG    | Houston       | 0   | 0   | 0   | 1   | 1     |

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## VOS Cooperative Ship Reports

*Continued from Page 82*

| SHIP NAME                | CALL    | PORT          | MAY | JUN | JUL | AUG | TOTAL |
|--------------------------|---------|---------------|-----|-----|-----|-----|-------|
| TORBEN                   | V2TI    | Norfolk       | 0   | 15  | 0   | 12  | 27    |
| TORM AMERICA             | J8FI5   | New York City | 0   | 19  | 0   | 0   | 19    |
| TORM FREYA               | OXDF3   | Norfolk       | 27  | 32  | 30  | 32  | 121   |
| TOWER BRIDGE             | ELJL3   | Seattle       | 14  | 14  | 12  | 15  | 55    |
| TRADE APOLLO             | VRUN7   | New York City | 25  | 51  | 63  | 39  | 178   |
| TRANSWORLD BRIDGE        | ELJJ5   | Seattle       | 60  | 60  | 55  | 43  | 218   |
| TRINITY                  | WRGL    | Houston       | 55  | 0   | 0   | 0   | 55    |
| TRITON                   | WTU2310 | Chicago       | 63  | 0   | 0   | 0   | 63    |
| TROPIC DAY               | J8PC    | Miami         | 0   | 0   | 16  | 0   | 16    |
| TROPIC FLYER             | J8NV    | Miami         | 0   | 0   | 15  | 24  | 39    |
| TROPIC ISLE              | J8PA    | Miami         | 0   | 18  | 11  | 14  | 43    |
| TROPIC JADE              | J8NY    | Miami         | 0   | 19  | 19  | 14  | 52    |
| TROPIC KEY               | J8PE    | Miami         | 13  | 32  | 0   | 0   | 45    |
| TROPIC LURE              | J8PD    | Miami         | 19  | 11  | 12  | 14  | 56    |
| TROPIC MIST              | J8NZ    | Miami         | 16  | 0   | 0   | 0   | 16    |
| TROPIC SUN               | 3EZK9   | New Orleans   | 63  | 45  | 33  | 37  | 178   |
| TROPIC TIDE              | 3FGQ3   | Miami         | 38  | 16  | 35  | 41  | 130   |
| TROPICALE                | ELBM9   | New Orleans   | 1   | 40  | 0   | 4   | 45    |
| TRSL ARCTURUS            | MSQQ8   | Baltimore     | 0   | 18  | 22  | 0   | 40    |
| TRUST 38                 | 3EUY3   | Baltimore     | 0   | 75  | 59  | 0   | 134   |
| TUI PACIFIC              | P3GB4   | Seattle       | 53  | 0   | 0   | 0   | 53    |
| TURMOIL                  | 9VGL    | New York City | 14  | 13  | 3   | 2   | 32    |
| TYSON LYKES              | WMLG    | Houston       | 31  | 47  | 48  | 20  | 146   |
| USCGC ACACIA (WLB406)    | NODY    | Chicago       | 0   | 3   | 16  | 9   | 28    |
| USCGC ACTIVE WMEC 618    | NRTF    | Seattle       | 91  | 0   | 119 | 20  | 230   |
| USCGC ACUSHNET WMEC 167  | NNHA    | Oakland       | 20  | 0   | 43  | 3   | 66    |
| USCGC ALERT (WMEC 630)   | NZVE    | Seattle       | 0   | 7   | 0   | 0   | 7     |
| USCGC BOUTWELL WHEC 719  | NYCQ    | Seattle       | 0   | 6   | 5   | 0   | 11    |
| USCGC BRAMBLE (WLB 392)  | NODK    | Cleveland     | 0   | 0   | 3   | 1   | 4     |
| USCGC CHASE (WHEC 718)   | NLPM    | Long Beach    | 0   | 0   | 1   | 0   | 1     |
| USCGC COURAGEOUS         | NCRG    | Norfolk       | 0   | 0   | 2   | 1   | 3     |
| USCGC DAUNTLESS WMEC 624 | NDTS    | Houston       | 0   | 25  | 19  | 88  | 132   |
| USCGC DILIGENCE WMEC 616 | NMUD    | Norfolk       | 0   | 0   | 7   | 4   | 11    |
| USCGC DURABLE (WMEC 628) | NRUN    | Houston       | 0   | 3   | 0   | 12  | 15    |
| USCGC EAGLE (WIX 327)    | NRCB    | Miami         | 0   | 4   | 0   | 1   | 5     |
| USCGC HAMILTON WHEC 715  | NMAG    | Long Beach    | 0   | 0   | 0   | 5   | 5     |
| USCGC HARRIET LANE       | NHNC    | Norfolk       | 31  | 9   | 13  | 16  | 69    |
| USCGC HORNBEAM           | NODM    | Norfolk       | 0   | 4   | 0   | 0   | 4     |
| USCGC LEGARE             | NRPM    | Norfolk       | 0   | 2   | 0   | 25  | 27    |
| USCGC MELLON (WHEC 717)  | NMEL    | Seattle       | 0   | 28  | 0   | 85  | 113   |
| USCGC MIDGETT (WHEC 726) | NHWR    | Seattle       | 0   | 2   | 25  | 61  | 88    |
| USCGC PLANETREE          | NRPY    | Seattle       | 0   | 0   | 34  | 4   | 38    |
| USCGC POLAR SEA_(WAGB 1  | NRUO    | Seattle       | 140 | 0   | 0   | 6   | 146   |
| USCGC RELIANCE WMEC 615  | NJPJ    | Miami         | 1   | 2   | 2   | 1   | 6     |
| USCGC SASSAFRAS          | NODT    | Oakland       | 0   | 0   | 1   | 1   | 2     |
| USCGC SEDGE (WLB 402)    | NODU    | Seattle       | 0   | 0   | 3   | 8   | 11    |
| USCGC SENECA             | NFMK    | Norfolk       | 31  | 0   | 30  | 26  | 87    |
| USCGC SPENCER            | NWHE    | Norfolk       | 5   | 0   | 0   | 0   | 5     |
| USCGC STEADFAST (WMEC 62 | NSTF    | Seattle       | 0   | 3   | 84  | 0   | 87    |
| USCGC STORIS (WMEC 38)   | NRUC    | Seattle       | 12  | 10  | 20  | 6   | 48    |
| USCGC SUNDEW (WLB 404)   | NODW    | Chicago       | 1   | 2   | 0   | 6   | 9     |
| USCGC SWEETBRIER WLB 405 | NODX    | Seattle       | 7   | 6   | 17  | 6   | 36    |
| USCGC TAHOMA             | NCBE    | Norfolk       | 29  | 13  | 13  | 96  | 151   |
| USCGC TAMPA WMEC 902     | NIKL    | Norfolk       | 0   | 0   | 0   | 97  | 97    |
| USCGC THETIS             | NYWL    | Jacksonville  | 23  | 0   | 0   | 39  | 62    |
| USCGC VALIANT (WMEC 621) | NVAI    | Miami         | 0   | 38  | 0   | 23  | 61    |
| USCGC VENTUROUS WMEC 625 | NVES    | Oakland       | 13  | 9   | 78  | 0   | 100   |
| USCGC WOODRUSH (WLB 407) | NODZ    | Seattle       | 0   | 5   | 3   | 1   | 9     |
| USNS ALGOL               | NAMW    | Jacksonville  | 0   | 0   | 0   | 1   | 1     |
| USNS APACHE (T-ATF 172)  | NIGP    | Norfolk       | 40  | 20  | 14  | 39  | 113   |
| USNS BOWDITCH            | NWSW    | New Orleans   | 0   | 0   | 51  | 53  | 104   |
| USNS CAPELLA             | NBXO    | Jacksonville  | 0   | 0   | 23  | 0   | 23    |
| USNS DENEbola            | NDSP    | Newark        | 0   | 0   | 8   | 0   | 8     |
| USNS GUS W. DARNELL      | KCDK    | Houston       | 13  | 4   | 6   | 46  | 69    |
| USNS HAYES               | NRLW    | Jacksonville  | 0   | 0   | 109 | 0   | 109   |
| USNS HENSON              | NENB    | New Orleans   | 48  | 0   | 0   | 0   | 48    |
| USNS JOHN MCDONNELL (T-A | NJMD    | New Orleans   | 0   | 93  | 20  | 0   | 113   |
| USNS LARAMIE T-AO 203    | NLAR    | New Orleans   | 0   | 2   | 0   | 0   | 2     |
| USNS PATHFINDER T-AGS 60 | NGKK    | New Orleans   | 0   | 0   | 86  | 57  | 143   |
| USNS PATUXENT            | NPCZ    | New Orleans   | 63  | 120 | 72  | 48  | 303   |
| USNS PECOS               | NPEC    | Oakland       | 0   | 504 | 11  | 0   | 515   |

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## VOS Cooperative Ship Reports

*Continued from Page 83*

| SHIP NAME                 | CALL    | PORT          | MAY | JUN | JUL | AUG | TOTAL   |
|---------------------------|---------|---------------|-----|-----|-----|-----|---------|
| USNS SATURN T-AFS-10      | NADH    | Norfolk       | 48  | 34  | 43  | 60  | 185     |
| USNS SIOUX                | NJOV    | Oakland       | 202 | 0   | 0   | 0   | 202     |
| USNS SIRIUS (T-AFS 8)     | NPGA    | Norfolk       | 0   | 24  | 48  | 48  | 120     |
| USNS SUMNER               | NZAU    | New Orleans   | 72  | 69  | 50  | 33  | 224     |
| USNS TIPPECANOE (TAO-199) | NTIP    | New Orleans   | 0   | 0   | 0   | 263 | 263     |
| USNS VANGUARD TAG 194     | NIDR    | Newark        | 0   | 10  | 247 | 45  | 302     |
| USNS YUKON (T-AO 202)     | NYUK    | New Orleans   | 27  | 0   | 0   | 0   | 27      |
| VASILTY BURKHANOV         | UZHC    | Seattle       | 12  | 15  | 31  | 12  | 70      |
| VEGA                      | 9VJS    | Houston       | 39  | 42  | 36  | 32  | 149     |
| VENUS DIAMOND             | 9VRR    | Houston       | 0   | 0   | 13  | 0   | 13      |
| VERA ACORDE               | 3EAG4   | Seattle       | 8   | 285 | 0   | 11  | 304     |
| VICTORIA                  | GBBA    | Miami         | 7   | 22  | 16  | 5   | 50      |
| VIRGINIA                  | 3EBW4   | Seattle       | 114 | 102 | 74  | 162 | 452     |
| VISAYAN GLORY             | 3EHJ7   | Seattle       | 0   | 28  | 135 | 0   | 163     |
| VIVA                      | LACU2   | Norfolk       | 0   | 63  | 61  | 110 | 234     |
| WALTER J. MCCARTHY        | WXU3434 | Cleveland     | 0   | 21  | 33  | 22  | 76      |
| WASHINGTON HIGHWAY        | JKHH    | Seattle       | 38  | 15  | 45  | 61  | 159     |
| WASHINGTON SENATOR        | DEAZ    | Long Beach    | 0   | 0   | 36  | 55  | 91      |
| WAVELET                   | DVDJ    | Seattle       | 0   | 0   | 0   | 13  | 13      |
| WECOMA                    | WSD7079 | Seattle       | 90  | 84  | 89  | 62  | 325     |
| WESTERN BRIDGE            | C6JQ9   | Baltimore     | 0   | 0   | 0   | 75  | 75      |
| WESTERN LION              | A8BN    | Long Beach    | 0   | 63  | 0   | 24  | 87      |
| WESTWARD                  | WZL8190 | Miami         | 28  | 0   | 0   | 24  | 52      |
| WESTWARD VENTURE          | KHJB    | Seattle       | 95  | 141 | 144 | 86  | 466     |
| WESTWOOD ANETTE           | DVDM    | Seattle       | 74  | 52  | 29  | 48  | 203     |
| WESTWOOD BELINDA          | C6CE7   | Seattle       | 44  | 48  | 55  | 61  | 208     |
| WESTWOOD CLEO             | C6OQ8   | Seattle       | 60  | 26  | 15  | 5   | 106     |
| WESTWOOD FUJI             | S6BR    | Seattle       | 63  | 35  | 58  | 53  | 209     |
| WESTWOOD HALLA            | S6BO    | Seattle       | 42  | 127 | 61  | 55  | 285     |
| WESTWOOD JAGO             | C6CW9   | Seattle       | 64  | 21  | 16  | 32  | 133     |
| WESTWOOD MARIANNE         | DVPV    | Seattle       | 0   | 6   | 23  | 22  | 51      |
| WILFRED SYKES             | WC5932  | Chicago       | 3   | 38  | 46  | 52  | 139     |
| WILLIAM E. CRAIN          | ELOR2   | Oakland       | 0   | 32  | 0   | 0   | 32      |
| WILLIAM E. MUSSMAN        | D5OE    | Seattle       | 66  | 42  | 57  | 46  | 211     |
| WOLVERINE                 | WZC4518 | Cleveland     | 0   | 68  | 11  | 21  | 100     |
| YUCATAN                   | XCUY    | Houston       | 39  | 130 | 20  | 28  | 217     |
| YURIY OSTROVSKIY          | UAGJ    | Seattle       | 79  | 189 | 81  | 82  | 431     |
| ZAGREB EXPRESS            | 9HPL3   | Norfolk       | 9   | 0   | 0   | 0   | 9       |
| ZENITH                    | ELOU5   | Miami         | 0   | 11  | 3   | 7   | 21      |
| ZIM ADRIATIC              | 4XIO    | Long Beach    | 0   | 36  | 23  | 5   | 64      |
| ZIM AMERICA               | 4XGR    | Newark        | 17  | 5   | 22  | 38  | 82      |
| ZIM ASIA                  | 4XFB    | New Orleans   | 52  | 68  | 48  | 22  | 190     |
| ZIM ATLANTIC              | 4XFD    | New York City | 26  | 33  | 20  | 55  | 134     |
| ZIM CANADA                | 4XGS    | Norfolk       | 55  | 33  | 29  | 41  | 158     |
| ZIM CHINA                 | 4XFQ    | New York City | 48  | 0   | 0   | 0   | 48      |
| ZIM EUROPA                | 4XFN    | New York City | 31  | 26  | 9   | 22  | 88      |
| ZIM IBERIA                | 4XFP    | New York City | 21  | 0   | 0   | 0   | 21      |
| ZIM ISRAEL                | 4XGX    | New Orleans   | 23  | 21  | 31  | 42  | 117     |
| ZIM ITALIA                | 4XGT    | New Orleans   | 69  | 22  | 39  | 16  | 146     |
| ZIM JAMAICA               | 4XFE    | New York City | 21  | 19  | 52  | 30  | 122     |
| ZIM JAPAN                 | 4XGV    | Baltimore     | 63  | 56  | 33  | 11  | 163     |
| ZIM KEELUNG               | 4XII    | Newark        | 0   | 7   | 3   | 27  | 37      |
| ZIM KOREA                 | 4XGU    | Miami         | 21  | 12  | 39  | 24  | 96      |
| ZIM MONTEVIDEO            | V2AG7   | Norfolk       | 22  | 9   | 11  | 9   | 51      |
| ZIM SANTOS                | ELRJ6   | Baltimore     | 39  | 50  | 53  | 32  | 174     |
| ZIM SAVANNAH              | 4XIL    | Long Beach    | 0   | 19  | 17  | 2   | 38      |
| ZIM U.S.A.                | 4XFO    | New York City | 0   | 0   | 0   | 5   | 5       |
| Totals                    | May     |               |     |     |     |     | 35,031  |
|                           | Jun     |               |     |     |     |     | 44,390  |
|                           | Jul     |               |     |     |     |     | 43,822  |
|                           | Aug     |               |     |     |     |     | 43,383  |
| Period Total              |         |               |     |     |     |     | 166,626 |



## Buoy Climatological Data Summary —

### April through August 1998

Weather observations are taken each hour during a 20-minute averaging period, with a sample taken every 0.67 seconds. The significant wave height is defined as the average height of the highest one-third of the waves during the average period each hour. The maximum significant wave height is the highest of those values for that month. At most stations, air temperature, water temperature, wind speed and direction are sampled once per second during an 8.0-minute averaging period each hour (moored buoys) and a 2.0-minute averaging period for fixed stations (C-MAN). Contact NDBC Data Systems Division, Bldg. 1100, SSC, Mississippi 39529 or phone (601) 688-1720 for more details.

