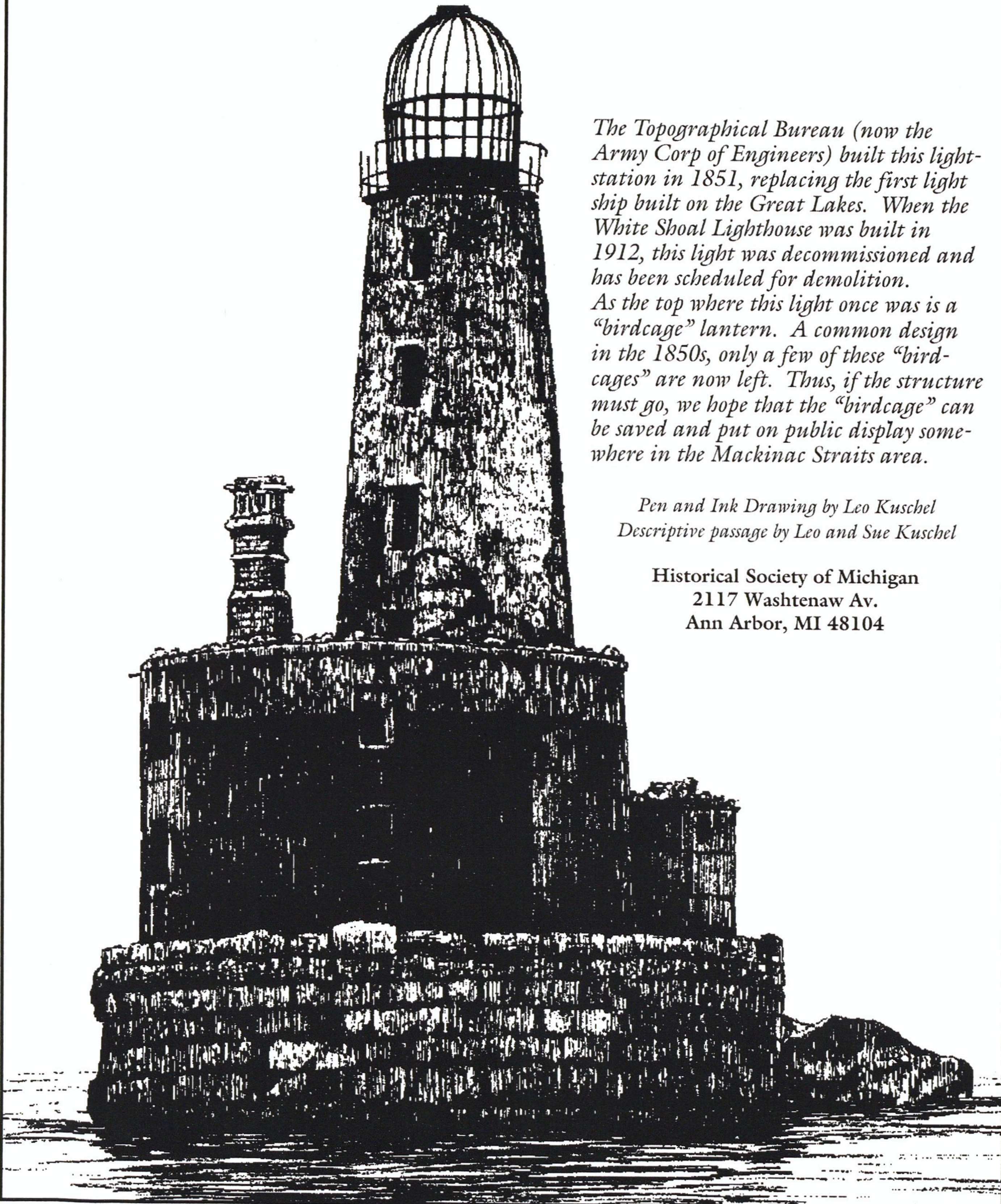
Mariners Weather Log

Fall 1995

Waugoshance Lightstation

Lake Michigan
Off Wilderness State Park, Michigan



The Topographical Bureau (now the Army Corp of Engineers) built this lightstation in 1851, replacing the first light ship built on the Great Lakes. When the White Shoal Lighthouse was built in 1912, this light was decommissioned and has been scheduled for demolition. As the top where this light once was is a "birdcage" lantern. A common design in the 1850s, only a few of these "birdcages" are now left. Thus, if the structure must go, we hope that the "birdcage" can be saved and put on public display somewhere in the Mackinac Straits area.

Pen and Ink Drawing by Leo Kuschel
Descriptive passage by Leo and Sue Kuschel

Historical Society of Michigan
2117 Washtenaw Av.
Ann Arbor, MI 48104

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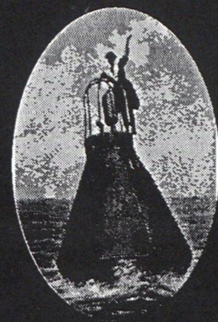

Girl on Buoy on the Massachusetts Coast–page 42

Departments

Cover: A mariner poses on an ice encrusted ship in the Great Lakes circa 1920s.

Inside Back Cover: Mark Twain's pilot license, 1859, from the collection of the Mariners' Museum Research Library and Archives, Newport News, Virginia. Museum photograph.

Back Cover: A beautful and deadly iceberg drifts across the North Atlantic. Photo courtesy of the International Ice Patrol.

Mariners Weather Log

Editor
Nancy O'Donnell

Columnists
Elinor DeWire, Lee Chesneau, Martin S. Baron, R. Tuxhorn, Teresa Fremaux, Jim Nelson and Skip Gillham

Computer Specialists
Roger Torstenson
Wilbur Biggs
Dick Knight

U.S. Department of Commerce
Ronald H. Brown, Secretary

National Oceanic and Atmospheric Administration
Dr. D. James Baker
Administrator

National Environmental Satellite, Data, and Information Service
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National Oceanographic Data Center
Ronald L. Fauquet, Acting Director

National Weather Service
Elbert W. Friday Jr., Assistant Administrator

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 July I, 1995.

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Articles, photographs and letters should be sent to:

Mariners Weather Log
National Weather Service
SSMC 2, 14th Floor
1315 East-West Highway
Silver Spring, MD 20910

The *Log* continues

To paraphase Mark Twain: "Reports of the [*Log*'s] death are greatly exaggerated." In the past months, when the future of the *Log* was cloudy at best, we've received many letters and phone calls from readers testifying to the value of the *Mariners Weather Log*. Townsend Horner, President of the West Bay Marine Corporation in Osterville, Massachusetts writes: *"Over the years [the Log] has been one of the most interesting and best put together of the many marine-related publications that come into this office. Each issue has been both entertaining and educating as well as statistically useful with its maps and data. Personally, I would be willing to pay almost any price for the ability to continue receiving it."*

With this fall issue the *Log* returns as a slimmer volume. Although Dick DeAngelis' witty and informative Marine Weather Review is missing and the Drifters, Scuttlebutt, and Radio Tips columns are absent, the spirit of the *Log* remains the same. In addition, this issue marks the transition to a new era for the Log.

We are pleased to announce that the *Log* will continue through the cooperative efforts and with the support of two NOAA offices–the National Weather Service (NWS) and the National Environmental, Satellite, Data, and Information Service (NESDIS) and the U.S. Navy. Although the realities of budget cuts and government downsizing will bring changes to its content and format, we believe that the *Log* again has a bright future. The first issue in the new format is expected to be available by early summer.

The *Log* began in 1957 as a publication of the Office of Climatology, U.S. Weather Bureau. In 1966, with the establishment of the Environmental Science Services Administration (ESSA), the Log was transferred to ESSA's Environmental Data Service, which was later to become part of NESDIS. So now the *Log* has come full circle and the NOAA National Weather Service will take the lead for its production and distribution. Through many changes over the years NWS, NESDIS, and the Navy have all played their part in supporting the *Mariners Weather Log* and ensuring that it fulfills its unchanging mission of providing useful information to mariners, shipboard weather observers, and many others whose lives and livelihood depend on knowledge and understanding of the sea.

Throw your trash overboard, and you could be dropping a bundle.

It's dark. You think nobody's watching. Why not toss that plastic trash bag overboard? Because if you do, you're throwing away a lot more than just the day's garbage. You're committing a class D felony, now punishable by imprisonment for up to six years and a corporate fine of up to $500,000.

Why the new penalties? Because our oceans aren't capable of absorbing unlimited amounts of trash. And a lot of people are tired of finding other people's garbage on their beaches.

So stow your trash on board for proper disposal on land. It's an idea the whole world can live with. And it can save you a bundle.

To find out more, write: The Center for Marine Conservation, PSA-CM, 1725 DeSales Street, N.W., Suite 500, Washington, D.C. 20036.

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The Center for Marine Conservation
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The Society of the Plastics Industry

Lightning with branching leaders and the main discharge. Courtesy of USA/NWS/NOAA.

Lightning at Sea

Edward C. Brainard I

Herman Melville writes of the terror and fright of lightning aboard the ***Pequod*** in *Moby Dick*. He also wrote in detail of the use of lightning rods for the ship's protection and the need for suitable grounding of the rods to the sea: "All the yard-arms were tipped with pallid fire; and touched at each end of the trip-pointed lightning-rod-ends with three tapering white flames, each of the three tall masts was silently burning in that sulphurous air, like three gigantic wax tapers before an altar. The corposants have mercy on us all." [Corposant is derived from *corpo santo* meaning 'body of a saint' which refers to the electrical discharges commonly called St. Elmo's fire.] "To sailors, oaths are household words; they will swear in the trance of a calm, and in the teeth of the tempest; they will imprecate curses from the topsail yard-arms, when most they teeter over to a seething sea; but in all my voyaging, seldom have I heard a common oath when God's burning finger has laid on the ship."

What reverence we have for lightning and with good cause.

Even though most of the fundamentals of lightning have been known for centuries, we forget them and in doing so are in danger.

Lightning, the visible discharge of atmospherwhen the atmosphere generates sufficient charge to ionize the air, is usually associated with cumulonimbus clouds or thunderheads. It also occurs in nimbostratus clouds, in snowstorms, dust storms, and sometimes in the dust and larger particles emitted by volcanoes. Lightning discharges occur within a cloud, between clouds, between cloud and air, or from a cloud to ground.

This discharge is generated when regions of net charges are generated by charge separation that produce an electrical dipole structure in the cloud. The charge separation is driven by the updraft of moisture laden air similar to the rotating belt of a Van de Graaff static electricity generator. This action concentrates large negative charge at the bottom of the cloud, positive charge aloft and a small positive charge on the lowest advancing section of the cloud. The electrical charges reside on ice crystals.