| BUOY       | LAT   | LONG   | OBS  | MEAN<br>AIR TP<br>(C) | MEAN<br>SEA TP<br>(C) | MEAN SIG<br>WAVE HT<br>(M) | MAX SIG<br>WAVE HT<br>(M) | MAX SIG<br>WAVE HT<br>(DA/HR) | SCALAR MEAN<br>WIND SPEED<br>(KNOTS) | PREV<br>WIND<br>(DIR) | MAX<br>WIND<br>(KTS) | MAX<br>WIND<br>(DA/HR) | MEAN<br>PRESS<br>(MB) |
|------------|-------|--------|------|-----------------------|-----------------------|----------------------------|---------------------------|-------------------------------|--------------------------------------|-----------------------|----------------------|------------------------|-----------------------|
| April 1998 |       |        |      |                       |                       |                            |                           |                               |                                      |                       |                      |                        |                       |
| 41001      | 34.7N | 072.6W | 0718 | 18.0                  | 20.0                  |                            |                           |                               |                                      |                       |                      |                        | 1014.4                |
| 41004      | 32.5N | 079.1W | 0692 | 18.3                  |                       | 1.3                        | 3.2                       | 09/15                         | 12.1                                 | SW                    | 30.7                 | 30/21                  | 1014.8                |
| 41008      | 31.4N | 080.9W | 0708 | 18.9                  | 19.0                  | 1.0                        | 2.3                       | 28/20                         | 11.7                                 | S                     | 25.3                 | 10/08                  | 1015.3                |
| 41009      | 28.5N | 080.2W | 1426 | 21.9                  | 22.1                  | 1.3                        | 3.2                       | 11/19                         | 12.5                                 | S                     | 29.3                 | 11/19                  | 1016.0                |
| 41010      | 28.9N | 078.6W | 1373 | 22.5                  | 24.8                  | 1.8                        | 4.0                       | 12/06                         | 14.4                                 | SE                    | 26.8                 | 09/12                  | 1016.0                |
| 42001      | 25.9N | 089.7W | 0719 | 23.1                  | 24.1                  | 1.5                        | 3.5                       | 14/12                         | 16.0                                 | SE                    | 29.0                 | 27/10                  | 1014.7                |
| 42002      | 25.9N | 093.6W | 0716 | 22.3                  | 23.1                  | 1.4                        | 3.5                       | 13/19                         | 12.6                                 | SE                    | 27.4                 | 13/04                  | 1013.4                |
| 42003      | 25.9N | 085.9W | 0715 |                       | 25.5                  | 1.3                        | 2.9                       | 11/15                         | 15.6                                 | SE                    | 33.8                 | 30/10                  | 1014.8                |
| 42007      | 30.1N | 088.8W | 0714 | 20.0                  | 20.7                  | 0.8                        | 2.9                       | 29/22                         | 12.5                                 | SE                    | 34.4                 | 29/22                  | 1014.5                |
| 42019      | 27.9N | 095.4W | 0718 | 20.4                  | 20.7                  | 1.3                        | 3.0                       | 17/15                         | 11.2                                 | SE                    | 26.8                 | 17/13                  | 1013.2                |
| 42020      | 26.9N | 096.7W | 0714 | 21.3                  | 21.3                  | 1.4                        | 2.9                       | 18/18                         | 11.8                                 | SE                    | 24.9                 | 17/13                  | 1012.7                |
| 42035      | 29.3N | 094.4W | 0714 | 19.8                  | 20.3                  | 0.9                        | 2.3                       | 25/15                         | 11.7                                 | SE                    | 26.4                 | 29/11                  | 1013.5                |
| 42036      | 28.5N | 084.5W | 0713 | 20.2                  | 20.3                  | 1.0                        | 3.3                       | 11/08                         | 11.2                                 | SE                    | 27.8                 | 30/08                  | 1016.3                |
| 42039      | 28.8N | 086.0W | 0573 | 20.9                  | 21.7                  | 1.2                        | 2.8                       | 11/07                         | 12.6                                 | SE                    | 35.9                 | 30/03                  | 1017.0                |
| 42040      | 29.2N | 088.3W | 0711 | 20.2                  | 21.0                  | 1.2                        | 3.0                       | 30/03                         | 12.2                                 | SE                    | 28.0                 | 29/23                  | 1015.7                |
| 44004      | 38.5N | 070.7W | 0690 | 9.6                   | 9.5                   | 2.0                        | 5.8                       | 23/13                         | 13.4                                 | W                     | 36.5                 | 23/11                  | 1013.1                |
| 44005      | 42.9N | 068.9W | 0713 | 5.5                   | 4.6                   | 1.4                        | 4.7                       | 24/03                         | 10.7                                 | SW                    | 32.4                 | 10/10                  | 1011.7                |
| 44007      | 43.5N | 070.2W | 0718 | 6.5                   | 5.6                   | 0.9                        | 4.1                       | 24/04                         | 9.9                                  | N                     | 31.7                 | 24/02                  | 1012.2                |
| 44008      | 40.5N | 069.4W | 0718 | 6.7                   | 5.7                   | 1.7                        | 5.9                       | 10/11                         | 12.6                                 | SW                    | 35.4                 | 10/11                  | 1012.2                |
| 44009      | 38.5N | 074.7W | 0712 | 10.4                  | 9.9                   | 1.2                        | 3.5                       | 04/22                         | 12.3                                 | S                     | 29.1                 | 04/16                  | 1013.1                |
| 44011      | 41.1N | 066.6W | 0712 | 5.9                   | 4.6                   | 2.0                        | 7.1                       | 10/20                         | 13.4                                 | SW                    | 35.9                 | 10/18                  | 1011.9                |
| 44013      | 42.4N | 070.7W | 0717 | 7.2                   | 5.9                   | 0.9                        | 4.1                       | 24/00                         | 9.2                                  | SE                    | 32.3                 | 10/09                  | 1011.5                |
| 44014      | 36.6N | 074.8W | 0531 | 10.9                  | 9.4                   | 1.5                        | 3.3                       | 23/07                         | 10.9                                 | S                     | 27.0                 | 09/21                  | 1015.0                |
| 44025      | 40.3N | 073.2W | 0683 | 8.3                   | 7.4                   | 1.2                        | 3.9                       | 10/02                         | 11.3                                 | SW                    | 34.6                 | 10/00                  | 1013.2                |
| 45001      | 48.1N | 087.8W | 0655 | 3.3                   | 2.5                   | 0.7                        | 2.8                       | 13/00                         | 10.0                                 | SW                    | 26.0                 | 13/00                  | 1016.4                |
| 45002      | 45.3N | 086.4W | 0710 | 4.8                   | 3.5                   | 0.7                        | 2.4                       | 01/04                         | 9.9                                  | NE                    | 28.0                 | 01/02                  | 1014.5                |
| 45003      | 45.3N | 082.8W | 0296 | 4.5                   | 3.3                   | 0.4                        | 1.4                       | 26/12                         | 7.0                                  | W                     | 17.9                 | 26/11                  | 1019.1                |
| 45004      | 47.6N | 086.6W | 0647 | 3.4                   | 2.9                   | 0.7                        | 3.4                       | 17/18                         | 10.0                                 | SE                    | 29.9                 | 17/15                  | 1016.9                |
| 45005      | 41.7N | 082.4W | 0717 | 7.5                   | 6.8                   | 0.7                        | 3.9                       | 10/00                         | 9.9                                  | NE                    | 33.0                 | 10/00                  | 1013.9                |
| 45006      | 47.3N | 089.9W | 0676 | 3.8                   | 2.2                   | 0.8                        | 2.7                       | 07/21                         | 9.0                                  | NE                    | 27.4                 | 07/21                  | 1016.4                |
| 45007      | 42.7N | 087.0W | 0713 | 5.5                   | 4.1                   | 0.7                        | 2.7                       | 09/21                         | 9.6                                  | N                     | 27.6                 | 26/14                  | 1014.1                |
| 45008      | 44.3N | 082.4W | 0378 | 4.8                   | 3.3                   | 0.6                        | 1.7                       | 17/11                         | 8.0                                  | NE                    | 23.5                 | 17/11                  | 1016.9                |

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## Buoy Climatological Data Summary

*Continued from Page 85*

| BUOY  | LAT   | LONG   | OBS  | MEAN<br>AIR TP<br>(C) | MEAN<br>SEA TP<br>(C) | MEAN SIG<br>WAVE HT<br>(M) | MAX SIG<br>WAVE HT<br>(M) | MAX SIG<br>WAVE HT<br>(DA/HR) | SCALAR MEAN<br>WIND SPEED<br>(KNOTS) | PREV<br>WIND<br>(DIR) | MAX<br>WIND<br>(KTS) | MAX<br>WIND<br>(DA/HR) | MEAN<br>PRESS<br>(MB) |
|-------|-------|--------|------|-----------------------|-----------------------|----------------------------|---------------------------|-------------------------------|--------------------------------------|-----------------------|----------------------|------------------------|-----------------------|
| 46001 | 56.3N | 148.2W | 0712 | 4.4                   | 5.4                   | 3.1                        | 7.0                       | 01/10                         | 15.8                                 | S                     | 33.6                 | 01/10                  | 1004.5                |
| 46002 | 42.5N | 130.3W | 0709 | 9.5                   | 10.7                  | 2.9                        | 6.0                       | 10/19                         | 13.0                                 | NW                    | 31.9                 | 10/10                  | 1018.6                |
| 46003 | 51.9N | 155.9W | 0164 | 4.2                   | 4.6                   | 2.3                        | 3.5                       | 29/09                         | 13.8                                 | NW                    | 25.1                 | 28/17                  | 1007.7                |
| 46005 | 46.1N | 131.0W | 0714 | 8.4                   | 9.6                   | 2.9                        | 6.9                       | 07/06                         | 13.2                                 | S                     | 26.8                 | 20/14                  | 1018.7                |
| 46011 | 34.9N | 120.9W | 0718 | 12.0                  | 13.0                  | 2.3                        | 5.0                       | 08/02                         | 11.8                                 | NW                    | 27.8                 | 25/04                  | 1016.4                |
| 46013 | 38.2N | 123.3W | 0683 | 11.0                  | 11.9                  | 2.6                        | 5.2                       | 02/00                         | 13.7                                 | NW                    | 30.1                 | 11/21                  | 1017.3                |
| 46014 | 39.2N | 124.0W | 0718 | 10.7                  | 11.5                  | 2.6                        | 5.2                       | 01/11                         | 12.8                                 | NW                    | 28.6                 | 30/23                  | 1016.7                |
| 46023 | 34.7N | 121.0W | 0710 | 12.2                  | 13.3                  | 2.4                        | 4.7                       | 01/20                         | 14.4                                 | NW                    | 32.3                 | 25/04                  | 1017.4                |
| 46045 | 33.8N | 118.5W | 0710 | 13.7                  | 15.3                  | 1.0                        | 2.8                       | 12/12                         | 7.6                                  | W                     | 22.3                 | 13/00                  | 1015.7                |
| 46050 | 44.6N | 124.5W | 0055 | 12.2                  | 12.3                  | 1.7                        | 2.5                       | 28/21                         | 9.9                                  | N                     | 19.6                 | 29/03                  | 1012.5                |
| 46054 | 34.3N | 120.5W | 0700 | 12.1                  | 12.7                  | 2.1                        | 4.5                       | 01/21                         | 14.8                                 | NW                    | 31.9                 | 25/06                  | 1016.2                |
| 46063 | 34.3N | 120.7W | 0056 | 11.7                  | 12.3                  | 1.7                        | 2.2                       | 29/08                         | 10.1                                 | NW                    | 18.3                 | 29/06                  | 1014.1                |
| 51001 | 23.4N | 162.3W | 0708 | 22.1                  | 23.2                  | 2.6                        | 4.7                       | 11/03                         | 14.9                                 | NE                    | 24.1                 | 12/14                  | 1023.2                |
| 51002 | 17.2N | 157.8W | 0715 | 23.7                  | 24.7                  | 2.8                        | 4.7                       | 11/16                         | 17.7                                 | NE                    | 26.7                 | 10/19                  | 1019.0                |
| 91328 | 8.6N  | 149.7E | 0463 | 28.0                  |                       |                            |                           |                               | 8.7                                  | NE                    | 15.5                 | 02/05                  | 1011.5                |
| 91343 | 7.6N  | 155.2E | 0714 | 28.2                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1011.0                |
| 91352 | 6.2N  | 160.7E | 0434 | 28.1                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1013.3                |
| 91377 | 6.1N  | 172.1E | 0468 | 27.9                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1014.6                |
| 91411 | 8.3N  | 137.5E | 0173 | 28.9                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1011.6                |
| 91442 | 4.6N  | 168.7E | 0713 | 27.9                  |                       |                            |                           |                               | 13.6                                 | NE                    | 26.2                 | 15/02                  | 1012.1                |
| ABAN6 | 44.3N | 075.9W | 0716 | 7.6                   | 5.1                   |                            |                           |                               | 4.6                                  | N                     | 19.3                 | 09/20                  | 1014.3                |
| ALSN6 | 40.5N | 073.8W | 0713 | 9.9                   |                       | 0.9                        | 2.9                       | 10/03                         | 15.5                                 | S                     | 41.7                 | 10/00                  | 1013.2                |
| BLIA2 | 60.8N | 146.9W | 1422 | 4.1                   |                       |                            |                           |                               | 9.5                                  | NE                    | 30.3                 | 28/07                  | 1009.0                |
| BURL1 | 28.9N | 089.4W | 0716 | 19.7                  |                       |                            |                           |                               | 13.7                                 | SE                    | 47.2                 | 29/01                  | 1014.5                |
| CARO3 | 43.3N | 124.4W | 0712 | 9.4                   |                       |                            |                           |                               | 8.5                                  | N                     | 26.7                 | 01/02                  | 1018.0                |
| CDRF1 | 29.1N | 083.0W | 0713 | 20.6                  |                       |                            |                           |                               | 9.7                                  | S                     | 22.9                 | 09/11                  | 1016.1                |
| CHLV2 | 36.9N | 075.7W | 0714 | 13.1                  | 12.1                  | 1.0                        | 3.9                       | 04/21                         | 15.6                                 | S                     | 44.5                 | 04/16                  | 1014.3                |
| CLKN7 | 34.6N | 076.5W | 0713 | 16.3                  |                       |                            |                           |                               | 13.4                                 | SW                    | 29.8                 | 04/21                  | 1016.4                |
| CSBF1 | 29.7N | 085.4W | 0713 | 19.7                  |                       |                            |                           |                               | 9.7                                  | SE                    | 29.2                 | 22/23                  | 1016.3                |
| DBLN6 | 42.5N | 079.4W | 0714 | 7.9                   |                       |                            |                           |                               | 10.2                                 | SW                    | 33.1                 | 09/22                  | 1014.7                |
| DESW1 | 47.7N | 124.5W | 0710 | 8.9                   |                       |                            |                           |                               | 8.6                                  | NW                    | 31.1                 | 10/23                  | 1017.2                |
| DPIA1 | 30.3N | 088.1W | 0711 | 19.5                  | 20.8                  |                            |                           |                               | 13.2                                 | SE                    | 38.9                 | 29/23                  | 1015.4                |
| DRYF1 | 24.6N | 082.9W | 0712 | 23.3                  | 23.0                  |                            |                           |                               | 11.0                                 | SE                    | 24.5                 | 11/14                  | 1014.9                |
| DSLN7 | 35.2N | 075.3W | 0714 | 14.8                  |                       | 1.8                        | 4.4                       | 05/05                         | 18.3                                 | SW                    | 43.5                 | 04/22                  | 1014.1                |
| DUCN7 | 36.2N | 075.8W | 0705 | 14.8                  |                       | 0.9                        | 2.9                       | 05/00                         | 13.3                                 | S                     | 41.1                 | 04/20                  | 1015.9                |
| FFIA2 | 57.3N | 133.6W | 0716 | 6.3                   |                       |                            |                           |                               | 8.5                                  | SE                    | 24.9                 | 05/17                  |                       |
| FPSN7 | 33.5N | 077.6W | 0710 | 17.7                  |                       | 1.4                        | 4.1                       | 09/19                         | 15.9                                 | SW                    | 41.4                 | 09/03                  | 1014.2                |
| FWYF1 | 25.6N | 080.1W | 0713 | 23.7                  | 24.6                  |                            |                           |                               | 16.0                                 | SE                    | 30.3                 | 11/06                  | 1017.2                |
| GDIL1 | 29.3N | 090.0W | 0713 | 20.5                  | 22.8                  |                            |                           |                               | 11.5                                 | SE                    | 32.4                 | 29/04                  | 1015.0                |
| GLLN6 | 43.9N | 076.5W | 0707 | 6.2                   |                       |                            |                           |                               | 10.6                                 | SW                    | 31.7                 | 17/23                  | 1014.3                |
| IOSN3 | 43.0N | 070.6W | 0712 | 7.3                   |                       |                            |                           |                               | 12.5                                 | NW                    | 36.1                 | 24/00                  | 1011.9                |
| KTNF1 | 29.8N | 083.6W | 0714 | 19.5                  |                       |                            |                           |                               | 10.7                                 | S                     | 27.6                 | 10/00                  | 1015.6                |
| LKWF1 | 26.6N | 080.0W | 0709 | 23.0                  | 24.1                  |                            |                           |                               | 12.6                                 | SE                    | 25.7                 | 11/22                  | 1016.5                |
| LONF1 | 24.9N | 080.9W | 0718 | 24.1                  | 25.0                  |                            |                           |                               | 13.7                                 | SE                    | 24.6                 | 12/04                  | 1015.9                |
| LPOI1 | 48.1N | 116.5W | 0713 | 7.8                   | 6.1                   |                            |                           |                               | 4.5                                  | S                     | 33.6                 | 24/01                  |                       |
| MDRM1 | 44.0N | 068.1W | 0712 | 5.3                   |                       |                            |                           |                               |                                      |                       |                      |                        | 1011.5                |
| MISM1 | 43.8N | 068.9W | 0714 | 5.4                   |                       |                            |                           |                               | 14.2                                 | N                     | 40.0                 | 24/04                  | 1011.4                |
| MLRF1 | 25.0N | 080.4W | 0714 | 23.9                  | 24.7                  |                            |                           |                               | 14.2                                 | SE                    | 26.6                 | 11/03                  | 1016.3                |
| MRKA2 | 61.1N | 146.7W | 1428 | 3.6                   |                       |                            |                           |                               | 6.1                                  | NE                    | 20.3                 | 28/08                  | 1010.3                |
| NWPO3 | 44.6N | 124.1W | 0714 | 8.9                   |                       |                            |                           |                               | 8.2                                  | E                     | 28.5                 | 11/06                  | 1018.1                |
| PILM4 | 48.2N | 088.4W | 0711 | 3.8                   |                       |                            |                           |                               | 11.7                                 | NE                    | 36.8                 | 01/04                  | 1017.0                |
| POTA2 | 61.1N | 146.7W | 1422 | 3.5                   |                       |                            |                           |                               | 10.2                                 | NE                    | 22.4                 | 17/14                  | 1008.9                |
| PTAC1 | 39.0N | 123.7W | 0715 | 10.1                  |                       |                            |                           |                               | 10.6                                 | N                     | 27.3                 | 12/01                  | 1016.7                |
| PTAT2 | 27.8N | 097.1W | 0710 | 20.8                  | 21.7                  |                            |                           |                               | 12.9                                 | SE                    | 28.9                 | 17/12                  | 1013.4                |
| PTGC1 | 34.6N | 120.7W | 0710 | 11.7                  |                       |                            |                           |                               | 14.8                                 | N                     | 39.2                 | 12/05                  | 1017.7                |
| ROAM4 | 47.9N | 089.3W | 0561 | 4.9                   | 2.6                   |                            |                           |                               | 12.1                                 | NE                    | 33.8                 | 01/04                  | 1015.6                |
| SANF1 | 24.5N | 081.9W | 0715 | 23.9                  | 24.3                  |                            |                           |                               | 13.6                                 | SE                    | 25.8                 | 11/06                  | 1015.9                |
| SAUF1 | 29.9N | 081.3W | 0717 | 20.3                  | 19.2                  |                            |                           |                               | 10.0                                 | S                     | 23.0                 | 28/23                  | 1016.2                |
| SBOI1 | 41.6N | 082.8W | 0710 | 9.0                   |                       |                            |                           |                               | 9.7                                  | NE                    | 25.4                 | 17/08                  | 1013.8                |
| SGNW3 | 43.8N | 087.7W | 0714 | 6.4                   | 8.0                   |                            |                           |                               | 10.9                                 | N                     | 32.6                 | 09/17                  |                       |
| SISW1 | 48.3N | 122.9W | 0719 | 9.3                   |                       |                            |                           |                               | 8.5                                  | W                     | 30.6                 | 24/11                  | 1017.6                |
| SMKF1 | 24.6N | 081.1W | 0715 | 24.3                  | 25.0                  |                            |                           |                               | 15.5                                 | SE                    | 28.1                 | 11/09                  | 1016.3                |
| SPGF1 | 26.7N | 079.0W | 0708 | 23.1                  |                       |                            |                           |                               | 11.0                                 | SE                    | 27.6                 | 12/00                  | 1016.1                |
| SRST2 | 29.7N | 094.1W | 0716 | 19.1                  |                       |                            |                           |                               | 11.0                                 | S                     | 26.4                 | 27/04                  | 1015.2                |
| STDM4 | 47.2N | 087.2W | 0713 | 4.6                   |                       |                            |                           |                               | 13.2                                 | NE                    | 40.9                 | 01/04                  | 1015.6                |
| SUPN6 | 44.5N | 075.8W | 0709 | 7.7                   | 5.8                   |                            |                           |                               | 9.0                                  | N                     | 27.5                 | 17/18                  | 1013.5                |
| THIN6 | 44.3N | 076.0W | 0544 | 8.2                   |                       |                            |                           |                               |                                      |                       |                      |                        |                       |
| TPLM2 | 38.9N | 076.4W | 0698 | 13.3                  | 12.8                  |                            |                           |                               | 10.7                                 | S                     | 35.9                 | 27/00                  | 1014.5                |
| TTIW1 | 48.4N | 124.7W | 0715 | 8.5                   |                       |                            |                           |                               | 9.4                                  | SW                    | 28.5                 | 29/18                  | 1017.9                |

*Continued on Page 87*





## Buoy Climatological Data Summary

*Continued from Page 86*

| BUOY  | LAT   | LONG   | OBS  | MEAN<br>AIR TP<br>(C) | MEAN<br>SEA TP<br>(C) | MEAN SIG<br>WAVE HT<br>(M) | MAX SIG<br>WAVE HT<br>(M) | MAX SIG<br>WAVE HT<br>(DA/HR) | SCALAR MEAN<br>WIND SPEED<br>(KNOTS) | PREV<br>WIND<br>(DIR) | MAX<br>WIND<br>(KTS) | MAX<br>WIND<br>(DA/HR) | MEAN<br>PRESS<br>(MB) |
|-------|-------|--------|------|-----------------------|-----------------------|----------------------------|---------------------------|-------------------------------|--------------------------------------|-----------------------|----------------------|------------------------|-----------------------|
| VENF1 | 27.1N | 082.5W | 0712 | 21.3                  | 23.3                  |                            |                           |                               | 10.9                                 | S                     | 27.3                 | 19/14                  | 1017.3                |
| WPOW1 | 47.7N | 122.4W | 0318 | 8.3                   |                       |                            |                           |                               | 8.4                                  | S                     | 22.8                 | 11/21                  | 1014.1                |

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|       |       |        |      |      |      |     |     |       |      |    |      |       |        |
|-------|-------|--------|------|------|------|-----|-----|-------|------|----|------|-------|--------|
| 41001 | 34.7N | 072.6W | 0745 | 21.5 | 22.4 |     |     |       |      |    |      |       | 1011.4 |
| 41002 | 32.3N | 075.2W | 0576 | 23.4 | 24.2 | 1.7 | 4.9 | 13/23 | 12.5 | SW | 31.9 | 08/09 | 1012.7 |
| 41004 | 32.5N | 079.1W | 0730 | 23.0 |      | 0.9 | 2.5 | 01/00 | 9.1  | SW | 21.8 | 03/22 | 1012.2 |
| 41008 | 31.4N | 080.9W | 0736 | 23.8 | 23.6 | 0.7 | 1.6 | 01/00 | 9.4  | S  | 22.3 | 11/02 | 1013.1 |
| 41009 | 28.5N | 080.2W | 1472 | 24.7 | 24.6 | 0.8 | 2.5 | 14/19 | 8.9  | S  | 26.6 | 04/20 | 1014.3 |
| 41010 | 28.9N | 078.6W | 1451 | 25.1 | 25.8 | 1.2 | 4.0 | 14/16 | 10.9 | S  | 31.3 | 04/23 | 1014.2 |
| 42001 | 25.9N | 089.7W | 0731 | 25.5 |      | 0.8 | 3.1 | 09/16 | 10.1 | SE | 35.2 | 09/15 | 1014.1 |
| 42002 | 25.9N | 093.6W | 0741 | 25.2 | 25.5 | 0.8 | 2.6 | 09/12 | 10.6 | SE | 27.6 | 09/07 | 1012.8 |
| 42003 | 25.9N | 085.9W | 0737 | 26.1 | 26.4 | 0.7 | 1.7 | 08/15 | 9.0  | SE | 23.9 | 27/09 | 1014.2 |
| 42007 | 30.1N | 088.8W | 0735 | 25.3 | 25.9 | 0.4 | 1.3 | 10/03 | 9.5  | SW | 20.4 | 10/03 | 1013.3 |
| 42019 | 27.9N | 095.4W | 0739 | 24.3 | 24.3 | 0.9 | 1.9 | 10/01 | 9.4  | SE | 20.0 | 15/01 | 1011.8 |
| 42020 | 26.9N | 096.7W | 0740 | 24.8 | 24.6 | 1.0 | 2.2 | 15/01 | 11.1 | SE | 22.9 | 15/08 | 1011.0 |
| 42035 | 29.3N | 094.4W | 0741 | 24.6 | 24.8 | 0.8 | 1.6 | 22/10 | 10.7 | SE | 21.6 | 09/06 | 1012.1 |
| 42036 | 28.5N | 084.5W | 0735 | 24.8 | 25.0 | 0.5 | 1.9 | 10/17 | 6.9  | SW | 17.5 | 01/14 | 1015.1 |
| 42039 | 28.8N | 086.0W | 0742 | 24.9 | 25.3 | 0.6 | 2.2 | 10/09 | 7.7  | SW | 19.2 | 08/08 | 1015.6 |
| 42040 | 29.2N | 088.3W | 0735 | 25.0 | 25.6 | 0.6 | 2.1 | 10/06 | 8.8  | SW | 19.2 | 11/02 | 1014.8 |
| 44004 | 38.5N | 070.7W | 0571 | 16.6 | 16.6 | 1.4 | 5.9 | 13/07 | 10.4 | SE | 29.0 | 12/23 | 1011.1 |
| 44005 | 42.9N | 068.9W | 0741 | 8.9  | 7.4  | 1.3 | 4.4 | 13/05 | 10.0 | S  | 23.9 | 11/10 | 1012.2 |
| 44007 | 43.5N | 070.2W | 0734 | 10.7 | 9.0  | 1.0 | 3.1 | 11/16 | 8.6  | S  | 25.8 | 12/05 | 1012.6 |
| 44008 | 40.5N | 069.4W | 0738 | 10.0 | 8.3  | 1.5 | 4.8 | 12/20 | 10.4 | SW | 27.8 | 12/00 | 1012.1 |
| 44009 | 38.5N | 074.7W | 0729 | 14.1 | 13.5 | 1.2 | 4.2 | 12/19 | 10.5 | S  | 29.3 | 09/20 | 1011.1 |
| 44011 | 41.1N | 066.6W | 0738 | 8.8  | 7.0  | 1.6 | 4.8 | 13/06 |      |    |      |       | 1012.7 |
| 44013 | 42.4N | 070.7W | 0732 | 11.9 | 10.2 | 0.9 | 4.0 | 11/21 | 9.7  | NE | 27.0 | 10/15 | 1011.4 |
| 44014 | 36.6N | 074.8W | 0741 | 14.2 | 12.7 | 1.2 | 4.9 | 13/18 | 9.1  | S  | 26.0 | 01/18 | 1010.9 |
| 44025 | 40.3N | 073.2W | 0705 | 12.2 | 11.1 | 1.2 | 4.0 | 12/18 | 11.0 | NE | 31.3 | 09/16 | 1012.0 |
| 45001 | 48.1N | 087.8W | 0731 | 5.7  | 3.4  | 0.6 | 2.6 | 17/00 | 9.5  | NE | 25.3 | 17/01 | 1012.1 |
| 45002 | 45.3N | 086.4W | 0732 | 9.5  | 7.4  | 0.5 | 1.8 | 16/14 | 8.6  | NE | 22.3 | 16/14 | 1011.3 |
| 45003 | 45.3N | 082.8W | 0723 | 7.5  | 4.6  | 0.4 | 2.1 | 31/18 | 8.1  | SE | 24.9 | 31/17 | 1012.2 |
| 45004 | 47.6N | 086.6W | 0733 | 5.6  | 3.5  | 0.5 | 2.1 | 17/06 | 8.8  | SE | 25.5 | 31/19 | 1012.9 |
| 45005 | 41.7N | 082.4W | 0736 | 15.7 | 14.8 | 0.4 | 1.4 | 08/19 | 7.8  | NE | 20.6 | 31/11 | 1011.5 |
| 45006 | 47.3N | 089.9W | 0736 | 6.1  | 2.4  | 0.5 | 2.0 | 08/11 | 9.2  | E  | 24.5 | 07/16 | 1006.7 |
| 45007 | 42.7N | 087.0W | 0736 | 11.3 | 9.2  | 0.5 | 1.6 | 08/22 | 7.8  | N  | 25.6 | 31/08 | 1012.2 |
| 45008 | 44.3N | 082.4W | 0737 | 9.1  | 6.3  | 0.4 | 2.1 | 31/13 | 8.6  | N  | 30.3 | 31/11 | 1012.3 |
| 46001 | 56.3N | 148.2W | 0734 | 5.9  | 6.4  | 2.4 | 5.5 | 09/05 | 14.5 | SW | 29.1 | 08/23 | 1010.1 |
| 46002 | 42.5N | 130.3W | 0736 | 10.9 | 12.0 | 2.3 | 5.8 | 02/06 | 13.4 | NW | 28.6 | 02/01 | 1017.2 |
| 46003 | 51.9N | 155.9W | 0717 | 5.1  | 5.1  | 2.7 | 6.8 | 06/12 | 15.6 | NE | 29.5 | 08/13 | 1012.8 |
| 46005 | 46.1N | 131.0W | 0730 | 9.7  | 10.7 | 2.3 | 6.0 | 14/22 | 11.4 | NW | 26.8 | 14/12 | 1017.8 |
| 46006 | 40.9N | 137.5W | 0688 | 10.5 | 11.3 | 2.5 | 5.7 | 01/21 | 14.6 | N  | 29.3 | 01/18 | 1021.5 |
| 46011 | 34.9N | 120.9W | 0740 | 13.0 | 13.1 | 1.9 | 3.9 | 02/11 | 12.4 | NW | 24.3 | 22/04 | 1015.5 |
| 46013 | 38.2N | 123.3W | 0724 | 12.3 | 12.4 | 2.1 | 5.3 | 02/03 | 13.2 | NW | 28.2 | 08/23 | 1016.2 |
| 46014 | 39.2N | 124.0W | 0741 | 12.1 | 12.5 | 2.0 | 4.5 | 28/17 | 11.4 | NW | 29.7 | 01/13 | 1015.3 |
| 46023 | 34.7N | 121.0W | 0734 | 13.2 | 13.6 | 2.1 | 4.4 | 02/11 | 15.3 | NW | 28.0 | 01/18 | 1016.6 |
| 46025 | 33.8N | 119.1W | 0733 | 15.3 | 16.6 | 1.4 | 3.3 | 02/15 | 7.5  | W  | 22.7 | 26/11 | 1015.9 |
| 46029 | 46.1N | 124.5W | 0589 | 11.5 | 12.6 | 1.9 | 4.4 | 15/06 | 11.3 | NW | 24.3 | 14/12 | 1015.6 |
| 46035 | 56.9N | 177.8W | 0722 | 0.9  | 2.8  | 2.2 | 6.7 | 18/07 | 17.6 | N  | 36.7 | 17/21 | 1002.3 |
| 46045 | 33.8N | 118.5W | 0741 | 15.5 | 16.8 | 1.1 | 2.4 | 02/16 | 6.7  | W  | 18.1 | 12/22 | 1015.2 |
| 46050 | 44.6N | 124.5W | 0741 | 12.1 | 12.6 | 2.0 | 4.6 | 15/08 | 9.9  | N  | 25.3 | 14/14 | 1015.5 |
| 46053 | 34.2N | 119.9W | 0739 | 13.9 | 13.9 | 1.2 | 2.8 | 02/13 | 10.7 | W  | 23.9 | 26/22 | 1015.5 |
| 46054 | 34.3N | 120.5W | 0733 | 13.0 | 12.8 | 1.8 | 4.2 | 02/13 | 15.5 | NW | 25.8 | 21/07 | 1015.4 |
| 46059 | 38.0N | 130.0W | 0739 |      | 13.7 | 2.3 | 4.9 | 01/11 | 13.5 | NW | 29.1 | 12/15 |        |
| 46060 | 60.6N | 146.8W | 1478 | 6.5  | 7.4  | 0.6 | 3.2 | 09/22 | 11.7 | E  | 39.6 | 09/21 | 1011.3 |
| 46061 | 60.2N | 146.8W | 1478 | 6.7  | 7.5  | 1.3 | 5.0 | 10/00 | 11.7 | SE | 37.9 | 09/21 | 1011.4 |
| 46062 | 35.1N | 121.0W | 0718 | 13.1 | 13.1 | 1.9 | 5.0 | 02/11 | 13.0 | NW | 24.9 | 10/04 | 1015.7 |
| 46063 | 34.3N | 120.7W | 0734 | 13.5 | 13.5 | 2.1 | 4.5 | 02/11 | 14.7 | NW | 25.3 | 20/12 | 1015.5 |
| 51001 | 23.4N | 162.3W | 0741 | 22.4 | 23.2 | 2.4 | 4.3 | 02/13 | 15.6 | E  | 22.0 | 02/02 | 1021.7 |
| 51002 | 17.2N | 157.8W | 0738 | 24.0 | 24.8 | 2.4 | 3.6 | 22/14 | 17.1 | NE | 24.6 | 21/09 | 1018.0 |
| 51003 | 19.1N | 160.8W | 0741 | 23.8 | 24.7 | 2.3 | 3.4 | 23/20 | 13.5 | NE | 20.8 | 02/09 | 1017.8 |
| 51004 | 17.4N | 152.5W | 0049 | 24.0 | 24.6 | 2.3 | 2.7 | 30/08 | 15.8 | E  | 19.8 | 30/07 | 1018.7 |
| 51028 | 0.0N  | 153.9W | 0715 | 27.4 | 27.9 | 2.0 | 3.3 | 24/13 | 8.4  | NE | 20.8 | 11/10 | 1010.5 |
| 91328 | 8.6N  | 149.7E | 0474 | 28.3 |      |     |     |       | 7.9  | NE | 15.5 | 17/05 | 1010.1 |
| 91343 | 7.6N  | 155.2E | 0731 | 28.4 |      |     |     |       |      |    |      |       | 1009.9 |
| 91352 | 6.2N  | 160.7E | 0426 | 28.1 |      |     |     |       |      |    |      |       | 1012.0 |