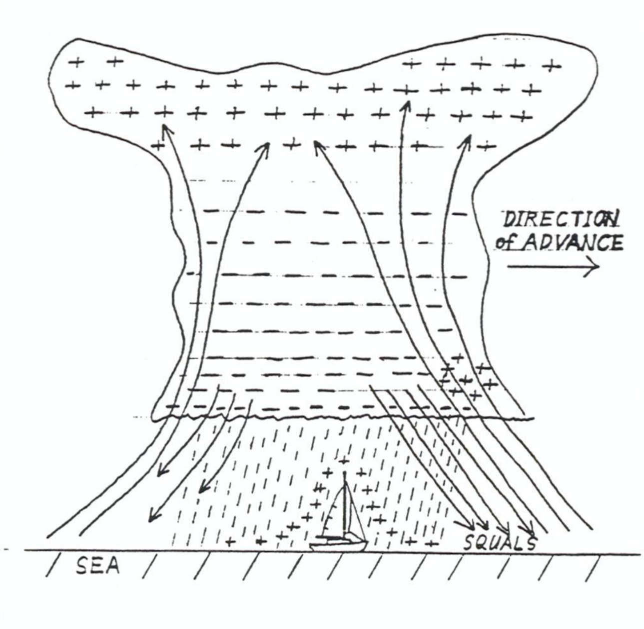
From cloud to ground, lightning is initiated by the neutralization of the small net positive charge from the lowest region of the cloud. This flash consists of at least two discharges. The leader stroke carries a negative charge to the ground. This is not very bright, and is commonly stepped with many branches extending from the main channel. As the leader approaches the ground, it attracts an opposite charge concentrated at the point to be struck. Then, a reverse flow of current freely flows through the low resistance ionized channel, where the cloud is short-circuited to ground forming the characteristic brilliant flash between a potential difference of several million volts with peak currents in excess of 20,000 amperes. The temperature in this small channel is increased to 50,000 degrees F in less than 70 microseconds. The thermally heated air expands energetically forming a supersonic shock wave resulting in claps and rumbles of thunder.

Lightning has one purpose; bring cloud-cloud or cloud-earth to a closer electrical potential. In doing this it is ruthless. It will take the lowest resistance path, and its high current flow will destroy anything in its path. I have seen the results of the lightning striking a tree during the dry season where the ground does not provide a good conductive path. The lightning hit the tree and blew it apart. It flowed out through the roots which were more conductive than the ground and heated them to the point of vaporization. They blew apart with the intensity of primer cord and opened ditches all around the tree, throwing heavy boulders for fifty feet. This shows the danger in not having a suitable low resistance path for the lightning to flow to ground potential.

On small vessels, a lightning rod will provide protection if it is suitably grounded. However, many precautions must be observed: if the mast is aluminum, ground its base to a suitable external sea water ground. If it is wood or carbon fiber, a heavy copper ground must lead from the masthead lightning rod with as straight a path as possible to the sea water ground. The shrouds, pulpits, and life lines must be grounded to this same sea water ground using No. 4 copper wire. In addition, all significant metal objects (stove, fuel tank, metal ventilators, anchor chain, steering pedestal and cables) above or below decks should be connected to this same grounding system to prevent auxiliary arching from the grounding system to the objects.

There is no perfect grounding system since the current flow is so extreme at the time of the strike. The lightning will electrically saturate your grounding system and find other paths to the sea. However, your attention to an adequate grounding system will minimize damage.

The extreme pulse of current caused by lightning induces voltages and current in nearby metallic object. This is effect is called Electromagnetic Pulse (EMP). EMP has been a great concern of the military. It is estimated that a 10 megaton thermo nuclear weapon set off in the stratosphere would create an EMP which would damage a significant amount of United States electronic and communications gear. Thus the art of "Hardening" electronics is a recently developed technique which can help us in the protection of yacht equipment. However, this technology is not being widely used by marine electronics manufacturers due to the increased costs.



Cross-Section of a Typical Local Thunderstorm

A nighttime storm over Miami, Florida is captured by photographer Ron Holle. "It's not often you get to take photos of lightning. By the time you get your equipment, it's gone. This storm was was nearly stationary for 2 hours. One cell or tower would be attacked for 10–15 minutes and then another would take up." Holle took the photo near Miami Shores, looking east over the Gulf Stream.

Thus electronic equipment in small vessels is at great risk during a direct lightning strike. The best way to protect it is to disconnect it from the antenna and ships power and ground the antenna to prevent lightning from arching from the antenna connect to other gear in the vessel. The modern VHF antenna is designed to protect your equipment and vessel; it is not just a bare wire cut to a resonant length mounted at your masthead. It includes a coil at its base which should be suitably grounded to the mast ground. The antenna lead taps into this coil forming a tuned system, but static electricity or lightning will be conducted directly to ground through the coil. Again, a direct strike will probably destroy your VHF transceiver, but the antenna will act as a protective lightening rod to discharge the local static electricity field and help reduce the probability of a direct strike on the small vessel.

Lightening strikes have been known to hit a number of miles away from the actual area of a thunder storm, so precautions should start early with the approaching disturbance. Personnel should remain in the lowest possible location in a small vessel during a thunderstorm avoiding metal objects within the vessel since lightning often jumps from the grounding system to ungrounded objects because of EMP and could arc to your body. It may not be practical in a small yacht, but you should maintain a distance of 2–meters between you and a large metal object. Do not touch metal objects within the yacht at these critical times. This also includes engine and autopilot controls.

Peter Price, a member of the Royal Cruising Club, reported a direct strike of his wooden 9 ton Hillyard in Scotland during the summer of 1971. The yacht was at her mooring with no one aboard. The lightning path included the head stay where it arced to the navigation lights which vaporized. Every electrical item was destroyed, even a battery operated piece of electronics packed away and not connected to the ship's power system. The lightning found its way to the sea through the propeller and shaft. It temporarily magnetized pig iron ballast and gave a compass deviation of 40 degrees. This deviation could be a major problem at sea if all other navigation equipment was damaged. It would be wise to have information for determining sun bearings. He has since used a chain hung overboard at the mooring or at sea during a lightning storm. This precaution is wise, but the area of the ground must be large enough.

A report from the log of the vessel ***Arwen*** describes being struck by lightning in Columbo, Sri Lanka. It was raining, but there was no thunder, a typical scenario for a major strike. Husband and wife were reading below. Suddenly a tremendous bang left their ears hissing for hours. The cabin was then full of smoke but no fire. It was apparent that a leak had occurred, and pumping controlled it. A 5 cm. hole was found behind the port bunk where the B& G speedometer through hull fitting had been blown away. Fortunately, the bunk partitions acted to restrain the flow of the sea water into the bilge or else the pumps could not have kept up with the inrush of water. The hole was plugged with a large rubber cork which fortunately had ben put aboard by a perceptive technician while fitting out of the voyage. All electric motors was damaged including an isolated video camera. The lightning also blew off the outboard end of the battery powered echosounder but left the shank of the transducer in the trough hull fitting.

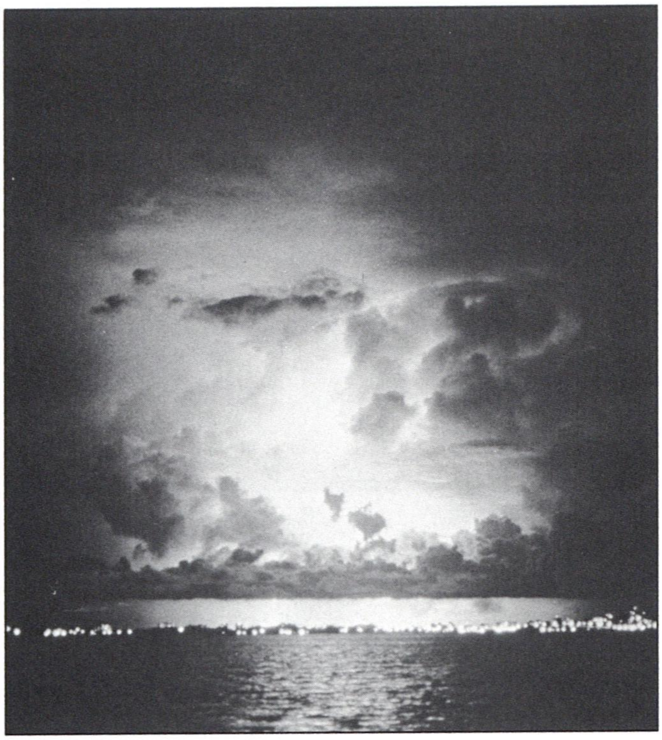
The lightning had found a major path to the sea down the deployed anchor chain where it had scored adjacent stainless steel and burnt rope laying on the chain. Thunderstorms continued after this strike with great intensity through the night. The couple could only hug each other and hope for no more direct strikes.

Reports are appearing of lightning striking fiberglass hulls which have carbon fiber laminates. In one case, the lightning heated the carbon fibers and delaminated the hull. Fortunately the carbon fiber layer was near the inner surface of the hull, so it could be repaired after removing the entire interior of the cabin.

These are just a few of numerous incidences of direct strike by lightning. The lesson is to take every precaution in advance to reduce the impact of the strike. These precautions will lesson the damage.

Summary of Precautions for Small Vessels

1) Make sure your vessel is well grounded.
2) Upgrade grounding conductors to No. 4 copper wire and ground all major metal objects to prevent dangerous secondary arcing.
3) If you feel your hair stand on end or if the radio starts to hiss with noise, you may be near to a strike condition. Go below and stay away from metal objects.
4) Consider using all metallic through hull fittings to provide a better electrical path to the sea.