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## Buoy Climatological Data Summary

*Continued from Page 87*

| BUOY  | LAT   | LONG   | OBS  | MEAN<br>AIR TP<br>(C) | MEAN<br>SEA TP<br>(C) | MEAN SIG<br>WAVE HT<br>(M) | MAX SIG<br>WAVE HT<br>(M) | MAX SIG<br>WAVE HT<br>(DA/HR) | SCALAR MEAN<br>WIND SPEED<br>(KNOTS) | PREV<br>WIND<br>(DIR) | MAX<br>WIND<br>(KTS) | MAX<br>WIND<br>(DA/HR) | MEAN<br>PRESS<br>(MB) |
|-------|-------|--------|------|-----------------------|-----------------------|----------------------------|---------------------------|-------------------------------|--------------------------------------|-----------------------|----------------------|------------------------|-----------------------|
| 91374 | 8.7N  | 171.2E | 0738 | 27.5                  |                       |                            |                           |                               | 6.5                                  | NE                    | 12.9                 | 30/17                  | 1011.6                |
| 91377 | 6.1N  | 172.1E | 0429 | 28.1                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1013.2                |
| 91411 | 8.3N  | 137.5E | 0243 | 29.2                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1009.9                |
| ABAN6 | 44.3N | 075.9W | 0743 | 15.1                  | 10.1                  |                            |                           |                               | 3.8                                  | N                     | 19.8                 | 31/15                  | 1012.3                |
| ALSN6 | 40.5N | 073.8W | 0738 | 14.6                  |                       | 1.0                        | 2.9                       | 09/19                         | 14.7                                 | S                     | 42.2                 | 31/22                  | 1011.9                |
| BLIA2 | 60.8N | 146.9W | 1464 | 6.1                   |                       |                            |                           |                               | 7.1                                  | NE                    | 27.8                 | 04/03                  | 1012.1                |
| BURL1 | 28.9N | 089.4W | 0730 | 24.7                  |                       |                            |                           |                               | 9.3                                  | SW                    | 22.3                 | 09/21                  | 1013.6                |
| BUZM3 | 41.4N | 071.0W | 0733 | 12.2                  |                       | 0.9                        | 3.3                       | 02/14                         | 14.9                                 | SW                    | 35.1                 | 10/23                  | 1013.0                |
| CARO3 | 43.3N | 124.4W | 0734 | 11.3                  |                       |                            |                           |                               | 8.1                                  | N                     | 25.6                 | 14/17                  | 1016.3                |
| CDRF1 | 29.1N | 083.0W | 0739 | 25.1                  |                       |                            |                           |                               | 7.8                                  | W                     | 20.8                 | 27/14                  | 1014.6                |
| CHLV2 | 36.9N | 075.7W | 0740 | 17.6                  | 16.4                  | 0.8                        | 2.8                       | 14/01                         | 13.3                                 | S                     | 37.7                 | 05/09                  | 1012.0                |
| CLKN7 | 34.6N | 076.5W | 0739 | 20.1                  |                       |                            |                           |                               | 10.4                                 | SW                    | 35.8                 | 05/04                  | 1013.6                |
| CSBF1 | 29.7N | 085.4W | 0730 | 24.4                  |                       |                            |                           |                               | 7.8                                  | SW                    | 22.2                 | 11/02                  | 1014.8                |
| DBLN6 | 42.5N | 079.4W | 0734 | 15.5                  |                       |                            |                           |                               | 8.3                                  | SW                    | 25.6                 | 31/21                  | 1012.3                |
| DESW1 | 47.7N | 124.5W | 0725 | 11.0                  |                       |                            |                           |                               | 6.6                                  | NW                    | 23.6                 | 14/12                  | 1014.6                |
| DISW3 | 47.1N | 090.7W | 0734 | 10.0                  |                       |                            |                           |                               | 10.4                                 | NE                    | 33.2                 | 05/01                  | 1011.5                |
| DPIA1 | 30.3N | 088.1W | 0738 | 25.1                  | 26.3                  |                            |                           |                               | 8.8                                  | SW                    | 23.9                 | 09/22                  | 1014.1                |
| DRYF1 | 24.6N | 082.9W | 0737 | 25.4                  | 24.1                  |                            |                           |                               | 6.1                                  | NE                    | 24.6                 | 05/01                  | 1014.1                |
| DSL7  | 35.2N | 075.3W | 0732 | 18.9                  |                       | 1.0                        | 1.7                       | 16/02                         | 14.6                                 | SW                    | 42.2                 | 01/13                  | 1011.3                |
| DUCN7 | 36.2N | 075.8W | 0735 | 19.0                  |                       | 0.8                        | 3.1                       | 13/14                         | 11.5                                 | SW                    | 31.2                 | 12/23                  | 1013.4                |
| FBIS1 | 32.7N | 079.9W | 0739 | 23.3                  |                       |                            |                           |                               | 7.6                                  | SW                    | 18.0                 | 18/04                  | 1013.2                |
| FFIA2 | 57.3N | 133.6W | 0732 | 9.1                   |                       |                            |                           |                               | 6.9                                  | S                     | 22.8                 | 06/17                  | 1013.3                |
| FPSN7 | 33.5N | 077.6W | 0724 | 22.0                  |                       | 1.1                        | 3.6                       | 01/06                         | 12.5                                 | SW                    | 47.6                 | 01/05                  | 1011.4                |
| FWYF1 | 25.6N | 080.1W | 0726 | 26.2                  | 26.4                  |                            |                           |                               | 11.0                                 | S                     | 43.9                 | 02/00                  | 1016.0                |
| GDIL1 | 29.3N | 090.0W | 0735 | 25.8                  | 28.6                  |                            |                           |                               | 8.5                                  | SE                    | 20.0                 | 10/06                  | 1014.0                |
| GLLN6 | 43.9N | 076.5W | 0739 | 13.9                  |                       |                            |                           |                               | 9.7                                  | SE                    | 38.8                 | 31/16                  | 1012.1                |
| IOSN3 | 43.0N | 070.6W | 0737 | 12.1                  |                       |                            |                           |                               | 12.7                                 | NE                    | 30.2                 | 11/16                  | 1011.9                |
| KTNF1 | 29.8N | 083.6W | 0739 | 24.4                  |                       |                            |                           |                               | 10.2                                 | SW                    | 27.8                 | 04/15                  | 1013.9                |
| LKWF1 | 26.6N | 080.0W | 0734 | 25.5                  | 25.6                  |                            |                           |                               | 8.0                                  | SE                    | 24.4                 | 05/22                  | 1015.0                |
| LONF1 | 24.9N | 080.9W | 0737 | 26.8                  | 28.6                  |                            |                           |                               | 8.3                                  | SE                    | 31.2                 | 01/23                  | 1014.8                |
| LPOI1 | 48.1N | 116.5W | 0735 | 12.3                  | 10.7                  |                            |                           |                               | 6.0                                  | S                     | 24.7                 | 14/00                  |                       |
| MDRM1 | 44.0N | 068.1W | 0732 | 8.6                   |                       |                            |                           |                               |                                      |                       |                      |                        | 1012.5                |
| MISM1 | 43.8N | 068.9W | 0736 | 9.1                   |                       |                            |                           |                               | 13.7                                 | SW                    | 36.0                 | 02/16                  | 1012.1                |
| MLRF1 | 25.0N | 080.4W | 0731 | 26.1                  | 26.3                  |                            |                           |                               | 8.6                                  | SE                    | 26.2                 | 05/02                  | 1015.2                |
| MRKA2 | 61.1N | 146.7W | 1449 | 6.1                   |                       |                            |                           |                               | 6.0                                  | NE                    | 23.9                 | 22/21                  | 1013.1                |
| NWPO3 | 44.6N | 124.1W | 0733 | 11.2                  |                       |                            |                           |                               | 8.0                                  | N                     | 28.8                 | 14/17                  | 1016.1                |
| PILM4 | 48.2N | 088.4W | 0735 | 7.4                   |                       |                            |                           |                               | 11.1                                 | NE                    | 37.5                 | 16/22                  | 1013.4                |
| POTA2 | 61.1N | 146.7W | 1470 | 5.9                   |                       |                            |                           |                               | 7.3                                  | NE                    | 23.7                 | 24/13                  | 1011.8                |
| PTAC1 | 39.0N | 123.7W | 0731 | 11.9                  |                       |                            |                           |                               | 9.7                                  | N                     | 32.6                 | 01/11                  | 1015.4                |
| PTAT2 | 27.8N | 097.1W | 0724 | 24.7                  | 26.2                  |                            |                           |                               | 13.0                                 | SE                    | 24.1                 | 09/09                  | 1011.5                |
| PTGC1 | 34.6N | 120.7W | 0734 | 13.0                  |                       |                            |                           |                               | 15.5                                 | N                     | 29.3                 | 17/13                  | 1016.9                |
| ROAM4 | 47.9N | 089.3W | 0615 | 9.2                   | 4.3                   |                            |                           |                               | 11.9                                 | NE                    | 36.1                 | 16/18                  | 1011.7                |
| SANF1 | 24.5N | 081.9W | 0739 | 26.0                  | 25.9                  |                            |                           |                               | 7.7                                  | E                     | 32.5                 | 05/01                  | 1015.1                |
| SAUF1 | 29.9N | 081.3W | 0737 | 24.6                  | 23.4                  |                            |                           |                               | 7.9                                  | W                     | 22.8                 | 04/18                  | 1014.4                |
| SBOI1 | 41.6N | 082.8W | 0733 | 17.3                  |                       |                            |                           |                               | 8.1                                  | NE                    | 29.0                 | 31/12                  | 1011.2                |
| SGNW3 | 43.8N | 087.7W | 0738 | 13.3                  |                       |                            |                           |                               | 11.0                                 | N                     | 28.1                 | 08/18                  |                       |
| SISW1 | 48.3N | 122.9W | 0730 | 10.9                  |                       |                            |                           |                               | 9.5                                  | SW                    | 32.1                 | 14/17                  | 1014.6                |
| SMKF1 | 24.6N | 081.1W | 0737 | 26.5                  | 27.1                  |                            |                           |                               | 8.4                                  | E                     | 34.3                 | 01/23                  | 1015.3                |
| SPGF1 | 26.7N | 079.0W | 0734 | 25.8                  |                       |                            |                           |                               | 8.4                                  | S                     | 24.7                 | 05/00                  | 1014.6                |
| SRST2 | 29.7N | 094.1W | 0730 | 24.7                  |                       |                            |                           |                               | 11.7                                 | S                     | 21.9                 | 03/13                  | 1013.6                |
| STDM4 | 47.2N | 087.2W | 0738 | 9.4                   |                       |                            |                           |                               | 14.2                                 | SE                    | 33.2                 | 15/03                  | 1012.1                |
| SUPN6 | 44.5N | 075.8W | 0734 | 15.3                  | 11.0                  |                            |                           |                               | 6.9                                  | N                     | 31.9                 | 31/18                  | 1011.5                |
| THIN6 | 44.3N | 076.0W | 0735 | 15.1                  |                       |                            |                           |                               |                                      |                       |                      |                        |                       |
| TPLM2 | 38.9N | 076.4W | 0730 | 18.6                  | 17.7                  |                            |                           |                               | 9.4                                  | S                     | 25.5                 | 10/02                  | 1012.5                |
| TTIW1 | 48.4N | 124.7W | 0739 | 10.3                  |                       |                            |                           |                               | 9.0                                  | SW                    | 38.9                 | 02/07                  | 1015.2                |
| VENF1 | 27.1N | 082.5W | 0501 | 23.6                  | 23.9                  |                            |                           |                               | 8.2                                  | NW                    | 23.7                 | 04/20                  | 1015.5                |
| WPOW1 | 47.7N | 122.4W | 0711 | 11.8                  |                       |                            |                           |                               | 9.5                                  | S                     | 26.3                 | 15/12                  | 1014.9                |

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|       |       |        |      |      |      |     |     |       |      |    |      |       |        |
|-------|-------|--------|------|------|------|-----|-----|-------|------|----|------|-------|--------|
| 41001 | 34.7N | 072.6W | 0709 | 24.3 | 24.9 |     |     |       |      |    |      |       | 1013.0 |
| 41002 | 32.3N | 075.2W | 0711 | 26.6 | 26.8 | 1.1 | 2.6 | 16/04 | 11.0 | SW | 23.5 | 30/23 | 1013.9 |
| 41004 | 32.5N | 079.1W | 0711 | 26.7 |      | 0.8 | 2.0 | 15/18 | 10.6 | SW | 28.8 | 11/00 | 1013.4 |
| 41008 | 31.4N | 080.9W | 0709 | 27.2 | 27.0 | 0.6 | 1.5 | 10/06 | 10.4 | SW | 25.1 | 19/22 | 1014.5 |
| 41009 | 28.5N | 080.2W | 1389 | 27.7 | 27.7 | 0.5 | 1.3 | 08/06 | 9.0  | S  | 18.5 | 17/04 | 1016.1 |
| 41010 | 28.9N | 078.6W | 0683 | 27.0 | 27.5 | 1.0 | 1.9 | 06/18 | 10.6 | SW | 17.9 | 14/04 | 1015.1 |
| 42001 | 25.9N | 089.7W | 0713 | 28.0 |      | 1.0 | 3.4 | 25/14 | 11.7 | SE | 32.3 | 25/10 | 1015.0 |
| 42002 | 25.9N | 093.6W | 0715 | 28.3 | 28.7 | 1.2 | 2.2 | 27/18 | 14.6 | SE | 25.1 | 27/16 | 1013.8 |

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## Buoy Climatological Data Summary

*Continued from Page 88*

| BUOY  | LAT   | LONG   | OBS  | MEAN<br>AIR TP<br>(C) | MEAN<br>SEA TP<br>(C) | MEAN SIG<br>WAVE HT<br>(M) | MAX SIG<br>WAVE HT<br>(M) | MAX SIG<br>WAVE HT<br>(DA/HR) | SCALAR MEAN<br>WIND SPEED<br>(KNOTS) | PREV<br>WIND<br>(DIR) | MAX<br>WIND<br>(KTS) | MAX<br>WIND<br>(DA/HR) | MEAN<br>PRESS<br>(MB) |
|-------|-------|--------|------|-----------------------|-----------------------|----------------------------|---------------------------|-------------------------------|--------------------------------------|-----------------------|----------------------|------------------------|-----------------------|
| 42003 | 25.9N | 085.9W | 0716 | 28.5                  | 29.4                  |                            |                           |                               | 8.2                                  | E                     | 22.0                 | 25/02                  | 1016.0                |
| 42007 | 30.1N | 088.8W | 0710 | 27.5                  | 28.2                  | 0.4                        | 1.4                       | 25/17                         | 10.1                                 | S                     | 28.2                 | 06/05                  | 1015.3                |
| 42019 | 27.9N | 095.4W | 0714 | 27.8                  | 28.0                  | 1.3                        | 2.4                       | 09/09                         | 13.5                                 | SE                    | 24.5                 | 11/07                  | 1012.3                |
| 42020 | 26.9N | 096.7W | 0713 | 27.9                  | 27.6                  | 1.3                        | 2.3                       | 11/08                         | 13.5                                 | SE                    | 23.3                 | 11/08                  | 1011.5                |
| 42035 | 29.3N | 094.4W | 0714 | 28.0                  | 28.4                  | 1.2                        | 2.1                       | 09/09                         | 14.1                                 | S                     | 26.2                 | 28/23                  | 1013.0                |
| 42036 | 28.5N | 084.5W | 0711 | 28.5                  | 29.0                  | 0.6                        | 2.0                       | 09/10                         | 8.1                                  | SW                    | 20.0                 | 06/11                  | 1016.9                |
| 42039 | 28.8N | 086.0W | 0716 | 28.5                  | 29.2                  | 0.6                        | 1.6                       | 06/12                         | 8.3                                  | SW                    | 25.6                 | 06/09                  | 1017.6                |
| 42040 | 29.2N | 088.3W | 0710 | 28.2                  | 29.2                  | 0.8                        | 2.2                       | 25/13                         | 9.7                                  | SW                    | 30.7                 | 25/11                  | 1016.7                |
| 44004 | 38.5N | 070.7W | 0718 | 19.9                  | 20.7                  | 1.3                        | 3.1                       | 14/00                         | 11.1                                 | W                     | 23.3                 | 28/06                  | 1011.5                |
| 44005 | 42.9N | 068.9W | 0716 | 12.1                  | 10.4                  | 1.1                        | 4.1                       | 14/22                         | 9.4                                  | S                     | 31.3                 | 27/20                  | 1010.1                |
| 44007 | 43.5N | 070.2W | 0713 | 13.2                  | 12.0                  | 0.8                        | 4.3                       | 14/16                         | 8.9                                  | S                     | 32.8                 | 14/16                  | 1010.2                |
| 44008 | 40.5N | 069.4W | 0719 | 13.5                  | 11.8                  | 1.2                        | 4.5                       | 14/12                         | 9.4                                  | S                     | 28.4                 | 14/11                  | 1011.3                |
| 44009 | 38.5N | 074.7W | 0708 | 19.4                  | 18.7                  | 0.8                        | 2.1                       | 28/13                         | 9.0                                  | S                     | 32.1                 | 16/03                  | 1011.2                |
| 44011 | 41.1N | 066.6W | 0717 | 12.8                  | 11.1                  | 1.3                        | 3.9                       | 14/22                         |                                      |                       |                      |                        | 1011.8                |
| 44013 | 42.4N | 070.7W | 0714 | 14.2                  | 12.4                  | 0.6                        | 2.7                       | 14/14                         | 8.0                                  | SE                    | 25.1                 | 14/12                  | 1009.4                |
| 44014 | 36.6N | 074.8W | 0715 | 21.4                  | 20.4                  | 0.8                        | 2.2                       | 16/10                         | 7.9                                  | S                     | 18.8                 | 04/02                  | 1011.5                |
| 44025 | 40.3N | 073.2W | 0685 | 17.9                  | 17.3                  | 0.9                        | 2.1                       | 14/10                         | 10.8                                 | S                     | 24.3                 | 03/05                  | 1011.2                |
| 45001 | 48.1N | 087.8W | 0709 | 8.3                   | 5.9                   | 0.5                        | 1.5                       | 03/20                         | 8.6                                  | SW                    | 19.2                 | 02/22                  | 1009.9                |
| 45002 | 45.3N | 086.4W | 0714 | 14.2                  | 13.1                  | 0.5                        | 3.0                       | 01/23                         | 8.5                                  | S                     | 29.0                 | 01/20                  | 1008.9                |
| 45003 | 45.3N | 082.8W | 0706 | 11.9                  | 10.3                  | 0.5                        | 2.1                       | 01/01                         | 8.4                                  | W                     | 24.9                 | 01/01                  | 1009.7                |
| 45004 | 47.6N | 086.6W | 0714 | 8.7                   | 6.6                   | 0.4                        | 1.7                       | 12/14                         | 8.4                                  | W                     | 23.7                 | 12/14                  | 1010.6                |
| 45005 | 41.7N | 082.4W | 0714 | 19.5                  | 19.7                  | 0.4                        | 1.4                       | 05/08                         | 9.0                                  | S                     | 25.6                 | 26/09                  | 1010.4                |
| 45007 | 42.7N | 087.0W | 0713 | 15.4                  | 14.2                  | 0.4                        | 2.1                       | 02/21                         | 7.7                                  | S                     | 27.6                 | 02/17                  | 1011.2                |
| 45008 | 44.3N | 082.4W | 0563 | 12.1                  | 10.7                  | 0.5                        | 2.2                       | 02/22                         | 7.6                                  | NW                    | 29.5                 | 02/20                  | 1010.7                |
| 46001 | 56.3N | 148.2W | 0708 | 8.3                   | 8.7                   | 2.1                        | 5.2                       | 08/16                         | 13.6                                 | W                     | 27.0                 | 20/21                  | 1017.2                |
| 46002 | 42.5N | 130.3W | 0711 | 12.4                  | 13.5                  | 2.1                        | 3.8                       | 12/05                         | 14.6                                 | NW                    | 24.5                 | 11/15                  | 1022.5                |
| 46003 | 51.9N | 155.9W | 0646 | 7.1                   | 6.8                   | 2.1                        | 7.9                       | 07/19                         | 14.2                                 | SW                    | 54.6                 | 07/16                  | 1017.5                |
| 46005 | 46.1N | 131.0W | 0710 | 11.3                  | 12.2                  | 2.0                        | 3.9                       | 25/10                         | 14.0                                 | NW                    | 23.3                 | 24/14                  | 1023.1                |
| 46006 | 40.9N | 137.5W | 0524 | 12.9                  | 13.9                  | 1.6                        | 2.8                       | 25/02                         | 11.4                                 | N                     | 19.2                 | 24/16                  | 1028.5                |
| 46011 | 34.9N | 120.9W | 0719 | 14.3                  | 14.3                  | 1.7                        | 3.7                       | 16/23                         | 9.2                                  | NW                    | 24.9                 | 30/21                  | 1015.5                |
| 46012 | 37.4N | 122.7W | 0310 | 13.3                  | 14.5                  | 1.7                        | 2.6                       | 26/20                         | 9.7                                  | NW                    | 19.4                 | 30/07                  | 1015.4                |
| 46013 | 38.2N | 123.3W | 0704 | 12.7                  | 12.3                  | 1.9                        | 4.4                       | 16/17                         | 11.7                                 | NW                    | 31.1                 | 16/15                  | 1015.4                |
| 46014 | 39.2N | 124.0W | 0719 | 12.6                  | 12.4                  | 2.1                        | 4.3                       | 16/22                         | 11.8                                 | NW                    | 30.9                 | 16/17                  | 1015.0                |
| 46023 | 34.7N | 121.0W | 0701 | 14.3                  | 14.4                  | 1.7                        | 3.6                       | 17/06                         | 10.9                                 | NW                    | 29.1                 | 30/22                  | 1015.9                |
| 46025 | 33.8N | 119.1W | 0703 | 16.5                  | 18.1                  | 1.0                        | 2.0                       | 03/09                         | 7.0                                  | W                     | 22.0                 | 03/05                  | 1015.0                |
| 46027 | 41.9N | 124.4W | 0019 | 11.1                  | 10.5                  | 1.0                        | 1.1                       | 30/21                         | 6.1                                  | NW                    | 8.0                  | 30/09                  | 1020.3                |
| 46029 | 46.1N | 124.5W | 0716 | 12.9                  | 14.1                  | 1.8                        | 3.7                       | 12/18                         | 9.7                                  | NW                    | 21.2                 | 16/05                  | 1017.6                |
| 46035 | 56.9N | 177.8W | 0699 | 4.1                   | 4.5                   | 1.4                        | 4.5                       | 06/01                         | 12.2                                 | N                     | 31.9                 | 05/19                  | 1009.0                |
| 46041 | 47.4N | 124.5W | 0484 | 12.5                  | 12.9                  | 1.7                        | 3.4                       | 12/13                         | 8.1                                  | NW                    | 21.0                 | 15/12                  | 1018.1                |
| 46042 | 36.8N | 122.4W | 0310 | 13.6                  | 14.4                  | 2.1                        | 3.4                       | 17/23                         | 11.5                                 | NW                    | 22.0                 | 27/02                  | 1015.8                |
| 46045 | 33.8N | 118.5W | 0719 | 16.6                  | 17.6                  | 0.8                        | 1.5                       | 03/04                         | 5.8                                  | SW                    | 12.8                 | 03/01                  | 1014.2                |
| 46050 | 44.6N | 124.5W | 0716 | 13.6                  | 13.4                  | 1.9                        | 4.2                       | 12/21                         | 10.7                                 | N                     | 22.2                 | 28/06                  | 1018.1                |
| 46053 | 34.2N | 119.9W | 0716 | 15.0                  | 15.5                  | 0.9                        | 1.9                       | 29/01                         | 9.9                                  | W                     | 24.3                 | 02/22                  | 1014.6                |
| 46054 | 34.3N | 120.5W | 0719 | 14.5                  | 13.9                  | 1.5                        | 3.3                       | 30/23                         | 13.7                                 | NW                    | 30.7                 | 30/09                  | 1014.7                |
| 46059 | 38.0N | 130.0W | 0717 |                       | 14.5                  | 2.1                        | 4.1                       | 12/23                         | 15.2                                 | N                     | 25.1                 | 11/14                  |                       |
| 46060 | 60.6N | 146.8W | 1366 | 10.5                  | 10.8                  | 0.5                        | 1.3                       | 08/21                         | 7.4                                  | E                     | 22.9                 | 08/03                  | 1017.8                |
| 46061 | 60.2N | 146.8W | 1429 | 10.4                  | 10.5                  | 1.0                        | 3.4                       | 21/11                         | 7.6                                  | E                     | 27.2                 | 21/10                  | 1017.7                |
| 46062 | 35.1N | 121.0W | 0705 | 14.4                  | 14.7                  | 1.7                        | 4.3                       | 17/00                         | 10.6                                 | NW                    | 27.2                 | 30/20                  | 1015.0                |
| 46063 | 34.3N | 120.7W | 0709 | 14.2                  | 14.0                  | 1.8                        | 3.4                       | 17/07                         | 12.4                                 | NW                    | 27.2                 | 30/07                  | 1014.8                |
| 51001 | 23.4N | 162.3W | 0717 | 23.8                  | 24.7                  | 1.9                        | 3.5                       | 23/02                         | 14.6                                 | E                     | 22.0                 | 22/19                  | 1019.6                |
| 51002 | 17.2N | 157.8W | 0717 | 24.6                  | 25.4                  | 2.1                        | 3.1                       | 25/10                         | 15.5                                 | NE                    | 23.3                 | 24/10                  | 1016.7                |
| 51003 | 19.1N | 160.8W | 0718 | 24.9                  | 25.7                  | 2.0                        | 3.0                       | 24/11                         | 11.7                                 | NE                    | 19.2                 | 22/20                  | 1016.3                |
| 51004 | 17.4N | 152.5W | 0715 | 24.4                  | 25.0                  | 2.1                        | 3.2                       | 24/15                         | 14.8                                 | E                     | 23.0                 | 22/21                  | 1017.4                |
| 51028 | 0.0N  | 153.9W | 0705 | 25.0                  | 25.2                  | 1.8                        | 3.5                       | 11/00                         | 10.2                                 | E                     | 16.7                 | 09/09                  | 1011.3                |
| 91328 | 8.6N  | 149.7E | 0452 | 28.3                  |                       |                            |                           |                               | 7.2                                  | NE                    | 13.6                 | 03/19                  | 1009.6                |
| 91343 | 7.6N  | 155.2E | 0714 | 28.3                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1009.4                |
| 91352 | 6.2N  | 160.7E | 0403 | 27.8                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1011.7                |
| 91374 | 8.7N  | 171.2E | 0714 | 28.0                  |                       |                            |                           |                               | 6.5                                  | NE                    | 16.4                 | 25/09                  | 1010.7                |
| 91377 | 6.1N  | 172.1E | 0437 | 28.0                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1012.9                |
| 91411 | 8.3N  | 137.5E | 0239 | 28.2                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1009.6                |
| ABAN6 | 44.3N | 075.9W | 0710 | 18.1                  | 16.2                  |                            |                           |                               | 3.6                                  | S                     | 15.9                 | 02/15                  | 1009.7                |
| ALSN6 | 40.5N | 073.8W | 0713 | 18.7                  |                       | 0.7                        | 2.0                       | 15/01                         | 14.3                                 | W                     | 35.2                 | 01/00                  | 1010.9                |
| BLIA2 | 60.8N | 146.9W | 1427 | 10.2                  |                       |                            |                           |                               | 5.9                                  | NW                    | 19.9                 | 21/15                  | 1018.3                |
| BURL1 | 28.9N | 089.4W | 0708 | 28.1                  |                       |                            |                           |                               | 11.8                                 | S                     | 30.7                 | 27/12                  | 1015.6                |
| BUZM3 | 41.4N | 071.0W | 0709 | 15.8                  |                       | 0.4                        | 1.9                       | 01/01                         | 13.6                                 | S                     | 33.7                 | 27/21                  | 1011.5                |
| CARO3 | 43.3N | 124.4W | 0711 | 12.3                  |                       |                            |                           |                               | 8.0                                  | N                     | 21.8                 | 24/20                  | 1018.6                |
| CDRF1 | 29.1N | 083.0W | 0711 | 28.3                  |                       |                            |                           |                               | 8.2                                  | W                     | 22.0                 | 24/01                  | 1016.4                |
| CHLV2 | 36.9N | 075.7W | 0712 | 22.9                  | 21.2                  | 0.6                        | 1.7                       | 28/18                         | 11.4                                 | S                     | 30.2                 | 17/00                  | 1012.3                |
| CLKN7 | 34.6N | 076.5W | 0712 | 25.5                  |                       |                            |                           |                               | 9.7                                  | SW                    | 33.5                 | 14/01                  | 1014.1                |

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## Buoy Climatological Data Summary