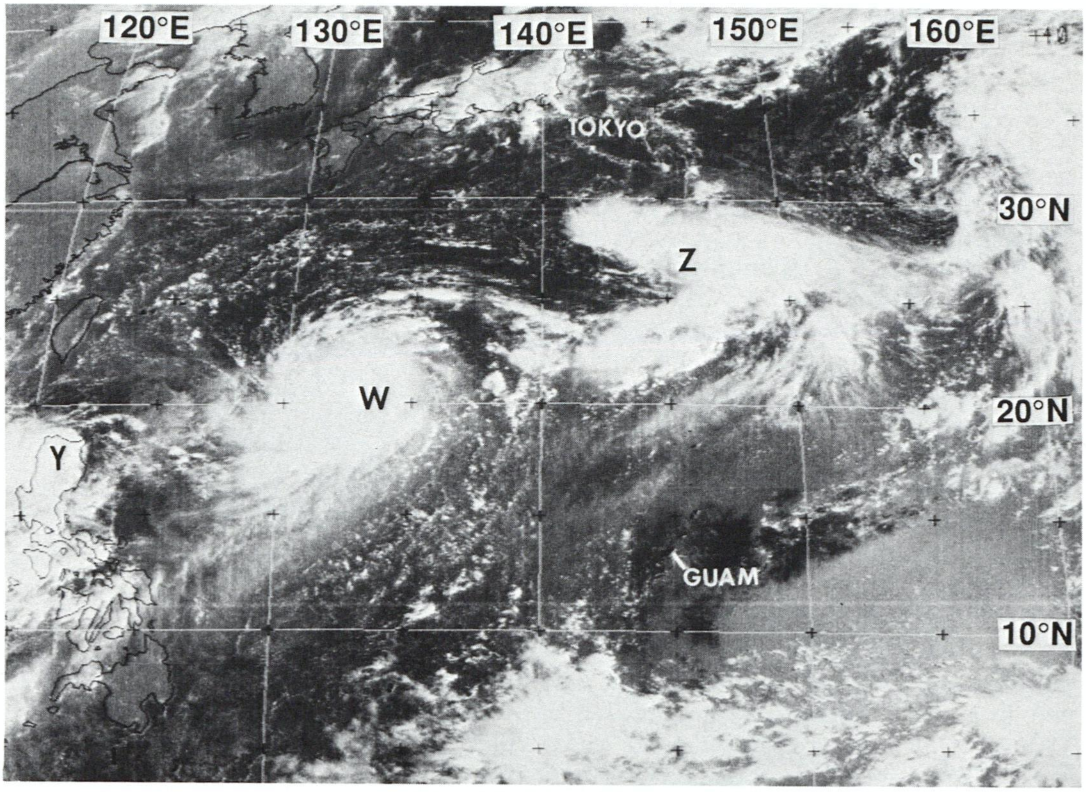
Lightning over the Miami skyline. ©Ron Holle.

5) Pump bilges before a lightning storm. This source of water may be vaporized to steam and its expansion may cause serious damage.
6) If your engine has a rubber coupling to its propeller shaft, install a heavy conducive strap between the engine and shaft across the coupling.
7) If you cruise in fresh areas and you are not grounded to an external keel, increase your ground plate area from the minimum of 1 square foot by a factor of 10.
8) Carry a good supply of plugs for securing through hull fittings if they are damaged by lightning. Make sure they are big enough.
9) If your small vessel is struck by lightning, check your mast and rigging. The very high currents will probably have caused some serious damage.
10) If your vessel is struck by lightning, check your mast and rigging. The very high currents will probably have caused serious damage.
11) Be current with your knowledge of CPR (Cardiopulmonary Resuscitation). This technique may save a life after electrical shock by lightning.

Acknowledgement: Special thanks to Professor Ed Williams at the Massachusetts Institute of Technology, Department of Earth and Planetary Sciences.

Western North Pacific

TYPHOONS 1994



Yunya (11°W), Zeke (12°W), and a subtropical disturbance are aligned SW–NE along the axis of a reverse-oriented monsoon trough (190031Z July visible GMS imagery).

Staff, Joint Typhoon Warning Center

The Northwest Pacific was especially active in 1994, with several long lived, slow-moving typhoons that dramatically increased the workload for the men and women of the Joint Typhoon Warning Center (JTWC). For the first time in its 36-year history, the JTWC issued more than 1,000 warnings in the North Western Pacific.

The year included six super typhoons, 16 lesser typhoons, 15 tropical storms and 5 tropical depressions. It was also a notable one as two of the longest-lived tropical cyclones on record battered the Pacific. John lasted for 30 days over the North Pacific Ocean, while Tropical Cyclone Rewa settled for 21 days in the southwestern Pacific Ocean. Also for the first time in history, the Joint Typhoon Warning Center recorded binary interaction between Typhoon Pat and Tropical Storm Ruth.

Some of the large-scale atmospheric and oceanic climatic parameters continued to be indicative of El Niño conditions during most of 1994: the sea surface temperature (SST) over much of the eastern equatorial Pacific – especially near the international

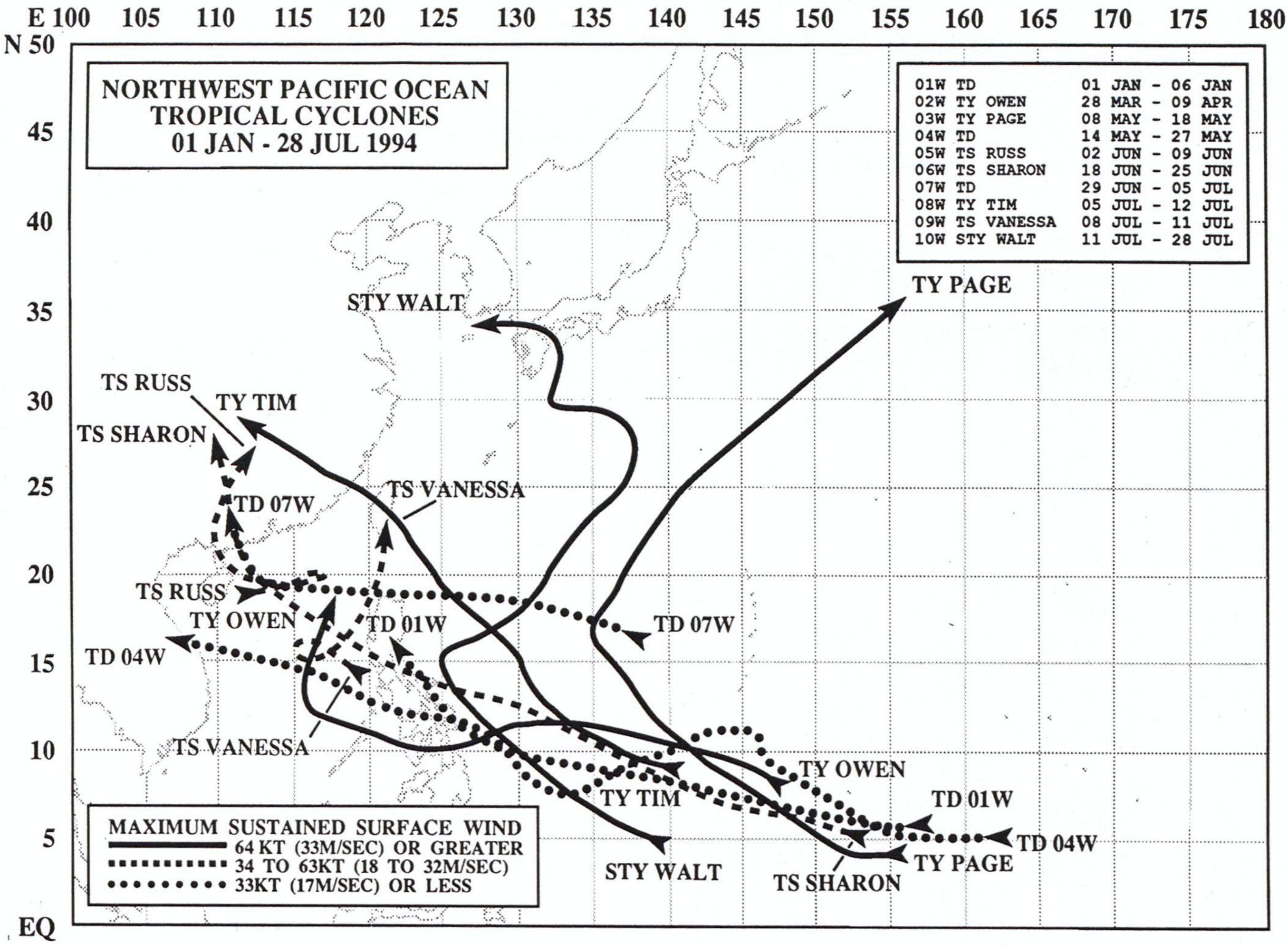
This summary is based upon the 1994 Annual Tropical Cyclone Report prepared by the Joint Typhoon Warning Center, Guam, Mariana Islands. Our special thanks to Frank H. Wells.

Western North Pacific Significant Tropical Cyclones, 1994

Tropical Cyclone	Period of Warning	Number of earnings Issued	Maximum Surface Winds Knots (meters/seconds)	Estimated MSLP millibar
(01W) TD	04 JAN – 06 JAN	5	25 (13)	1002
(02W) TY OWEN	01 MAR - 08 MAR	32	75 (39)	968
(03W) TY PAGE	11 MAY - 17 MAY	25	90 (46)	954
(04W) TD	24 MAY - 26 MAY	11	30 (15)	1000
(05W) TS RUSS	04 JUN - 09 JUN	20	55 (28)	984
(06W) TS SHARON	21-22 JUNE/22-25 JUN	14	45 (23)	991
(07W) TD	03 JUL - 04 JUL	7	30 (15)	1000
(08W) TY TIM	07 JUL - 11 JUL	18	125 (64)	916
(09W) TS VANESSA	09 JUL - 11 JUL	10	45 (23)	991
(10W) STY WALT	14 JUL- 26 JUL	50	130 (67)	910
(11W) TS YUNYA	18 JUL - 21 JUL	14	45 (23)	991
(12W) TY ZEKE	18 JUL - 24 JUL	26	65 (33)	976
(13W) TD	25 JUL - 26 JUL	4	25 (13)	1002
(14W) TS BRENDAN	29 JUL - 01 AUG	15	50 (26)	987
(15W) TS AMY	29 JUL - 31 JUL	8	40 (21)	994
(16W) TS CAITLAN	02 AUG - 04 AUG	9	60 (31)	980
(17W) STY DOUG	02 AUG - 13 AUG	42	140 (72)	898
(18W) TY ELLIE	08 AUG - 16 AUG	33	80 (41)	963
(08E) TS LI	13 AUG - 18 AUG	21	55 (28)	984
(19W) STY FRED	14 AUG - 22 AUG	33	130 (67)	910
(20W) TY GLADYS	22 AUG - 02 SEP	45	105 (54)	938
(21W) TS HARRY	25 AUG - 29 AUG	15	60 (31)	980
(22W) TY IVY	28 AUG - 03 SEP	26	75 (39)	968
(10E) TY JOHN	28 AUG - 08 SEP	45	105 (54)	938
(23W) TS JOEL	04 SEP - 11 SEP	27	85 (44)	958
(25W) TS LUKE	09 SEP - 14 SEP	22	50 (26)	987
(26W) STY MELISSA	11 SEP - 18 SEP	29	135 (69)	904
(27W) TS NAT	15 SEP - 22 SEP	29	45 (23)	991
(28W) STY ORCHID	18 SEP – 30 SEP	48	135 (69)	904
(29W) TY PAT	21 SEP – 26 SEP	48	95 (49)	949
(30W) TS RUTH	24 SEP – 28 SEP	18	45 (23)	991
(31W) TD	29 SEP – 03 OCT	11	30 (15)	1000
(32W) TY SETH	02 OCT – 11 OCT	37	120 (62)	922
(33W) TY VERNE	15 OCT – 31 OCT	66	115 (59)	927
(34W) TY TERESA	17 OCT – 26 OCT	37	80 (41)	963
(35W) TY WILDA	20 OCT – 01 NOV	49	125 (64)	916
(36W) TS YURI	(23 OCT – 25 OCT	9	35 (18)	997
(37W) STY ZELDA	28 OCT – 8 NOV	44	135 (69)	904
(38W) TX AXEL	13–14 DEC/15-25 DEC	42	115 (59)	927
(39W) TS BOBBIE	17 DEC – 25 DEC	29	50 (26)	987