*Continued from Page 89*

| BUOY  | LAT   | LONG   | OBS  | MEAN<br>AIR TP<br>(C) | MEAN<br>SEA TP<br>(C) | MEAN SIG<br>WAVE HT<br>(M) | MAX SIG<br>WAVE HT<br>(M) | MAX SIG<br>WAVE HT<br>(DA/HR) | SCALAR MEAN<br>WIND SPEED<br>(KNOTS) | PREV<br>WIND<br>(DIR) | MAX<br>WIND<br>(KTS) | MAX<br>WIND<br>(DA/HR) | MEAN<br>PRESS<br>(MB) |
|-------|-------|--------|------|-----------------------|-----------------------|----------------------------|---------------------------|-------------------------------|--------------------------------------|-----------------------|----------------------|------------------------|-----------------------|
| CSBF1 | 29.7N | 085.4W | 0713 | 27.3                  |                       |                            |                           |                               | 7.4                                  | W                     | 25.0                 | 06/10                  | 1016.8                |
| DBLN6 | 42.5N | 079.4W | 0707 | 18.4                  |                       |                            |                           |                               | 9.2                                  | SW                    | 29.6                 | 26/20                  | 1010.9                |
| DESW1 | 47.7N | 124.5W | 0704 | 12.5                  |                       |                            |                           |                               | 7.6                                  | NW                    | 25.1                 | 15/14                  | 1017.1                |
| DISW3 | 47.1N | 090.7W | 0708 | 12.9                  |                       |                            |                           |                               | 9.2                                  | SW                    | 42.8                 | 25/11                  | 1009.8                |
| DPIA1 | 30.3N | 088.1W | 0712 | 27.7                  | 29.3                  |                            |                           |                               | 8.7                                  | SW                    | 29.6                 | 06/06                  | 1016.2                |
| DRYF1 | 24.6N | 082.9W | 0697 | 29.1                  | 28.9                  |                            |                           |                               | 5.9                                  | E                     | 16.1                 | 23/03                  | 1015.8                |
| DSL7N | 35.2N | 075.3W | 0715 | 25.0                  |                       | 0.7                        | 1.3                       | 14/14                         | 12.2                                 | SW                    | 37.4                 | 19/20                  | 1011.9                |
| DUCN7 | 36.2N | 075.8W | 0709 | 24.2                  |                       | 0.4                        | 1.3                       | 28/22                         | 10.0                                 | SW                    | 30.5                 | 16/03                  | 1013.8                |
| FBIS1 | 32.7N | 079.9W | 0714 | 26.9                  |                       |                            |                           |                               | 7.9                                  | SW                    | 25.2                 | 10/18                  | 1014.5                |
| FFIA2 | 57.3N | 133.6W | 0717 | 12.3                  |                       |                            |                           |                               | 6.3                                  | SW                    | 20.8                 | 14/22                  | 1017.3                |
| FPSN7 | 33.5N | 077.6W | 0705 | 26.2                  |                       | 0.9                        | 2.4                       | 15/23                         | 13.1                                 | SW                    | 38.7                 | 20/00                  | 1012.4                |
| FWYF1 | 25.6N | 080.1W | 0700 | 28.9                  | 29.2                  |                            |                           |                               | 9.6                                  | E                     | 27.3                 | 23/09                  | 1017.9                |
| GDIL1 | 29.3N | 090.0W | 0712 | 28.4                  | 30.9                  |                            |                           |                               | 9.7                                  | S                     | 24.7                 | 25/17                  | 1016.0                |
| GLLN6 | 43.9N | 076.5W | 0713 | 17.0                  |                       |                            |                           |                               | 12.4                                 | W                     | 34.0                 | 03/19                  | 1009.7                |
| IOSN3 | 43.0N | 070.6W | 0711 | 14.3                  |                       |                            |                           |                               | 12.0                                 | SE                    | 34.7                 | 05/00                  | 1009.6                |
| KTNF1 | 29.8N | 083.6W | 0704 | 27.4                  |                       |                            |                           |                               | 10.7                                 | SW                    | 28.6                 | 06/11                  | 1015.9                |
| LKWF1 | 26.6N | 080.0W | 0709 | 28.0                  | 28.3                  |                            |                           |                               | 7.7                                  | SE                    | 20.8                 | 30/21                  | 1016.8                |
| LONF1 | 24.9N | 080.9W | 0175 | 29.1                  | 31.6                  |                            |                           |                               | 6.5                                  | NW                    | 13.3                 | 02/01                  | 1015.3                |
| LPOI1 | 48.1N | 116.5W | 0410 | 15.4                  | 13.7                  |                            |                           |                               | 6.7                                  | S                     | 20.8                 | 15/04                  | 1013.3                |
| MDRM1 | 44.0N | 068.1W | 0709 | 11.1                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1010.2                |
| MISM1 | 43.8N | 068.9W | 0714 | 11.3                  |                       |                            |                           |                               | 13.7                                 | S                     | 38.9                 | 14/18                  | 1009.7                |
| MLRF1 | 25.0N | 080.4W | 0710 | 28.9                  | 29.4                  |                            |                           |                               | 7.7                                  | SE                    | 21.2                 | 09/05                  | 1017.1                |
| MRKA2 | 61.1N | 146.7W | 1418 | 10.0                  |                       |                            |                           |                               | 7.6                                  | NE                    | 20.9                 | 25/00                  | 1018.6                |
| NWPO3 | 44.6N | 124.1W | 0716 | 12.1                  |                       |                            |                           |                               | 7.4                                  | N                     | 25.6                 | 01/02                  | 1018.7                |
| PILM4 | 48.2N | 088.4W | 0697 | 10.7                  |                       |                            |                           |                               | 11.3                                 | W                     | 31.0                 | 21/23                  | 1011.2                |
| POTA2 | 61.1N | 146.7W | 1416 | 10.1                  |                       |                            |                           |                               | 6.7                                  | NE                    | 20.5                 | 21/16                  | 1017.7                |
| PTAC1 | 39.0N | 123.7W | 0712 | 12.6                  |                       |                            |                           |                               | 9.0                                  | N                     | 28.5                 | 16/10                  | 1015.1                |
| PTAT2 | 27.8N | 097.1W | 0702 |                       | 29.4                  |                            |                           |                               | 16.3                                 | SE                    | 33.0                 | 16/01                  | 1012.0                |
| PTGC1 | 34.6N | 120.7W | 0711 | 13.7                  |                       |                            |                           |                               | 14.3                                 | N                     | 31.7                 | 30/09                  | 1016.3                |
| ROAM4 | 47.9N | 089.3W | 0661 | 12.5                  | 7.9                   |                            |                           |                               | 11.1                                 | NE                    | 32.2                 | 19/06                  | 1009.8                |
| SANF1 | 24.5N | 081.9W | 0715 | 28.9                  | 29.3                  |                            |                           |                               | 7.1                                  | E                     | 21.5                 | 10/05                  | 1016.9                |
| SAUF1 | 29.9N | 081.3W | 0711 | 28.0                  | 25.8                  |                            |                           |                               | 8.7                                  | W                     | 27.7                 | 20/01                  | 1016.0                |
| SBOI1 | 41.6N | 082.8W | 0700 | 20.5                  |                       |                            |                           |                               | 9.6                                  | NW                    | 47.0                 | 12/23                  | 1010.5                |
| SGNW3 | 43.8N | 087.7W | 0714 | 16.6                  |                       |                            |                           |                               | 9.1                                  | S                     | 31.1                 | 02/16                  | 1010.0                |
| SISW1 | 48.3N | 122.9W | 0713 | 12.0                  |                       |                            |                           |                               | 9.4                                  | W                     | 38.0                 | 16/01                  | 1016.7                |
| SMKF1 | 24.6N | 081.1W | 0717 | 29.4                  | 30.3                  |                            |                           |                               | 7.6                                  | E                     | 20.9                 | 23/12                  | 1017.1                |
| SPGF1 | 26.7N | 079.0W | 0712 | 28.4                  |                       |                            |                           |                               | 7.9                                  | SW                    | 20.1                 | 26/22                  | 1016.4                |
| SRST2 | 29.7N | 094.1W | 0710 | 27.9                  |                       |                            |                           |                               | 14.9                                 | S                     | 29.5                 | 16/03                  | 1014.6                |
| STDM4 | 47.2N | 087.2W | 0715 | 12.4                  |                       |                            |                           |                               | 13.2                                 | NW                    | 30.7                 | 12/11                  | 1009.9                |
| SUPN6 | 44.5N | 075.8W | 0698 | 17.9                  | 16.7                  |                            |                           |                               | 7.8                                  | SW                    | 27.3                 | 03/18                  | 1009.0                |
| THIN6 | 44.3N | 076.0W | 0706 | 17.9                  |                       |                            |                           |                               |                                      |                       |                      |                        |                       |
| TPLM2 | 38.9N | 076.4W | 0711 | 21.8                  | 21.7                  |                            |                           |                               | 9.5                                  | S                     | 26.3                 | 02/19                  | 1012.4                |
| TTIW1 | 48.4N | 124.7W | 0705 | 11.4                  |                       |                            |                           |                               | 9.8                                  | S                     | 28.9                 | 22/20                  | 1017.6                |
| VENF1 | 27.1N | 082.5W | 0580 | 28.0                  | 28.6                  |                            |                           |                               | 7.1                                  | NW                    | 18.6                 | 25/00                  | 1017.9                |
| WPOW1 | 47.7N | 122.4W | 0687 | 13.7                  |                       |                            |                           |                               | 8.5                                  | S                     | 23.9                 | 24/18                  | 1016.7                |

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|       |       |        |      |      |      |     |     |       |      |    |      |       |        |
|-------|-------|--------|------|------|------|-----|-----|-------|------|----|------|-------|--------|
| 41001 | 34.7N | 072.6W | 0714 | 26.4 | 26.7 | 1.6 | 3.6 | 18/00 | 13.0 | SW | 23.9 | 17/23 | 1016.0 |
| 41002 | 32.3N | 075.2W | 0734 | 27.7 | 28.1 | 1.5 | 2.9 | 01/06 | 12.6 | SW | 25.5 | 01/04 | 1016.3 |
| 41004 | 32.5N | 079.1W | 0732 | 27.9 |      | 1.1 | 2.2 | 01/05 | 12.7 | SW | 24.5 | 01/04 | 1014.8 |
| 41008 | 31.4N | 080.9W | 0733 | 28.0 | 28.5 | 0.8 | 1.8 | 13/02 | 12.2 | SW | 33.0 | 23/23 | 1015.4 |
| 41009 | 28.5N | 080.2W | 1465 | 27.9 | 28.2 | 0.6 | 1.4 | 15/01 | 8.8  | SW | 21.6 | 07/22 | 1016.9 |
| 41010 | 28.9N | 078.6W | 0778 | 29.1 | 29.7 | 1.0 | 1.6 | 15/17 | 9.0  | S  | 20.0 | 22/14 | 1017.6 |
| 42001 | 25.9N | 089.7W | 0740 | 29.2 |      | 0.6 | 3.3 | 02/08 | 8.1  | E  | 30.1 | 02/07 | 1016.4 |
| 42002 | 25.9N | 093.6W | 0740 | 29.2 | 30.0 | 0.8 | 3.0 | 03/09 | 10.3 | SE | 34.4 | 03/08 | 1016.3 |
| 42003 | 25.9N | 085.9W | 0731 | 29.1 | 30.1 | 0.6 | 1.0 | 24/14 | 7.3  | E  | 28.4 | 11/21 | 1016.8 |
| 42007 | 30.1N | 088.8W | 0736 | 28.8 | 29.5 | 0.3 | 0.9 | 10/12 | 8.6  | SW | 25.5 | 10/21 | 1016.1 |
| 42019 | 27.9N | 095.4W | 0735 | 28.8 | 29.3 | 0.8 | 2.8 | 03/17 |      |    |      |       | 1015.4 |
| 42020 | 26.9N | 096.7W | 0740 | 28.8 | 29.0 | 1.0 | 2.3 | 03/20 | 12.1 | SE | 20.8 | 03/06 | 1014.7 |
| 42035 | 29.3N | 094.4W | 0742 | 29.2 | 29.6 | 0.7 | 2.3 | 03/14 | 10.6 | S  | 24.5 | 03/13 | 1015.5 |
| 42036 | 28.5N | 084.5W | 0735 | 29.0 | 29.7 | 0.5 | 1.8 | 11/03 | 7.6  | SW | 24.5 | 10/12 | 1017.4 |
| 42039 | 28.8N | 086.0W | 0735 | 29.3 | 30.4 | 0.5 | 1.9 | 10/22 | 7.8  | W  | 23.5 | 12/21 | 1018.1 |
| 42040 | 29.2N | 088.3W | 0738 | 29.0 | 30.2 | 0.4 | 1.7 | 03/01 | 7.9  | W  | 27.4 | 14/18 | 1017.5 |
| 44004 | 38.5N | 070.7W | 0740 | 22.7 | 22.7 | 1.1 | 3.0 | 01/06 | 8.8  | SW | 24.9 | 31/21 | 1015.1 |
| 44005 | 42.9N | 068.9W | 0735 | 18.2 | 17.3 | 1.0 | 2.4 | 29/16 | 9.2  | S  | 22.5 | 23/20 | 1012.1 |
| 44007 | 43.5N | 070.2W | 0738 | 17.5 | 15.6 | 0.7 | 1.5 | 28/02 | 7.5  | S  | 19.2 | 28/01 | 1012.2 |
| 44008 | 40.5N | 069.4W | 0744 | 17.5 | 15.9 | 1.0 | 2.5 | 01/01 | 7.4  | S  | 22.9 | 31/18 | 1014.2 |

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| BUOY  | LAT   | LONG   | OBS  | MEAN<br>AIR TP<br>(C) | MEAN<br>SEA TP<br>(C) | MEAN SIG<br>WAVE HT<br>(M) | MAX SIG<br>WAVE HT<br>(M) | MAX SIG<br>WAVE HT<br>(DA/HR) | SCALAR MEAN<br>WIND SPEED<br>(KNOTS) | PREV<br>WIND<br>(DIR) | MAX<br>WIND<br>(KTS) | MAX<br>WIND<br>(DA/HR) | MEAN<br>PRESS<br>(MB) |
|-------|-------|--------|------|-----------------------|-----------------------|----------------------------|---------------------------|-------------------------------|--------------------------------------|-----------------------|----------------------|------------------------|-----------------------|
| 44009 | 38.5N | 074.7W | 0732 | 23.2                  | 22.7                  | 0.8                        | 2.4                       | 31/16                         | 7.6                                  | S                     | 24.3                 | 31/15                  | 1014.3                |
| 44011 | 41.1N | 066.6W | 0731 | 16.2                  | 14.8                  | 1.1                        | 3.6                       | 01/04                         | 6.7                                  | S                     | 22.0                 | 31/21                  | 1014.3                |
| 44013 | 42.4N | 070.7W | 0735 | 19.1                  | 17.2                  | 0.4                        | 0.9                       | 05/21                         | 7.2                                  | S                     | 19.6                 | 01/22                  | 1011.9                |
| 44014 | 36.6N | 074.8W | 0737 | 25.1                  | 25.0                  | 0.9                        | 2.1                       | 31/22                         | 9.6                                  | SW                    | 25.6                 | 26/14                  | 1014.2                |
| 44025 | 40.3N | 073.2W | 0738 | 22.5                  | 22.1                  | 0.8                        | 1.8                       | 01/09                         | 8.8                                  | S                     | 22.7                 | 31/07                  | 1014.5                |
| 45001 | 48.1N | 087.8W | 0726 | 16.3                  | 15.4                  | 0.6                        | 2.4                       | 21/19                         | 9.4                                  | SW                    | 26.4                 | 21/18                  | 1013.1                |
| 45002 | 45.3N | 086.4W | 0727 | 19.6                  | 19.4                  | 0.6                        | 2.1                       | 27/06                         | 9.5                                  | S                     | 25.6                 | 27/06                  | 1013.4                |
| 45003 | 45.3N | 082.8W | 0729 | 18.6                  | 18.3                  | 0.5                        | 2.0                       | 23/21                         | 9.4                                  | W                     | 25.1                 | 23/20                  | 1013.7                |
| 45004 | 47.6N | 086.6W | 0742 | 16.5                  | 15.6                  | 0.6                        | 2.7                       | 21/21                         | 8.9                                  | W                     | 25.8                 | 21/20                  | 1013.9                |
| 45005 | 41.7N | 082.4W | 0740 | 22.9                  | 23.7                  | 0.4                        | 1.6                       | 22/13                         | 9.1                                  | SW                    | 28.6                 | 22/04                  | 1014.4                |
| 45006 | 47.3N | 089.9W | 0741 | 17.0                  | 18.2                  | 0.5                        | 2.5                       | 15/06                         | 9.2                                  | W                     | 22.7                 | 15/03                  | 1018.5                |
| 45007 | 42.7N | 087.0W | 0736 | 21.7                  | 21.9                  | 0.5                        | 1.7                       | 04/18                         | 8.7                                  | N                     | 30.7                 | 21/19                  | 1015.7                |
| 45008 | 44.3N | 082.4W | 0221 | 19.7                  | 19.8                  | 0.5                        | 1.9                       | 24/00                         | 9.2                                  | NW                    | 22.5                 | 27/10                  | 1014.4                |
| 46001 | 56.3N | 148.2W | 0728 | 11.4                  | 12.1                  | 1.3                        | 2.6                       | 20/09                         | 9.3                                  | SW                    | 24.3                 | 20/07                  | 1013.3                |
| 46002 | 42.5N | 130.3W | 0728 | 15.1                  | 15.6                  | 1.7                        | 2.7                       | 03/07                         | 12.6                                 | NE                    | 22.3                 | 14/11                  | 1020.2                |
| 46003 | 51.9N | 155.9W | 0712 | 9.4                   | 9.4                   | 1.6                        | 4.0                       | 17/07                         | 12.1                                 | W                     | 28.2                 | 16/06                  | 1014.1                |
| 46005 | 46.1N | 131.0W | 0727 | 14.1                  | 14.3                  | 1.7                        | 3.7                       | 16/19                         | 11.9                                 | NW                    | 26.2                 | 14/19                  | 1020.1                |
| 46006 | 40.9N | 137.5W | 0514 | 16.5                  | 17.2                  | 1.6                        | 3.3                       | 14/09                         | 11.1                                 | N                     | 24.5                 | 15/23                  | 1021.7                |
| 46011 | 34.9N | 120.9W | 0737 | 14.6                  | 15.5                  | 1.7                        | 3.4                       | 02/04                         | 11.2                                 | NW                    | 25.8                 | 01/18                  | 1014.2                |
| 46012 | 37.4N | 122.7W | 0727 | 13.4                  | 13.5                  | 1.5                        | 3.1                       | 03/13                         | 8.9                                  | NW                    | 21.4                 | 02/02                  | 1015.0                |
| 46013 | 38.2N | 123.3W | 0734 | 12.3                  | 11.3                  | 1.8                        | 3.6                       | 19/09                         | 13.7                                 | NW                    | 30.7                 | 04/01                  | 1015.0                |
| 46014 | 39.2N | 124.0W | 0741 | 12.7                  | 12.5                  | 1.7                        | 3.3                       | 03/09                         | 11.4                                 | NW                    | 27.2                 | 04/03                  | 1015.1                |
| 46022 | 40.7N | 124.5W | 0736 | 12.7                  | 12.2                  | 1.5                        | 3.1                       | 24/07                         | 8.6                                  | N                     | 24.5                 | 05/10                  | 1017.0                |
| 46023 | 34.7N | 121.0W | 0730 | 14.5                  | 15.4                  | 1.8                        | 3.8                       | 02/02                         | 13.3                                 | NW                    | 29.1                 | 27/20                  | 1014.7                |
| 46025 | 33.8N | 119.1W | 0728 | 17.8                  | 19.4                  | 1.1                        | 2.0                       | 02/05                         | 5.9                                  | W                     | 15.7                 | 26/02                  | 1013.6                |
| 46027 | 41.9N | 124.4W | 0735 | 12.1                  | 11.5                  | 1.5                        | 3.3                       | 03/02                         | 6.6                                  | NW                    | 29.9                 | 05/23                  | 1016.6                |
| 46029 | 46.1N | 124.5W | 0736 | 14.7                  | 15.3                  | 1.3                        | 2.7                       | 14/19                         | 9.3                                  | NW                    | 24.3                 | 14/18                  | 1017.5                |
| 46030 | 40.4N | 124.5W | 0721 | 11.6                  | 10.3                  | 1.6                        | 3.2                       | 24/10                         | 12.3                                 | N                     | 22.7                 | 02/14                  | 1017.1                |
| 46035 | 56.9N | 177.8W | 0708 | 7.1                   | 7.6                   | 1.2                        | 3.9                       | 31/04                         | 11.5                                 | SE                    | 27.8                 | 21/17                  | 1012.5                |
| 46041 | 47.4N | 124.5W | 0732 | 13.8                  | 13.8                  | 1.2                        | 2.8                       | 14/22                         | 7.8                                  | NW                    | 24.1                 | 14/18                  | 1017.6                |
| 46042 | 36.8N | 122.4W | 0736 | 13.6                  | 13.7                  | 1.7                        | 3.3                       | 03/12                         | 11.9                                 | NW                    | 27.8                 | 16/22                  | 1015.2                |
| 46045 | 33.8N | 118.5W | 0738 | 18.6                  | 20.5                  | 0.8                        | 1.6                       | 02/05                         | 5.5                                  | SW                    | 12.8                 | 05/00                  | 1012.8                |
| 46050 | 44.6N | 124.5W | 0740 | 15.1                  | 15.1                  | 1.5                        | 3.1                       | 21/02                         | 9.9                                  | N                     | 22.3                 | 20/18                  | 1017.7                |
| 46053 | 34.2N | 119.9W | 0735 | 16.9                  | 18.0                  | 1.0                        | 2.2                       | 02/03                         | 8.9                                  | W                     | 22.7                 | 29/05                  | 1013.2                |
| 46054 | 34.3N | 120.5W | 0736 | 15.8                  | 16.2                  | 1.8                        | 3.5                       | 02/03                         | 15.7                                 | NW                    | 31.1                 | 02/09                  | 1013.1                |
| 46059 | 38.0N | 130.0W | 0732 |                       | 16.6                  | 1.7                        | 2.9                       | 03/12                         | 12.6                                 | NW                    | 22.0                 | 02/16                  |                       |
| 46060 | 60.6N | 146.8W | 1463 | 13.0                  | 13.6                  | 0.3                        | 1.0                       | 05/17                         | 7.4                                  | E                     | 22.3                 | 22/15                  | 1015.8                |
| 46061 | 60.2N | 146.8W | 1472 | 12.7                  | 13.5                  | 0.8                        | 2.8                       | 22/01                         | 9.0                                  | E                     | 27.0                 | 11/14                  | 1015.2                |
| 46062 | 35.1N | 121.0W | 0712 | 14.3                  | 15.3                  | 1.7                        | 3.3                       | 02/01                         | 12.6                                 | NW                    | 29.0                 | 02/02                  | 1013.8                |
| 46063 | 34.3N | 120.7W | 0730 | 14.9                  | 15.6                  | 1.9                        | 3.7                       | 02/02                         | 15.1                                 | NW                    | 30.7                 | 01/14                  | 1013.3                |
| 51001 | 23.4N | 162.3W | 0741 | 24.4                  | 25.2                  |                            |                           |                               | 14.9                                 | E                     | 24.1                 | 08/14                  | 1020.1                |
| 51002 | 17.2N | 157.8W | 0739 | 25.1                  | 25.8                  | 2.1                        | 3.0                       | 06/22                         | 15.8                                 | SE                    | 21.6                 | 14/21                  | 1016.7                |
| 51003 | 19.1N | 160.8W | 0740 | 25.4                  | 26.1                  | 1.9                        | 3.1                       | 07/16                         | 13.1                                 | NE                    | 21.2                 | 08/16                  | 1017.3                |
| 51004 | 17.4N | 152.5W | 0739 | 24.9                  | 25.7                  | 2.0                        | 2.7                       | 12/17                         | 14.8                                 | NE                    | 21.3                 | 13/04                  | 1017.0                |
| 51028 | 0.0N  | 153.9W | 0719 | 23.9                  | 23.7                  | 1.7                        | 2.8                       | 10/04                         | 10.2                                 | NE                    | 17.9                 | 12/13                  | 1012.0                |
| 91328 | 8.6N  | 149.7E | 0501 | 28.3                  |                       |                            |                           |                               | 4.8                                  | NE                    | 11.6                 | 05/18                  | 1009.7                |
| 91343 | 7.6N  | 155.2E | 0622 | 28.2                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1009.7                |
| 91352 | 6.2N  | 160.7E | 0470 | 27.8                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1012.2                |
| 91374 | 8.7N  | 171.2E | 0734 | 27.4                  |                       |                            |                           |                               | 5.5                                  | NE                    | 15.1                 | 14/02                  | 1010.9                |
| 91377 | 6.1N  | 172.1E | 0441 | 27.9                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1013.4                |
| 91411 | 8.3N  | 137.5E | 0356 | 28.5                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1009.3                |
| ABAN6 | 44.3N | 075.9W | 0741 | 20.8                  | 20.9                  |                            |                           |                               | 3.5                                  | S                     | 13.1                 | 21/19                  | 1013.3                |
| ALSN6 | 40.5N | 073.8W | 0737 | 22.8                  |                       | 0.6                        | 1.8                       | 28/00                         | 13.2                                 | S                     | 30.9                 | 29/00                  | 1014.1                |
| BLIA2 | 60.8N | 146.9W | 1463 | 12.3                  |                       |                            |                           |                               | 6.0                                  | NW                    | 24.0                 | 25/15                  | 1016.4                |
| BURL1 | 28.9N | 089.4W | 0723 | 29.3                  |                       |                            |                           |                               | 8.9                                  | W                     | 24.7                 | 14/18                  | 1016.6                |
| BUZM3 | 41.4N | 071.0W | 0727 | 20.3                  |                       | 0.4                        | 1.2                       | 01/11                         | 11.3                                 | SW                    | 24.8                 | 02/00                  | 1014.4                |
| CARO3 | 43.3N | 124.4W | 0729 | 13.3                  |                       |                            |                           |                               | 6.8                                  | N                     | 28.6                 | 14/21                  | 1018.2                |
| CDRF1 | 29.1N | 083.0W | 0740 | 28.8                  |                       |                            |                           |                               | 7.2                                  | W                     | 16.9                 | 22/00                  | 1016.9                |
| CHLV2 | 36.9N | 075.7W | 0739 | 25.1                  | 24.2                  | 0.7                        | 1.5                       | 26/16                         | 10.0                                 | SW                    | 27.7                 | 31/18                  | 1015.3                |
| CLKN7 | 34.6N | 076.5W | 0737 | 27.1                  |                       |                            |                           |                               | 10.9                                 | SW                    | 24.9                 | 18/02                  | 1016.6                |
| CSBF1 | 29.7N | 085.4W | 0724 | 27.6                  |                       |                            |                           |                               | 6.1                                  | W                     | 22.3                 | 31/14                  | 1017.3                |
| DBLN6 | 42.5N | 079.4W | 0730 | 21.8                  |                       |                            |                           |                               | 8.4                                  | SW                    | 33.1                 | 21/19                  | 1014.8                |
| DESW1 | 47.7N | 124.5W | 0717 | 13.8                  |                       |                            |                           |                               | 9.2                                  | NW                    | 36.4                 | 14/22                  | 1017.3                |
| DISW3 | 47.1N | 090.7W | 0736 | 18.7                  |                       |                            |                           |                               | 9.4                                  | SW                    | 40.7                 | 15/03                  | 1014.3                |
| DPIA1 | 30.3N | 088.1W | 0733 | 28.6                  | 30.3                  |                            |                           |                               | 7.7                                  | SW                    | 30.1                 | 10/03                  | 1016.8                |
| DRYF1 | 24.6N | 082.9W | 0618 | 29.5                  | 30.4                  |                            |                           |                               | 8.0                                  | E                     | 18.7                 | 23/07                  | 1016.7                |
| DSLN7 | 35.2N | 075.3W | 0733 | 26.5                  |                       | 0.9                        | 1.4                       | 14/23                         | 13.7                                 | SW                    | 29.6                 | 09/08                  | 1014.5                |
| DUCN7 | 36.2N | 075.8W | 0718 | 26.0                  |                       | 0.5                        | 1.5                       | 26/17                         | 10.2                                 | SW                    | 25.7                 | 26/15                  | 1016.6                |
| FBIS1 | 32.7N | 079.9W | 0737 | 28.1                  |                       |                            |                           |                               | 9.8                                  | SW                    | 19.9                 | 14/23                  | 1015.8                |

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## Buoy Climatological Data Summary

*Continued from Page 91*

| BUOY  | LAT   | LONG   | OBS  | MEAN<br>AIR TP<br>(C) | MEAN<br>SEA TP<br>(C) | MEAN SIG<br>WAVE HT<br>(M) | MAX SIG<br>WAVE HT<br>(M) | MAX SIG<br>WAVE HT<br>(DA/HR) | SCALAR MEAN<br>WIND SPEED<br>(KNOTS) | PREV<br>WIND<br>(DIR) | MAX<br>WIND<br>(KTS) | MAX<br>WIND<br>(DA/HR) | MEAN<br>PRESS<br>(MB) |
|-------|-------|--------|------|-----------------------|-----------------------|----------------------------|---------------------------|-------------------------------|--------------------------------------|-----------------------|----------------------|------------------------|-----------------------|
| FFIA2 | 57.3N | 133.6W | 0551 | 13.1                  |                       |                            |                           |                               | 6.5                                  | S                     | 30.2                 | 16/05                  | 1016.8                |
| FPSN7 | 33.5N | 077.6W | 0722 | 27.8                  |                       | 1.2                        | 2.7                       | 01/08                         | 14.1                                 | SW                    | 34.0                 | 01/07                  | 1014.4                |
| FWYF1 | 25.6N | 080.1W | 0732 | 29.2                  | 30.2                  |                            |                           |                               | 10.1                                 | E                     | 31.5                 | 22/07                  | 1018.4                |
| GDIL1 | 29.3N | 090.0W | 0733 | 29.5                  | 32.0                  |                            |                           |                               | 7.7                                  | SW                    | 25.2                 | 14/17                  | 1017.0                |
| GLLN6 | 43.9N | 076.5W | 0734 | 21.0                  |                       |                            |                           |                               | 11.2                                 | SW                    | 28.8                 | 29/06                  | 1013.3                |
| IOSN3 | 43.0N | 070.6W | 0736 | 19.8                  |                       |                            |                           |                               | 11.5                                 | S                     | 24.9                 | 29/11                  | 1011.8                |
| KTNF1 | 29.8N | 083.6W | 0737 | 27.9                  |                       |                            |                           |                               | 8.8                                  | SW                    | 27.9                 | 04/02                  | 1016.3                |
| LKWF1 | 26.6N | 080.0W | 0738 | 28.3                  | 29.0                  |                            |                           |                               | 7.1                                  | SE                    | 19.7                 | 07/20                  | 1017.6                |
| LONF1 | 24.9N | 080.9W | 0627 | 29.5                  | 31.1                  |                            |                           |                               | 8.1                                  | E                     | 24.7                 | 04/21                  | 1016.8                |
| MDRM1 | 44.0N | 068.1W | 0722 | 14.8                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1012.1                |
| MISM1 | 43.8N | 068.9W | 0732 | 15.7                  |                       |                            |                           |                               | 12.7                                 | S                     | 30.0                 | 10/22                  | 1011.5                |
| MLRF1 | 25.0N | 080.4W | 0727 | 29.2                  | 30.4                  |                            |                           |                               | 9.1                                  | SE                    | 28.6                 | 21/05                  | 1017.6                |
| MRKA2 | 61.1N | 146.7W | 1460 | 11.6                  |                       |                            |                           |                               | 7.7                                  | NE                    | 24.9                 | 06/09                  | 1016.0                |
| NWPO3 | 44.6N | 124.1W | 0726 | 13.5                  |                       |                            |                           |                               | 7.5                                  | N                     | 23.1                 | 21/03                  | 1018.3                |
| PILM4 | 48.2N | 088.4W | 0729 | 16.7                  |                       |                            |                           |                               | 11.7                                 | W                     | 32.4                 | 21/19                  | 1014.5                |
| POTA2 | 61.1N | 146.7W | 1459 | 11.8                  |                       |                            |                           |                               | 6.5                                  | NE                    | 22.0                 | 31/11                  | 1015.6                |
| PTAC1 | 39.0N | 123.7W | 0725 | 12.3                  |                       |                            |                           |                               | 10.5                                 | N                     | 21.3                 | 19/06                  | 1015.1                |
| PTAT2 | 27.8N | 097.1W | 0717 |                       | 29.9                  |                            |                           |                               | 13.0                                 | SE                    | 22.8                 | 03/23                  | 1015.1                |
| PTGC1 | 34.6N | 120.7W | 0734 | 14.1                  |                       |                            |                           |                               | 16.7                                 | N                     | 32.0                 | 01/14                  | 1015.0                |
| ROAM4 | 47.9N | 089.3W | 0664 | 17.0                  | 14.0                  |                            |                           |                               | 7.4                                  | SW                    | 28.1                 | 29/20                  | 1013.9                |
| SANF1 | 24.5N | 081.9W | 0739 | 29.2                  | 30.2                  |                            |                           |                               | 9.6                                  | E                     | 28.5                 | 12/21                  | 1017.3                |
| SAUF1 | 29.9N | 081.3W | 0731 | 27.9                  | 27.8                  |                            |                           |                               | 7.4                                  | SW                    | 25.5                 | 12/17                  | 1016.9                |
| SBOI1 | 41.6N | 082.8W | 0730 | 23.4                  |                       |                            |                           |                               | 8.5                                  | SW                    | 30.8                 | 21/13                  | 1014.4                |
| SGNW3 | 43.8N | 087.7W | 0739 | 20.7                  |                       |                            |                           |                               | 9.0                                  | S                     | 21.5                 | 04/07                  | 1015.1                |
| SISW1 | 48.3N | 122.9W | 0728 | 13.1                  |                       |                            |                           |                               | 8.7                                  | W                     | 28.7                 | 11/01                  | 1017.1                |
| SMKF1 | 24.6N | 081.1W | 0656 | 29.5                  | 30.8                  |                            |                           |                               | 10.2                                 | E                     | 27.8                 | 04/22                  | 1017.5                |
| SPGF1 | 26.7N | 079.0W | 0733 | 29.0                  |                       |                            |                           |                               | 6.8                                  | SE                    | 19.7                 | 14/21                  | 1017.2                |
| SRST2 | 29.7N | 094.1W | 0727 | 29.1                  |                       |                            |                           |                               | 12.0                                 | S                     | 25.6                 | 03/14                  | 1016.9                |
| STDM4 | 47.2N | 087.2W | 0737 | 18.3                  |                       |                            |                           |                               | 11.7                                 | W                     | 32.0                 | 21/21                  | 1013.7                |
| SUPN6 | 44.5N | 075.8W | 0730 | 20.7                  | 21.3                  |                            |                           |                               | 7.1                                  | S                     | 17.1                 | 01/18                  | 1012.4                |
| THIN6 | 44.3N | 076.0W | 0723 | 20.5                  |                       |                            |                           |                               |                                      |                       |                      |                        |                       |
| TPLM2 | 38.9N | 076.4W | 0726 | 25.1                  | 25.4                  |                            |                           |                               | 9.1                                  | S                     | 24.5                 | 01/00                  | 1015.5                |
| TTIW1 | 48.4N | 124.7W | 0730 | 13.0                  |                       |                            |                           |                               | 9.6                                  | S                     | 27.5                 | 15/02                  | 1017.9                |
| VENF1 | 27.1N | 082.5W | 0538 | 27.7                  | 30.2                  |                            |                           |                               | 7.2                                  | W                     | 22.0                 | 11/20                  | 1018.0                |
| WPOW1 | 47.7N | 122.4W | 0723 | 16.2                  |                       |                            |                           |                               | 7.6                                  | NE                    | 17.3                 | 13/04                  | 1017.0                |