TOTAL: 1058

date line — was consistently warmer than normal, and the Southern Oscillation Index (SOI) (Climate Analysis Center, 1994) was strongly negative for most of the year. From September through the remainder of the year, low-level westerly winds penetrated far to the east of normal. By the end of December, monsoonal low-level westerly wind flow was straddling the equator and had penetrated well-beyond the international date line to near 160°W. Based on the Pacific basin SST patterns and the distribution of wind and surface pressure in the tropics of the Pacific basin, the U.S. Climate Analysis Center (along with other international meteorological centers) officially declared that an El Niño event was under way, and predicted that it would reach its mature phase in early 1995. With the anomalous eastward push of monsoonal westerlies, several of



the year's tropical cyclones formed east of 160°E and south of 20°N. The number of tropical cyclones that form in this region is highly dependent upon El Niño, with more during El Niño years and less in other years. Unlike most El Niño years, however, there were several tropical cyclones that formed east of 160°E and north of 20°N.

JANUARY THROUGH MAY

Tropical cyclone activity got off to an early start during 1994. Tropical Depression 01W, which occurred in January in the near-equatorial trough, is most properly considered to be late-season storm, born in atmospheric conditions that evolved during November and December of the previous calendar year. The next two months were equally quiet.

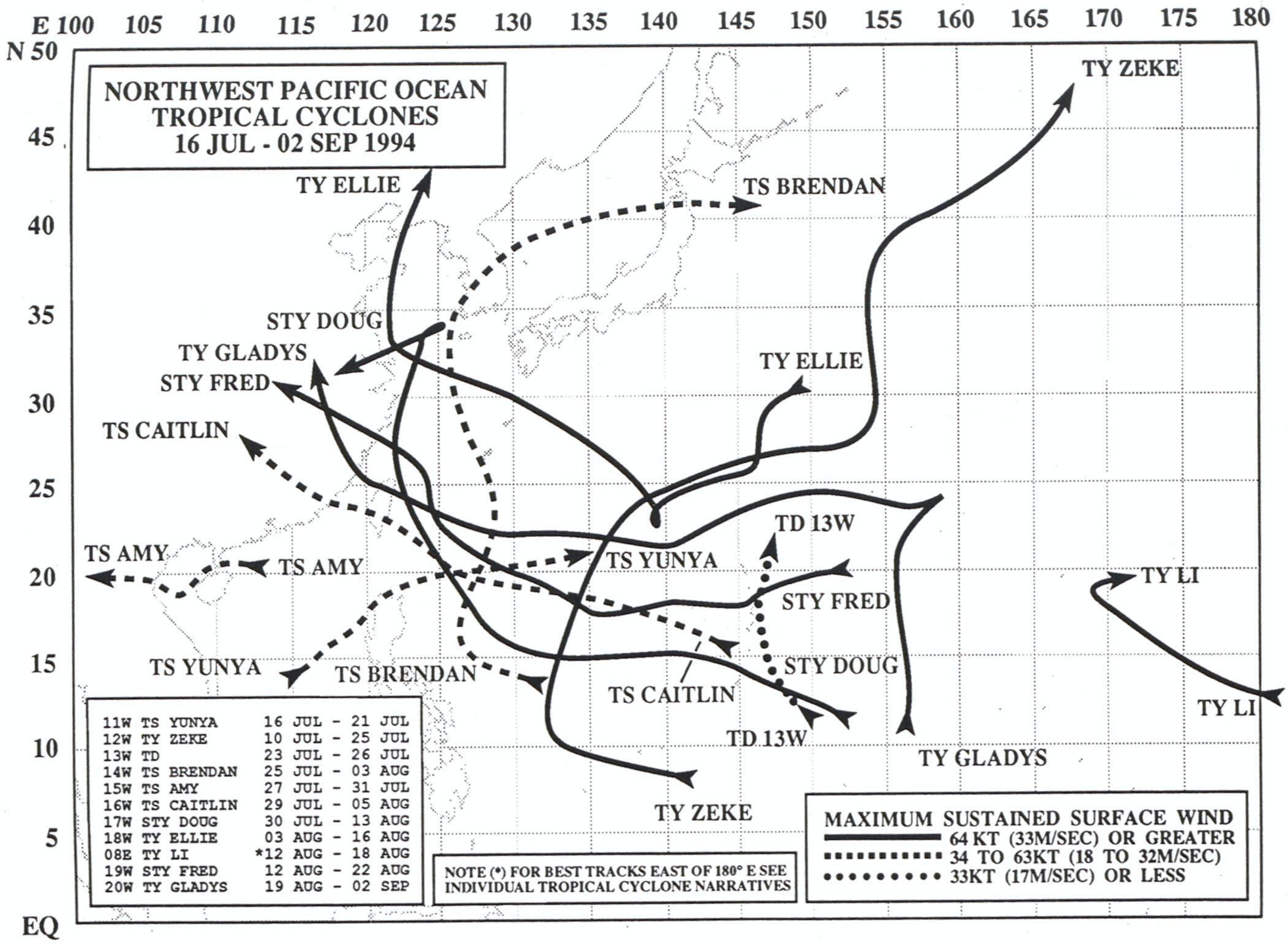
February is traditionally the month with the lowest average number of tropical cyclones in the western North Pacific, and there were no significant tropical cyclones in the western North Pacific basin during this time. March always held no significant tropical cyclones in the western North Pacific basin, however, the tropical disturbance which became Typhoon Owen was first detected in late March in a near-equatorial trough in the Caroline islands.

APRIL

Owen formed in the Caroline islands at the end of March. Tracking westward, Owen reached peak intensity of 75 knots (39 m/sec) one day before it crossed several islands of the Philippine archipelago where three people were killed and four were reported missing. Emerging into the South China Sea, it turned northward, steadily weakened, and dissipated over water northwest of Luzon. The rest of April was quiet.

MAY

During early May, the Mei-yu front became established from Hong Kong to Japan. In the deeper tropics, a near-equatorial trough became established



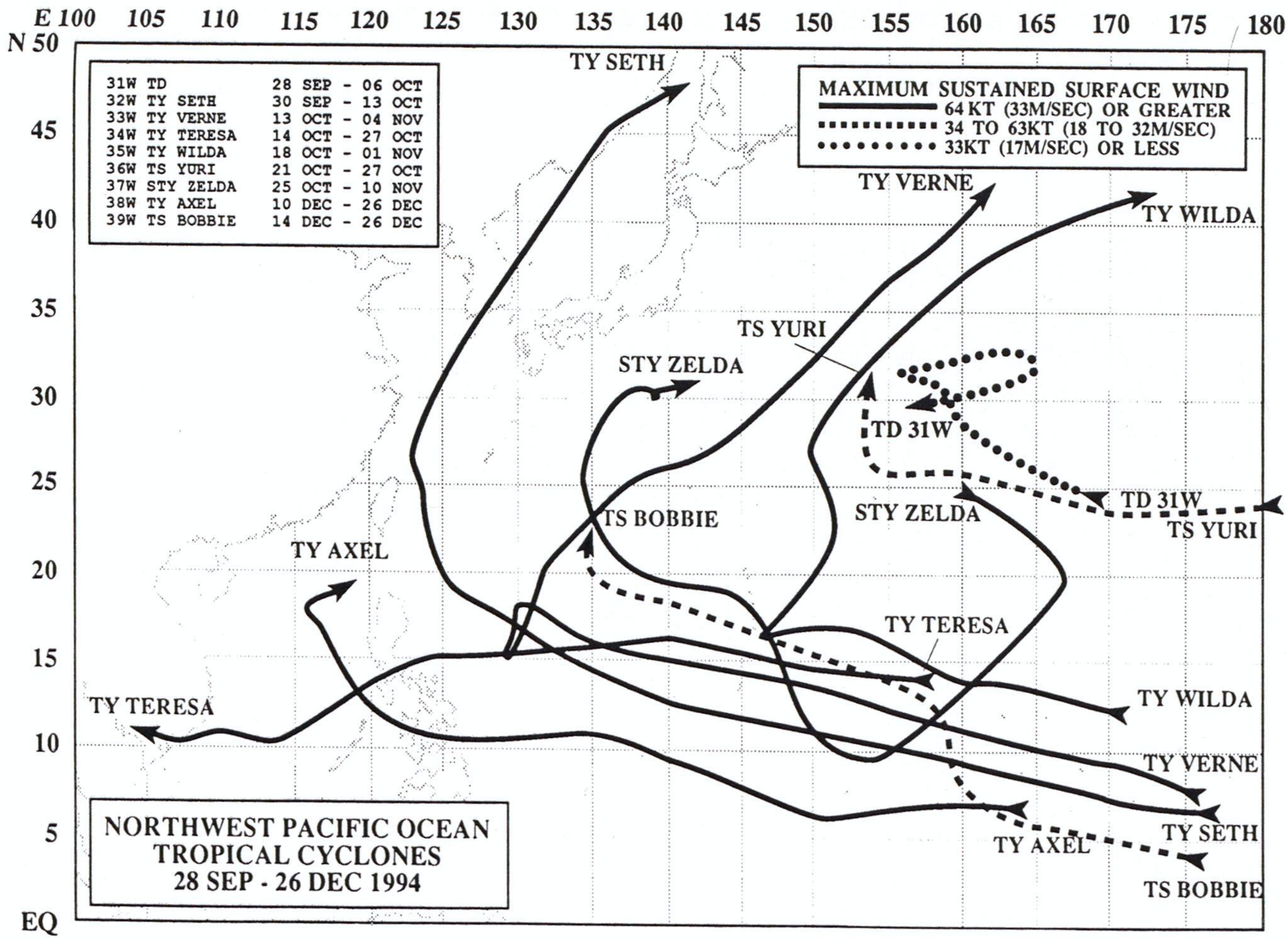
across the western North Pacific between 5°N and 10°N. On 08 May, a cloud cluster in the near–equatorial trough began to organize and drift toward the northwest. Four days later, this disturbance became Page at a location about 300 nm (550 km) west of Guam. It continued to move northwestward and became a typhoon on 15 May. Shortly thereafter, it recurved. Page reached its peak intensity of 90 knots (46 m/sec) 30 hours after the point of recurvature. On 18 May, Page accelerated into the mid latitudes and became extratropical. The tropics quieted down until 23 May when Tropical Depression 04W developed east of the Philippines. It crossed the South China Sea and dissipated over Vietnam. The remainder of May was inactive as the amount of deep convection in the tropics was suppressed.

JUNE

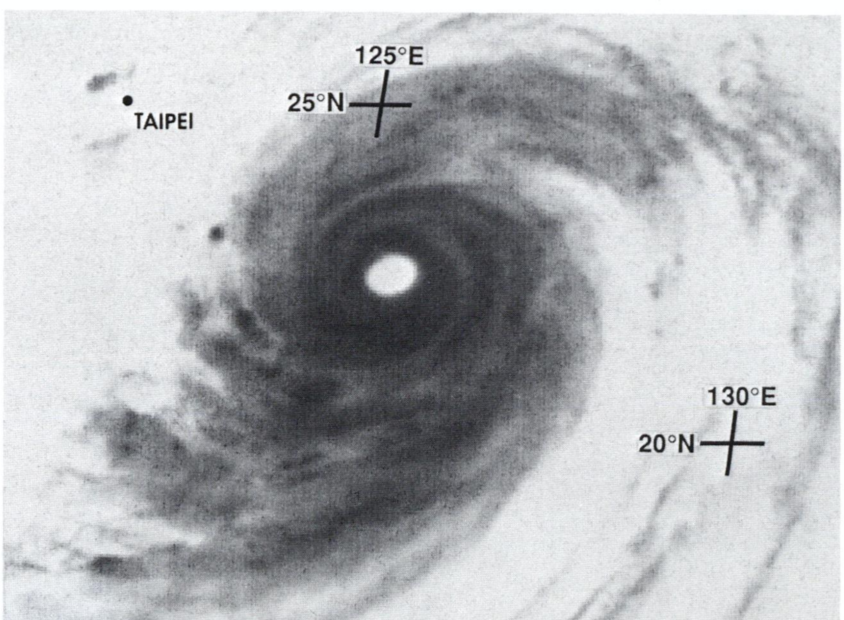
During early June, tropical cyclone activity was focused in the South China Sea. On 04 June, Russ developed and moved northward toward Hong Kong. When about 100 nm (185 km) south of Hong Kong, Russ turned toward the west and went ashore in southern China just east of the Luichow peninsula on 09 June. Russ was the first of a series of tropical cyclones that hit southern China and contributed to destructive flooding. During the middle of June, deep convection increased across the western North Pacific south of 10°N to the international date line. Despite the increase of deep convection, no tropical cyclones formed until 22 June when a tropical depression formed east of the Philippines. After crossing the Philippines, this tropical depression became Sharon on 23 June. Five days later Sharon made landfall in central Vietnam.

JULY

This month was one of the busiest July on record with a total of nine tropical cyclones occurring. Tropical cyclone activity for the month began in the



South China Sea with the development of Tropical Depression 07W south of Hong Kong on 03 July. This short-lived system moved westward and made landfall in southern China, just northeast of the Luichow Peninsula on 04 July. During the first week of July, a very intense tropical upper tropospheric trough



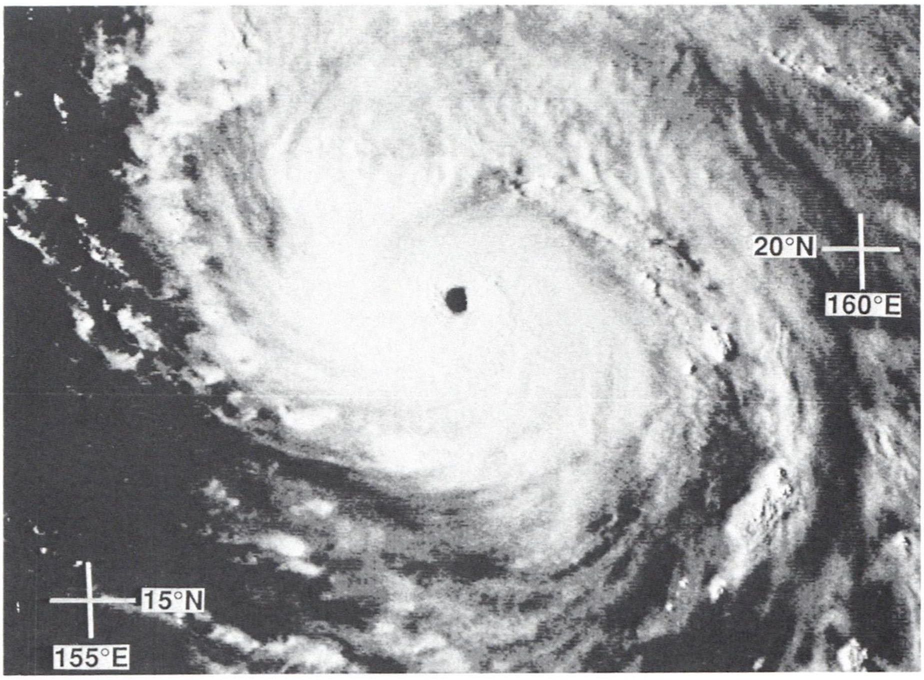
(TUTT) established from the east coast of China to the international date line. South of this TUTT, large-scale deep convection increased. On 07 July, the tropical disturbance that became Tim appeared in the Philippine Sea. While on a northwestward track, this system rapidly reached a peak intensity of 125 knots (64 m/sec), and on 10 July, it made landfall on the east coast of Taiwan. As Tim neared the Taiwan coast, Vanessa formed in the South China Sea. Vanessa was short-lived, moved northeastward, and was absorbed by the circulation of the larger Tim.

On 14 July, a reverse oriented monsoon trough developed east of the Philippines. The first super typhoon of the season, Walt formed along the axis of this trough. Walt underwent unusual northeastward motion along the trough axis, and reached its 130 knots (67 m/sec) peak intensity on 19 July before turning back to the northwest. As Walt weakened, it slowly tracked to the west and dissipated during the early morning hours of 27 July near western Japan after a total of 50 warnings.

Along with Walt, two other tropical cyclones formed along the axis of the reverse oriented monsoon trough – Yunya, west of Walt; and Zeke, northeast of Walt. Yunya developed in the South China Sea west of Luzon. It underwent unusual eastward motion and crossed Luzon from west to east on 19 July with a landfall intensity of 45 knots (23 m/sec). Heading east, Yunya dissipated over water in the Philippine Sea on 21 July. Meanwhile, Zeke developed northeast of Walt and moved on an unusual "S-shaped" track. Zeke reached its maximum intensity of 65 knots (33 m/sec) on 22 July as it made a sharp turn toward the north. It later turned northeastward and became extratropical poleward of 40°N on 24 July.

On 24 July, the large-scale low-level circulation of the western North Pacific became organized as a monsoon gyre. Tropical Depression 13W developed on 25 July in a monsoon surge along the southeastern periphery of the gyre. Tropical depression 13W dissipated on 26 July. Its remnants accelerated to the north within a band of large-scale deep convection that formed a fish-hook pattern on the eastern side of the gyre.

The gyre that had dominated the flow gave way to a more typical monsoon cloud band stretching from the South China Sea eastward into Micronesia on 28 July. On 29 July, a tropical disturbance that formed in this monsoon trough became Brendan. It moved rapidly to the north and was located over Korea by the end of the month. Two other tropical cyclones also formed in the monsoon trough during the last week of July – Amy and Caitlin. Amy formed in the South China Sea near Hainan Island on 28 July, and made landfall near Haiphong in northern Vietnam on 31 July. The tropical disturbance that became Caitlin formed near Guam on 29 July, and moved west-northwestward. It did not become a tropical storm until early August.

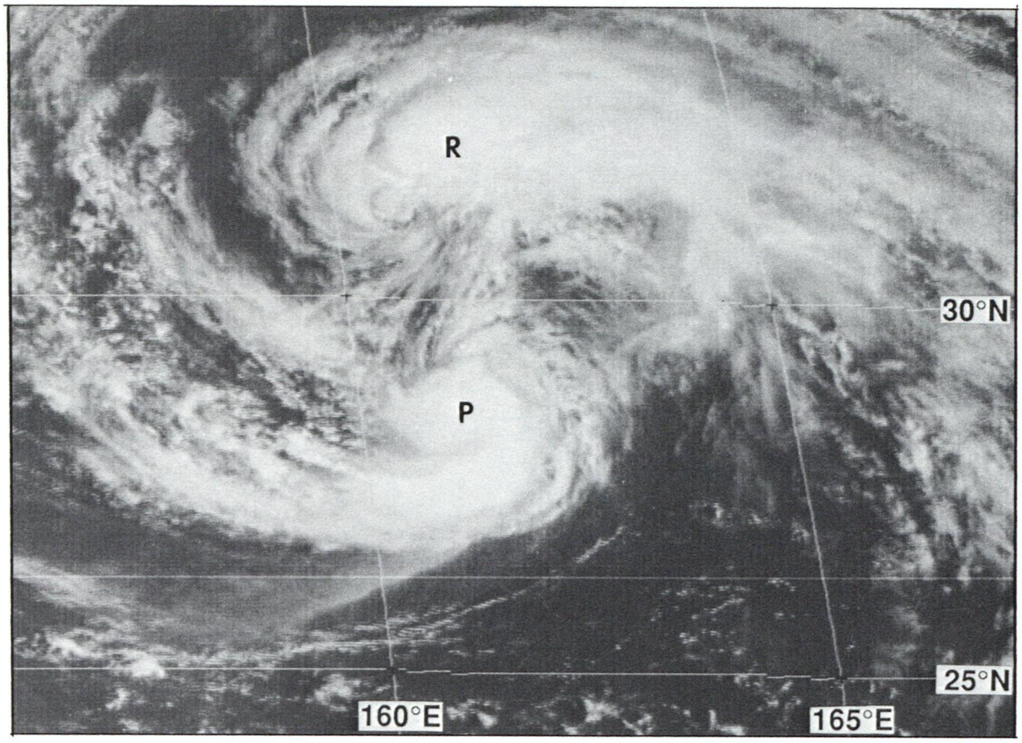


Above: Melissa near peak intensity (150537Z Sept. visible GMS imagery). Below left, Fred at his peak intensity of 130 kt (67 m/sec). In inverse infrared image, the cold clouds are dark and the warm sea surface is white.