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|       |       |        |      |      |      |     |     |       |      |    |      |       |        |
|-------|-------|--------|------|------|------|-----|-----|-------|------|----|------|-------|--------|
| 41001 | 34.7N | 072.6W | 0558 | 27.0 | 27.8 | 1.5 | 5.3 | 26/20 | 9.4  | E  | 31.9 | 27/04 | 1017.5 |
| 41002 | 32.3N | 075.2W | 0737 | 27.6 | 28.6 | 1.7 | 9.7 | 26/02 | 10.8 | SW | 41.2 | 26/03 | 1015.7 |
| 41004 | 32.5N | 079.1W | 0710 | 26.9 |      | 1.3 | 6.2 | 26/04 | 10.4 | NE | 38.5 | 26/12 | 1015.3 |
| 41008 | 31.4N | 080.9W | 0731 | 27.6 | 27.6 | 0.9 | 2.7 | 02/00 | 10.6 | NE | 24.5 | 02/08 | 1015.8 |
| 41009 | 28.5N | 080.2W | 1448 | 28.4 | 28.9 | 1.0 | 4.0 | 25/15 | 8.4  | SE | 27.4 | 20/17 | 1016.1 |
| 41010 | 28.9N | 078.6W | 1472 | 29.0 | 30.0 | 1.5 | 6.0 | 24/20 | 9.4  | NE | 26.8 | 25/18 | 1016.1 |
| 42001 | 25.9N | 089.7W | 0738 | 29.3 |      | 0.6 | 2.8 | 31/22 | 9.4  | E  | 31.7 | 20/14 | 1014.5 |
| 42002 | 25.9N | 093.6W | 0743 | 29.5 | 30.5 | 0.7 | 3.1 | 31/22 | 9.2  | E  | 27.2 | 20/19 | 1014.7 |
| 42003 | 25.9N | 085.9W | 0738 | 29.0 | 30.2 | 0.5 | 1.6 | 20/08 | 8.0  | E  | 24.5 | 05/19 | 1014.9 |
| 42007 | 30.1N | 088.8W | 0734 | 28.9 | 30.1 | 0.5 | 1.9 | 21/16 | 8.3  | E  | 29.0 | 14/17 | 1015.3 |
| 42019 | 27.9N | 095.4W | 0741 | 28.8 | 29.8 | 0.7 | 4.4 | 22/04 | 9.1  | SE | 29.7 | 22/02 | 1014.3 |
| 42020 | 26.9N | 096.7W | 0742 | 28.9 | 29.2 | 0.7 | 2.9 | 22/05 | 9.9  | SE | 26.6 | 21/13 | 1014.0 |
| 42035 | 29.3N | 094.4W | 0736 | 29.3 | 30.7 | 0.6 | 3.0 | 21/23 | 8.8  | S  | 27.8 | 22/01 | 1014.9 |
| 42036 | 28.5N | 084.5W | 0738 | 28.9 | 29.9 | 0.5 | 2.0 | 21/03 | 7.3  | E  | 26.6 | 20/16 | 1016.5 |
| 42039 | 28.8N | 086.0W | 0737 | 28.9 | 30.2 | 0.5 | 2.1 | 21/11 | 7.6  | E  | 31.3 | 19/12 | 1017.0 |
| 42040 | 29.2N | 088.3W | 0734 | 29.0 | 30.3 | 0.6 | 3.0 | 21/18 | 7.9  | E  | 26.6 | 19/16 | 1016.3 |
| 44004 | 38.5N | 070.7W | 0742 | 23.4 | 23.4 | 1.6 | 6.8 | 29/01 | 11.4 | NE | 34.4 | 29/00 | 1017.8 |
| 44005 | 42.9N | 068.9W | 0739 | 19.0 | 18.4 | 1.0 | 3.5 | 29/18 | 8.6  | S  | 26.2 | 26/09 | 1016.9 |
| 44007 | 43.5N | 070.2W | 0739 | 17.4 | 17.3 | 0.6 | 1.8 | 29/22 | 7.4  | S  | 17.9 | 10/21 | 1017.3 |
| 44008 | 40.5N | 069.4W | 0736 | 20.1 | 19.4 | 1.2 | 5.4 | 29/10 | 8.1  | NE | 23.9 | 29/13 | 1018.1 |
| 44009 | 38.5N | 074.7W | 0738 | 23.8 | 24.4 | 1.1 | 3.6 | 28/17 | 10.9 | NE | 30.5 | 28/16 | 1017.1 |
| 44011 | 41.1N | 066.6W | 0737 | 18.8 | 18.0 | 1.2 | 5.9 | 29/17 | 7.4  | N  | 35.0 | 29/16 | 1018.4 |
| 44013 | 42.4N | 070.7W | 0741 | 18.2 | 16.4 | 0.4 | 1.6 | 29/17 | 6.5  | S  | 20.6 | 29/11 | 1016.7 |
| 44014 | 36.6N | 074.8W | 0742 | 24.9 | 24.9 | 1.5 | 6.1 | 27/23 | 11.1 | NE | 37.3 | 28/01 | 1015.9 |
| 44025 | 40.3N | 073.2W | 0737 | 22.5 | 22.7 | 1.0 | 3.1 | 29/01 | 8.8  | S  | 28.0 | 19/06 | 1017.7 |
| 45001 | 48.1N | 087.8W | 0733 | 18.8 | 18.9 | 0.6 | 1.7 | 16/20 | 10.3 | SW | 25.1 | 17/11 | 1016.0 |
| 45002 | 45.3N | 086.4W | 0711 | 21.1 | 21.7 | 0.5 | 1.7 | 20/08 | 10.1 | S  | 26.8 | 14/23 | 1015.9 |
| 45003 | 45.3N | 082.8W | 0732 | 20.0 | 20.4 | 0.5 | 1.5 | 20/15 | 9.2  | S  | 22.2 | 23/11 | 1017.0 |

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## Buoy Climatological Data Summary

*Continued from Page 92*

| BUOY  | LAT   | LONG   | OBS  | MEAN<br>AIR TP<br>(C) | MEAN<br>SEA TP<br>(C) | MEAN SIG<br>WAVE HT<br>(M) | MAX SIG<br>WAVE HT<br>(M) | MAX SIG<br>WAVE HT<br>(DA/HR) | SCALAR MEAN<br>WIND SPEED<br>(KNOTS) | PREV<br>WIND<br>(DIR) | MAX<br>WIND<br>(KTS) | MAX<br>WIND<br>(DA/HR) | MEAN<br>PRESS<br>(MB) |
|-------|-------|--------|------|-----------------------|-----------------------|----------------------------|---------------------------|-------------------------------|--------------------------------------|-----------------------|----------------------|------------------------|-----------------------|
| 45004 | 47.6N | 086.6W | 0740 | 18.6                  | 18.5                  | 0.6                        | 1.9                       | 17/16                         | 9.8                                  | S                     | 22.7                 | 17/16                  | 1016.9                |
| 45005 | 41.7N | 082.4W | 0739 | 23.0                  | 23.8                  | 0.4                        | 1.4                       | 19/02                         | 8.6                                  | SW                    | 24.1                 | 25/14                  | 1017.0                |
| 45006 | 47.3N | 089.9W | 0742 | 19.5                  | 19.3                  | 0.5                        | 1.6                       | 24/01                         | 9.8                                  | NE                    | 29.1                 | 29/07                  | 1016.1                |
| 45007 | 42.7N | 087.0W | 0736 | 22.6                  | 23.2                  | 0.5                        | 2.0                       | 16/00                         | 9.0                                  | S                     | 19.6                 | 15/23                  | 1017.4                |
| 45008 | 44.3N | 082.4W | 0740 | 21.0                  | 21.1                  | 0.5                        | 1.9                       | 18/08                         | 8.9                                  | N                     | 24.1                 | 18/07                  | 1017.3                |
| 46001 | 56.3N | 148.2W | 0735 | 12.4                  | 13.2                  | 2.0                        | 8.2                       | 31/22                         | 12.4                                 | W                     | 29.3                 | 31/04                  | 1011.7                |
| 46002 | 42.5N | 130.3W | 0741 | 17.3                  | 18.1                  | 1.5                        | 2.6                       | 30/19                         | 10.5                                 | N                     | 20.4                 | 23/07                  | 1022.7                |
| 46003 | 51.9N | 155.9W | 0741 | 11.1                  | 11.6                  | 2.1                        | 5.6                       | 31/16                         | 15.0                                 | W                     | 31.7                 | 31/14                  | 1016.5                |
| 46005 | 46.1N | 131.0W | 0735 | 16.2                  | 16.9                  | 1.4                        | 2.5                       | 09/07                         | 9.6                                  | NW                    | 20.4                 | 05/11                  | 1022.8                |
| 46006 | 40.9N | 137.5W | 0514 | 18.6                  | 19.2                  | 1.4                        | 2.2                       | 09/02                         | 9.5                                  | N                     | 18.1                 | 02/12                  | 1024.1                |
| 46011 | 34.9N | 120.9W | 0744 | 15.6                  | 17.1                  | 1.8                        | 3.3                       | 08/00                         | 11.2                                 | NW                    | 23.5                 | 23/23                  | 1014.0                |
| 46012 | 37.4N | 122.7W | 0735 | 13.6                  | 14.5                  | 1.7                        | 3.2                       | 07/14                         | 9.4                                  | NW                    | 20.0                 | 23/02                  | 1014.8                |
| 46013 | 38.2N | 123.3W | 0733 | 12.4                  | 12.5                  | 2.0                        | 3.6                       | 06/22                         | 15.4                                 | NW                    | 29.3                 | 07/01                  | 1014.7                |
| 46014 | 39.2N | 124.0W | 0738 | 12.4                  | 11.9                  | 2.0                        | 3.6                       | 07/03                         | 13.6                                 | NW                    | 27.2                 | 17/00                  | 1014.8                |
| 46022 | 40.7N | 124.5W | 0738 | 13.0                  | 12.4                  | 1.7                        | 3.2                       | 08/04                         | 9.3                                  | N                     | 20.8                 | 08/10                  | 1017.2                |
| 46023 | 34.7N | 121.0W | 0738 | 15.4                  | 17.1                  | 1.8                        | 3.0                       | 07/22                         | 13.8                                 | NW                    | 26.2                 | 23/23                  | 1014.6                |
| 46025 | 33.8N | 119.1W | 0729 | 19.2                  | 20.6                  | 1.1                        | 1.9                       | 04/21                         | 5.9                                  | W                     | 15.2                 | 05/00                  | 1013.5                |
| 46026 | 37.8N | 122.8W | 0287 | 12.7                  | 13.7                  | 1.4                        | 2.3                       | 23/04                         | 11.8                                 | NW                    | 23.7                 | 23/04                  | 1014.5                |
| 46027 | 41.9N | 124.4W | 0360 | 12.2                  | 11.9                  | 1.6                        | 3.4                       | 08/00                         | 6.8                                  | NW                    | 32.6                 | 07/22                  | 1016.8                |
| 46028 | 35.7N | 121.9W | 0413 | 14.5                  | 15.4                  | 2.1                        | 3.4                       | 29/06                         | 16.9                                 | NW                    | 28.0                 | 23/04                  | 1013.4                |
| 46029 | 46.1N | 124.5W | 0743 | 15.8                  | 16.0                  | 1.2                        | 2.3                       | 30/23                         | 9.0                                  | N                     | 21.0                 | 31/06                  | 1019.5                |
| 46030 | 40.4N | 124.5W | 0733 | 12.2                  | 10.9                  | 1.8                        | 3.0                       | 15/04                         | 14.4                                 | N                     | 25.1                 | 05/13                  | 1017.1                |
| 46035 | 56.9N | 177.8W | 0718 | 8.3                   | 8.6                   | 1.9                        | 5.5                       | 16/11                         | 14.9                                 | SW                    | 35.8                 | 25/02                  | 1012.0                |
| 46041 | 47.4N | 124.5W | 0740 | 14.4                  | 14.0                  | 1.1                        | 2.2                       | 24/02                         | 7.2                                  | NW                    | 20.0                 | 13/02                  | 1019.8                |
| 46042 | 36.8N | 122.4W | 0741 | 14.2                  | 15.2                  | 1.9                        | 3.2                       | 17/06                         | 12.9                                 | NW                    | 25.6                 | 29/00                  | 1014.9                |
| 46045 | 33.8N | 118.5W | 0741 | 19.5                  | 20.6                  | 0.7                        | 1.4                       | 19/05                         | 4.8                                  | SW                    | 11.9                 | 18/22                  | 1012.6                |
| 46050 | 44.6N | 124.5W | 0743 | 15.6                  | 14.4                  | 1.5                        | 2.7                       | 31/06                         | 11.7                                 | N                     | 21.4                 | 30/07                  | 1019.3                |
| 46053 | 34.2N | 119.9W | 0687 | 17.6                  | 19.4                  | 0.9                        | 1.8                       | 24/03                         | 9.6                                  | W                     | 20.8                 | 18/03                  | 1013.4                |
| 46054 | 34.3N | 120.5W | 0735 | 16.3                  | 17.3                  | 1.7                        | 2.7                       | 07/23                         | 17.3                                 | NW                    | 31.1                 | 18/01                  | 1012.7                |
| 46059 | 38.0N | 130.0W | 0739 |                       | 18.4                  | 1.7                        | 2.7                       | 31/22                         | 12.1                                 | N                     | 20.8                 | 24/15                  |                       |
| 46060 | 60.6N | 146.8W | 1479 | 12.6                  | 14.0                  | 0.4                        | 1.9                       | 31/21                         | 9.8                                  | E                     | 31.3                 | 31/20                  | 1012.7                |
| 46061 | 60.2N | 146.8W | 1472 | 12.6                  | 13.6                  | 1.0                        | 4.5                       | 31/23                         | 10.2                                 | E                     | 37.1                 | 31/22                  | 1012.0                |
| 46062 | 35.1N | 121.0W | 0724 | 15.3                  | 16.8                  | 1.8                        | 3.0                       | 07/18                         | 12.4                                 | NW                    | 24.9                 | 23/19                  | 1013.6                |
| 46063 | 34.3N | 120.7W | 0739 | 15.8                  | 16.8                  | 1.9                        | 3.1                       | 23/16                         | 16.0                                 | NW                    | 25.6                 | 29/05                  | 1013.0                |
| 51001 | 23.4N | 162.3W | 0740 | 25.2                  | 26.1                  | 2.0                        | 3.1                       | 23/22                         | 14.5                                 | E                     | 21.8                 | 23/00                  | 1018.4                |
| 51002 | 17.2N | 157.8W | 0737 | 25.9                  | 26.5                  | 2.2                        | 3.4                       | 19/18                         | 14.2                                 | NE                    | 22.2                 | 21/02                  | 1015.6                |
| 51003 | 19.1N | 160.8W | 0574 | 26.0                  | 26.7                  | 1.8                        | 2.8                       | 24/02                         | 11.4                                 | NE                    | 20.3                 | 24/20                  | 1016.3                |
| 51004 | 17.4N | 152.5W | 0741 | 25.7                  | 26.3                  | 2.1                        | 3.6                       | 23/23                         | 14.3                                 | NE                    | 20.9                 | 24/20                  | 1016.0                |
| 51028 | 0.0N  | 153.9W | 0713 | 23.2                  | 23.0                  | 2.0                        | 3.0                       | 04/16                         | 10.7                                 | E                     | 19.4                 | 18/10                  | 1012.3                |
| 91204 | 9.9N  | 139.7E | 0512 | 49.5                  |                       |                            |                           |                               | 5.6                                  | NE                    | 27.2                 | 10/04                  | 1010.0                |
| 91328 | 8.6N  | 149.7E | 0511 | 28.1                  |                       |                            |                           |                               | 4.4                                  | NE                    | 21.3                 | 27/06                  | 1009.5                |
| 91343 | 7.6N  | 155.2E | 0503 | 28.2                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1009.1                |
| 91352 | 6.2N  | 160.7E | 0464 | 27.9                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1011.9                |
| 91374 | 8.7N  | 171.2E | 0737 | 27.4                  |                       |                            |                           |                               | 4.4                                  | NE                    | 15.3                 | 01/02                  | 1010.5                |
| 91377 | 6.1N  | 172.1E | 0447 | 28.0                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1013.1                |
| 91411 | 8.3N  | 137.5E | 0383 | 28.5                  |                       |                            |                           |                               |                                      |                       |                      |                        | 1009.6                |
| ABAN6 | 44.3N | 075.9W | 0741 | 20.7                  | 21.4                  |                            |                           |                               | 3.6                                  | S                     | 14.1                 | 18/19                  | 1017.8                |
| ALSN6 | 40.5N | 073.8W | 0738 | 23.3                  |                       | 0.8                        | 2.1                       | 28/22                         | 11.5                                 | S                     | 33.1                 | 19/05                  | 1018.0                |
| BLIA2 | 60.8N | 146.9W | 1478 | 11.4                  |                       |                            |                           |                               | 8.3                                  | N                     | 31.3                 | 31/16                  | 1013.4                |
| BURL1 | 28.9N | 089.4W | 0735 | 29.4                  |                       |                            |                           |                               | 8.8                                  | E                     | 29.9                 | 15/21                  | 1015.3                |
| BUZM3 | 41.4N | 071.0W | 0735 | 20.8                  |                       | 0.5                        | 2.1                       | 26/08                         | 10.3                                 | S                     | 30.0                 | 19/07                  | 1018.8                |
| CARO3 | 43.3N | 124.4W | 0736 | 13.1                  |                       |                            |                           |                               | 6.5                                  | NE                    | 20.3                 | 28/20                  | 1019.3                |
| CDRF1 | 29.1N | 083.0W | 0741 | 28.0                  |                       |                            |                           |                               | 7.4                                  | NE                    | 27.7                 | 08/00                  | 1016.4                |
| CHLV2 | 36.9N | 075.7W | 0742 | 24.6                  | 24.4                  | 1.0                        | 3.5                       | 28/15                         | 13.4                                 | NE                    | 71.8                 | 28/06                  | 1017.4                |
| CLKN7 | 34.6N | 076.5W | 0713 | 26.2                  |                       |                            |                           |                               | 13.0                                 | NE                    | 58.6                 | 27/05                  | 1017.3                |
| CSBF1 | 29.7N | 085.4W | 0734 | 28.3                  |                       |                            |                           |                               | 6.0                                  | NE                    | 21.5                 | 07/21                  | 1016.7                |
| DBLN6 | 42.5N | 079.4W | 0741 | 22.0                  |                       |                            |                           |                               | 7.2                                  | SW                    | 30.2                 | 25/17                  | 1018.0                |
| DESW1 | 47.7N | 124.5W | 0730 | 14.3                  |                       |                            |                           |                               | 9.3                                  | NW                    | 31.9                 | 13/01                  | 1019.5                |
| DISW3 | 47.1N | 090.7W | 0732 | 19.8                  |                       |                            |                           |                               | 9.9                                  | SW                    | 23.3                 | 17/12                  | 1016.3                |
| DPIA1 | 30.3N | 088.1W | 0737 | 28.7                  | 30.8                  |                            |                           |                               | 8.2                                  | E                     | 22.1                 | 21/15                  | 1016.2                |
| DRYF1 | 24.6N | 082.9W | 0735 | 29.5                  | 30.8                  |                            |                           |                               | 7.1                                  | E                     | 23.3                 | 19/20                  | 1014.6                |
| DSLN7 | 35.2N | 075.3W | 0737 | 25.8                  |                       | 1.0                        | 3.5                       | 26/01                         | 14.5                                 | NE                    | 63.0                 | 27/19                  | 1015.8                |
| DUCN7 | 36.2N | 075.8W | 0726 | 25.4                  |                       | 0.9                        | 2.9                       | 27/20                         | 12.3                                 | NE                    | 44.9                 | 27/20                  | 1018.5                |
| FBIS1 | 32.7N | 079.9W | 0738 | 27.1                  |                       |                            |                           |                               | 8.4                                  | SW                    | 23.6                 | 20/11                  | 1016.8                |



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