AUGUST

Yet another very active month over the Western Pacific with a total of nine significant tropical cyclones. Eight formed during the month joining one that remained from July. On the first day of the month, Brendan, which developed in July, became extratropical in the Sea of Japan. On 02 August, Caitlin developed northeast of the Philippines and moved northwestward over Taiwan and into southeastern China. A few days later, the disturbance that became Doug developed east of the Philippines. It moved northwestward passing just off the northeastern tip of Taiwan. Doug then moved northward toward Korea. Close to the resort island of Cheju on 10 August, it created poor weather and gusty winds which contributed to the crash of a Korean Air Lines A-300 jet trying to land at Cheju International Airport.

On 08 August, the tropical disturbance that became Ellie developed in the subtropics (i.e., north of 25°N) at the base of a mid latitude trough. Ellie passed southwest of Kyushu on 13 August where wind gusts up to 87 knots (45 m/sec) were recorded. It later recurved in the Yellow Sea and dissipated over land in northeastern China. On 13 August Hurricane Li approached 180°E from the central Pacific, weakened as it crossed into JTWC's area of responsibility,



Pat and Ruth (30W) have moved to within 200 nm (370 km) of one another (26031Z September GMS visible imagery), above.

Below right, Super Typhoon Zelda at its peak intensity of 135 kt (69 m/sec) 042331Z November visible GMS imagery).

and dissipated near Wake Island on 16 August. On 14 August, the tropical disturbance that became Fred became a tropical depression near 19°N, 139°E. Fred tracked just north of Taiwan and went ashore south of Shanghai on 22 August as one of the most destructive typhoons to hit that region in decades.

A mid latitude trough on 20 August in combination with the TUTT produced several areas of deep convection in the subtropics (i.e., approximately 25°N) from 160°E to the international date line. Two typhoons – Gladys and Ivy – formed in this area. Gladys was a very small tropical cyclone that had its first warning on 22 August as it moved westward. The first warning on Ivy was issued on 28 August as it moved toward the northwest.

On 25 August, a tropical disturbance in the monsoon trough became a tropical depression east of the Philippines on 25 August. This tropical depression moved across Luzon and became Harry on 26 August. Harry passed south of Hong Kong, crossed Hainan Island, and went ashore near Haiphong, Vietnam. It dissipated over land on 29 August.

The next day John moved from the central Pacific across 180°E, forming and east-west chain of tropical cyclones with Gladys and Ivy. By the end of August, Gladys was approaching northern Taiwan as a typhoon, Ivy was heading northwestward near 30°N ; 159°E, and John was weakening near 29°N ; 172°E.

SEPTEMBER

September was even more active than August, with a total of 12 tropical cyclones: nine that formed during the month and three that were still active from August. On the first day of the month, Gladys, which developed in August, crossed Taiwan, and dissipated over China on 02 September. Ivy, which also developed during August, recurved far to the east of Japan and became extratropical on 03 September. John, the last of the August tropical cyclones overlapping into September, weakened during the first few days of September, but on 06 September, it began to reintensify. John recurved, and on 08 September, it moved back across 180°E into the central North Pacific as a Hurricane.

During the first week of September, after Gladys moved into China, monsoon southwesterlies began to strengthen over the South China Sea and across low latitudes of the western North Pacific. Joel, formed in the South China Sea along the axis of the monsoon trough, moved northwestward across Hainan Island and then went ashore in Vietnam near Haiphong on 07 September. On 05 September, a large monsoon depression formed west of the Mariana island chain. A separate tropical disturbance which formed on the northeastern side of this monsoon depression broke free of it, and moved northward. This tropical disturbance became Kinna. Kinna began to strengthen over the South China Sea and across low latitudes of the western North Pacific. Joel, formed in the South China Sea along the axis of the monsoon trough, moved northwestward across Hainan Island and then went ashore in Vietnam near Haiphong on 07 September. On 05 September, a large monsoon depression formed west of the Mariana island chain. A separate tropical disturbance which formed on the northeastern side of this monsoon depression broke free of it, and moved northward. This tropical disturbance became Kinna. Kinna recurved south of Tokyo, accelerated to the northeast, and became extratropical on 11 September. On 09 September, a tropical disturbance developed in the Philippine Sea, moved northwestward, and passed across northern Luzon. Once it entered the South China Sea, it intensified and became Luke. Luke moved westward and passed over Hainan Island, and then moved ashore in northern Vietnam close to where Harry and Joel had made landfall earlier.

A monsoon depression (which later became Melissa) formed on 10 September in the Marshall Islands. The large circulation of Melissa at one point covered a substantial portion of the western North Pacific basin from 180°E to the Philippines. Melissa moved on a north-oriented "S-shaped" track. It recurved southeast of Hokkaido, Japan, on 19 September and became extratropical.

By mid-September, a reverse-oriented monsoon trough stretched from the South China Sea, east-northeastwards into the cloud bands south of Melissa's large circulation. Nat formed in the Philippine Sea along the axis of this monsoon trough and moved eastward following an "S-shaped" track: initially moving eastward, it turned northward along 150°E, and recurved near 30°N. Nat dissipated over water on 22 September. On 18 September, another tropical disturbance formed in the Philippine Sea along the monsoon trough axis in approximately the same location where Nat originated. This tropical disturbance became Orchid. Like Nat, Orchid initially moved eastward followed by a turn to the north. Orchid became the fourth super typhoon of 1994 on 10 September. It accelerated toward the north-northeast on 28 September and made landfall on the Japanese main island of Shikoku the next day.

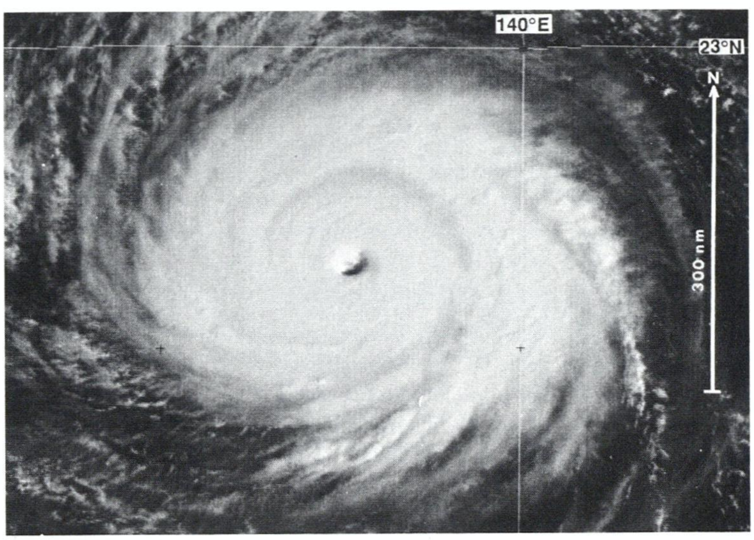
As Orchid intensified, two more tropical disturbances formed to its east along the monsoon trough axis – Pat and Ruth. Together they underwent a binary interaction. During the night of 26 September, Pat and Ruth merged to become one tropical cyclone. The merged Pat and Ruth recurved and dissipated over open water on 28 September. The next day, Tropical Depression 31W developed near 22°N ; 150°E in association with a TUTT cell. It dissipated over water on 03 October.

OCTOBER

The fourth consecutive month of above normal tropical cyclone activity in the western North Pacific basin had five typhoons, one of them a super typhoon, and two tropical storms. The tropical cyclones of October were notable for their longevity: three of the seven longest-lived tropical cyclones of 1994 occurred. Verne, for example, persisted for more than half the month, and required 66 warnings.

On the first day of the month, the tropical disturbance that became Seth formed in the Marshall Islands. This disturbance moved toward the west-northwest, intensified, and passed south of Guam as a tropical storm on 05 October. Seth reached a peak intensity of 120 knots (62 m/sec) while southeast of Taiwan on 07 October. It later skirted the northeastern tip of Taiwan, recurved along the China coast south of Shanghai, and went ashore in Korea where wind gusts to near 70 knots (36 m/sec) and rainfall in excess of 300 mm (11.8 inches) were experienced. Seth became extratropical in the Sea of Japan on 11 October.

The three days (12-14 October) were the only days during the month without a tropical cyclone active in the western North Pacific basin. During the period 15 to 20 October, three tropical cyclones – Teresa , Verne, and Wilda – formed in a monsoon trough which stretched east-west across Micronesia. On 21 October, the westernmost of the three, Teresa,



roofs from houses. Eleven people were injured in typhoon-related accidents. Wilda then moved turned north-northeastward and moved on an unusual "S-shaped" track. It was accelerating into the mid latitudes on the last day of the month.

Toward the end of the month, a tropical disturbance developed east of the international date line at relatively high latitude (25°N), in direct association with a TUTT cell. This disturbance moved rapidly westward, crossed the international date line, and became Yuri (36W) on 24 October. Yuri slowed, turned north, and dissipated over water on 27 October.

Finally, Zelda formed and spent the majority of its life in November. As Verne and Wilda were undergoing extratropical transition on the last day of October, Zelda (37W) was intensifying near 10°N ; 150°E.

NOVEMBER

Zelda was located southeast of Guam and intensifying as the month of November began. It became a typhoon on 02 November, moved west-northwestward and passed directly over Anatahan (a small island of the Northern Marianas located about 70 nm (130 km) north of Saipan). The large eye of Zelda passed over Anatahan where the homes and crops of the 39 residents were devastated. On 05 November, Zelda reached peak intensity of 135 knots (69 m/sec), making it the sixth and final super typhoon of 1994. Zelda recurved and dissipated over water south of Japan on 08 November.

Despite the presence of a near-equatorial trough, and westerly low-level winds extending to the international date line, deep convection was largely absent over most of the area, and no significant tropical cyclones formed in the western North Pacific basin during November.

DECEMBER

The first half of December was very quiet, continuing the break in tropical cyclone activity that began in early November. Amounts of deep convection began to increase in the Marshall Islands during mid-December in association with a twin-trough monsoon flow pattern. Two tropical cyclones – Axel (38W) and Bobbie (39W) – began as tropical disturbances that formed in the Marshall Islands in the near-equatorial trough of the northern hemisphere. On 16 December, Axel reached minimal tropical storm intensity while passing well south of Guam. Moving steadily westward along about 10°N, Axel crossed through the Philippine Archipelago on 21 December where at least 12 people died.

While Axel was intensifying in the Philippine Sea on 17 December, the final tropical cyclone of 1994, Bobbie was forming in the southern Marshall Islands. Bobbie moved toward the west-northwest, and reached peak intensity of 50 knots (26 m/sec) on 22 December. On 23 December, it passed north of Saipan with winds of 45 knots (23 m/sec). Bobbie had no significant impact on Saipan or on other islands of the Northern Marianas. On Christmas Day, Bobbie dissipated as a significant tropical cyclone, closing out the 1994 tropical cyclone season. The remainder of December was quiet, as deep convection and tropical cyclone activity shifted to the southern hemisphere.

Twenty-three of the 41 significant tropical cyclones in the western North Pacific basin during 1994 made landfall in Asia. The Philippine islands were especially hard hit with eight significant landfalling tropical cyclones. Other countries, Taiwan, Korea, China, Japan, experiencing significant impacts from landfalling tropical cyclone. The Ryukyu Islands experienced three major typhoons passing through the southern end of this island chain, Vietnam (four significant landfalling tropical cyclones), and the islands of Micronesia (Saipan and Anatahan of the Northern Mariana island group were severely impacted by Zelda. The greatest loss of life occurred in southern China where the landfall of typhoons Russ and Sharon, and Tropical Depression 07W contributed to widespread flooding that left more than 1,400 people dead. The damage, which included the destruction of nearly one million houses in southern China, was estimated in excess of US$6 billion. Loss of life also occurred in the Philippines and Taiwan. The greatest loss of life at sea occurred when a Maltese oil tanker, the ***Thanassis A***, sank in the South China Sea in heavy seas associated with Teresa (34W) and the northeast monsoon. Seventeen people were reported to be dead or missing and nineteen other crew members were rescued.

Heavy Weather Avoidance A Mariner's Perspective

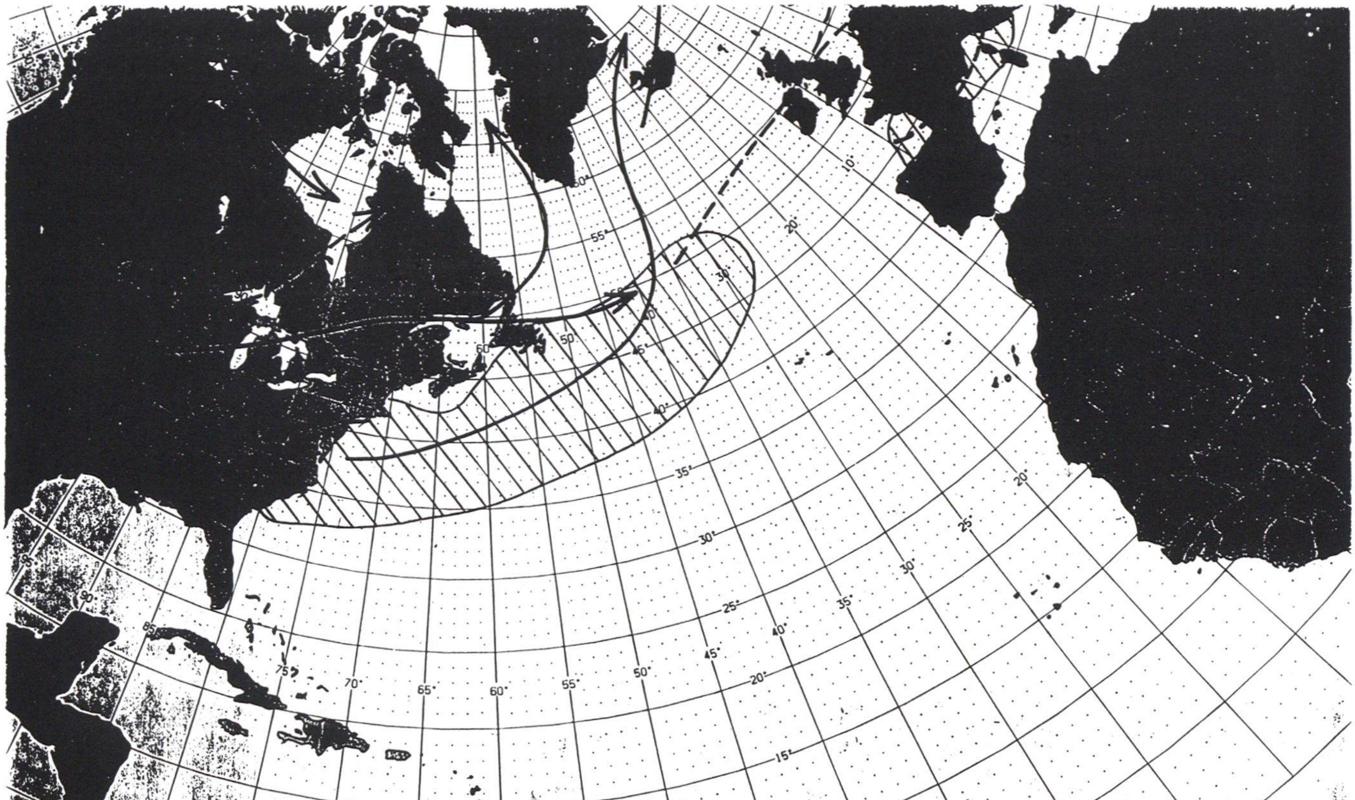
Part 2

Glen Paine
Maritime Institute of Technology and Graduate Studies

The National Weather Service's (NWS) upper–air or 500 millibar charts, broadcasted via radio fax (for the North Pacific and the North Atlantic), provides mariners with detailed information concerning meteorological conditions at the 500 millibar level in the atmosphere. The Winter 1995 issue of the *Mariners Weather Log* previously discussed some of the practical benefits of these charts[1]. This article illustrates another example of how to incorporate the 500 millibar charts into vessel–routing decisions.

Generally, westbound vessels in the North Atlantic (from the English Channel to the United States) find it difficult to stay north of the oncoming surface lows. Geography, icebergs, and historical storm tracks[2] (see below) play major roles in limiting a vessel's routing options. Unable to take advantage of following winds and seas above the low, the vessel may have to transit well south to avoid harsh head wind and sea conditions. The drawback, of course, is the extra cost associated with the longer tracks.

However, even in the North Atlantic, there are



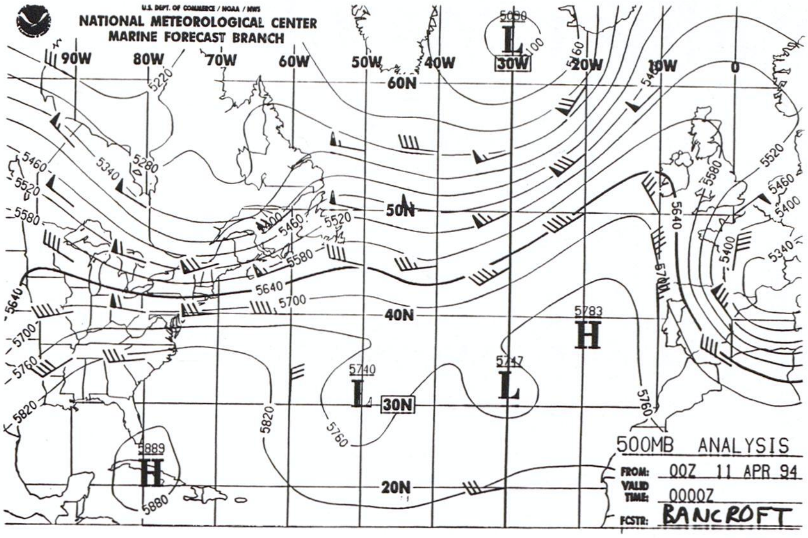


Figure 1

times when a westbound vessel can take advantage of the favorable conditions on "top" of the lows. The 500 millibar analysis and prognosis (prog) charts provide valuable information for determining when conditions are favorable for this type of routing.

NWS's 500 millibar analysis for the upper air conditions at 00Z on April 11, 1994 is shown in figure 1. The highlighted 5,640 contour line[3] depicts the general direction and southernmost extent of storms of force 7 or greater in the winter (force 6 in the summer). Stronger upper-air winds tend to intensify surface conditions. With the higher upper-air winds concentrated north of 40°N, (across most of the North Atlantic) it is unlikely that a westbound vessel will be able to transit at a latitude high enough to "top" the oncoming lows. This 500 millibar pattern is the type that would generate the storm tracks illustrated on the previous page.

Figure 2 (the +48hr prog valid at 00Z, on April 13, 1994), predicts some changes in the upper-air pattern. Notice the short-wave trough[4] pushing the 5,640 contour line south of 40°N near 45°W, and north[5] near 20°W. This upper-air pattern will tend to change the surface storm track from a zonal to a more meridional[6] direction.

Two days later, the +96hr prog (figure 3, valid at 00Z, for April 15, 1994), predicts further changes in the upper-air pattern. The upper-air wind flow has split near 55°W. This creates one storm track heading north of 60N, and a second one diving south of 30N. An upper-air low is also predicted to form near 40N, 40W. This usually means a low has been established on the surface somewhat to the east of the upper air low. The stronger winds to the west of the upper-air low (near 50°W) will probably mean the southerly storm track will push even farther southward.

A vessel departing the English Channel around April 11, 1994, would initially be under the influence of the upper-air ridge. The ridge should create favorable surface wind and sea conditions. From this point the vessel should head for a point just north of the upper-air low (about 40°N, 40°W) predicted to form by the 15th.

At first glance, the 500 millibar prog for the 13th seems to indicate that the vessel should head farther south to avoid the head westerlies generated by the short-wave trough near 50°W (figure 3). However, the vessel should not change its original track since the +96hr prog predicts a split to

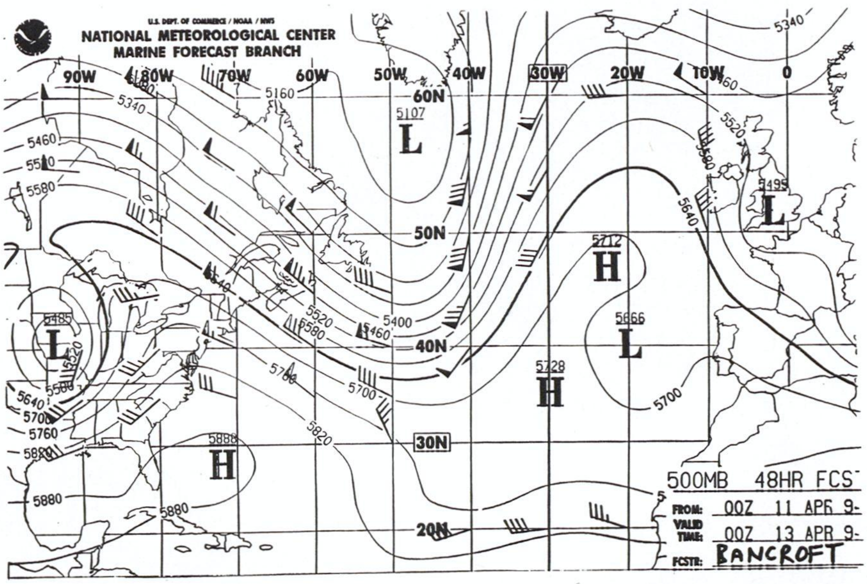


Figure 2

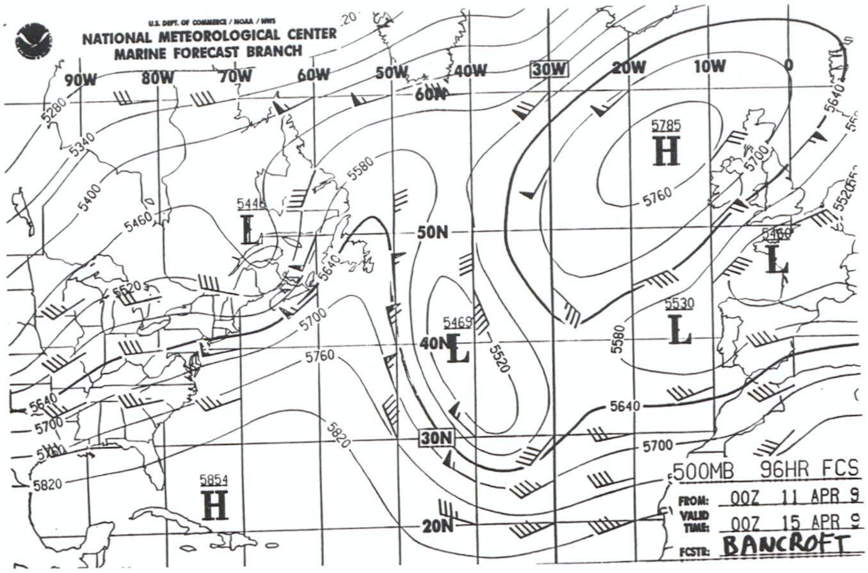


Figure 3

occur in the upper–air wind flow. The split near 50°W, by the 15th (figure 2), will allow the vessel to take advantage of the wind flow around the newly formed low (that is directly south), and to avoid the northeastward moving storm track that is heading north of 60°N, 60°W.

After the 15th the vessel should be approaching the upper-air ridge near 50°W. With the storm track well to the north, the vessel should be able to avoid severe weather for the rest of the trip.

An examination of NWS's surface analysis[7] and progs for the same valid times confirms this route. The surface analysis chart for 00Z, April 11, 1994, (figure 4) depicts a high pressure system moving towards the coast of Europe. A 20 to 25–knot vessel should be able to stay south of the high and take advantage of the beam to following wind conditions.

By the 13th, our vessel may be experiencing fairly strong beam winds and seas as it approaches the cold front near 40°W (see figure 5, the +48hr surface prog valid for 00Z, April 13, 1994). Note that the surface prog is predicting a new low to form south of us by the 14th near 32°N, 38°W.

By the 15th, our vessel should be north of the new 1002 low (located near 32°N, 32°W), and handling quartering wind conditions (figure 6). As the ship moves over the top of this low, it will move into the 1030 high pressure system. This places the vessel well south the upper–air storm track to the west.

This routing decision is highly dependent on the weather forecasts. Figure 7 is the actual 500MB analysis for 00Z April 15, 1994. Note how similar it is to the prognosis chart issued four days earlier for the same valid time (figure 3).

As with any routing decision, this article assumes the vessel is seaworthy, and has the speed/power to take advantage of the weather situation. The initial routing decision should always be based on all available resources such as the vessel's routing service/computer, and checked daily with the updated NWS radio facsimile charts. Many other factors such as oceanic currents, ice, fog, vessel, and navigational restrictions will also influence results.

The 500 millibar is not a panacea. It is, however, an extremely powerful tool for assessing future surface storm move-

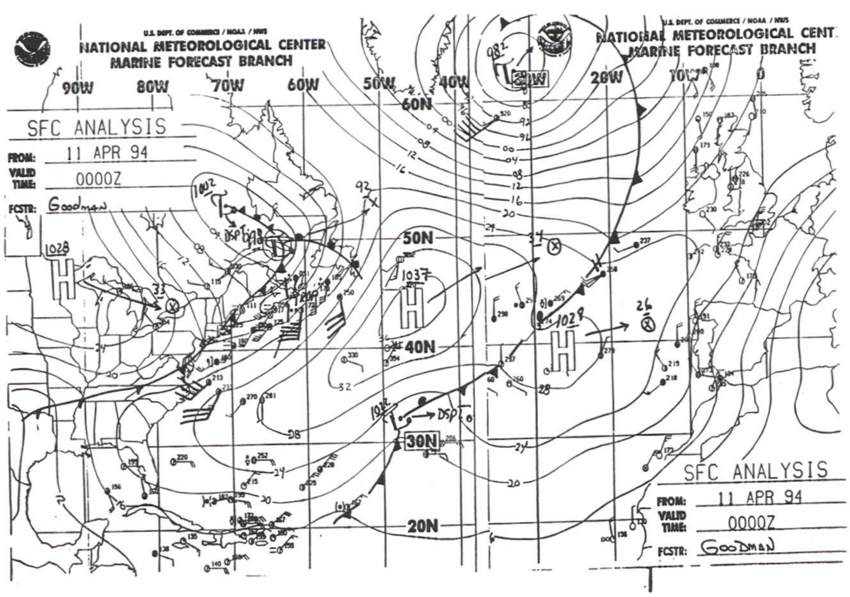


Figure 4

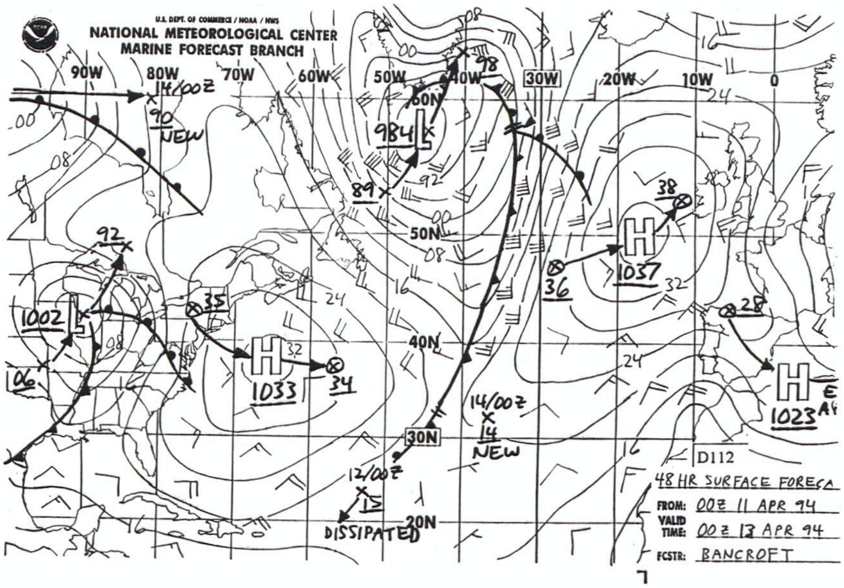
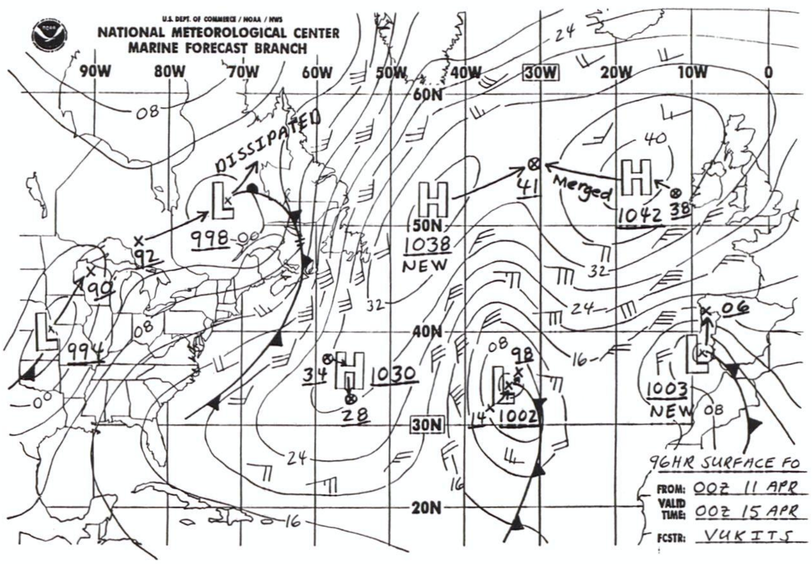
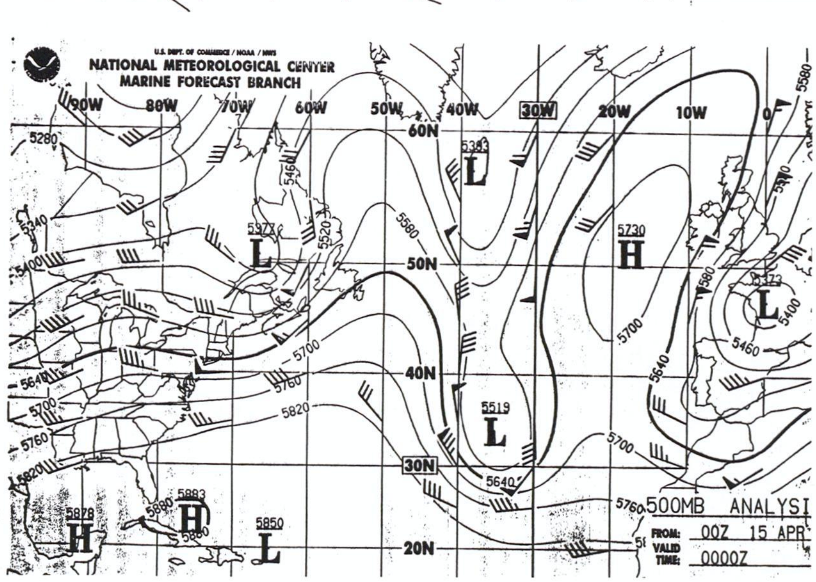


Figure 5, 6 and 7





ments, intensification, and wind direction/ speed. When combined with the other available tools, routing decisions can be measurably improved.

[1]*Paine, G. (Winter, 1995). "Heavy Weather Avoidance."* Mariners Weather Log, *39(1), 16-19.*

[2]*Diagram is a compilation of storm track data generated by the U.S. Naval Atlantic Meteorology and Oceanography Center, in Norfolk, Virginia.*

[3]*Height contour lines on the 500 millibar chart define the altitude (in meters) at which the pressure is equal to 500 millibars. Studies have shown that surface features are significantly influenced by the meteorological conditions in the upper-air. For more information see "Mariner's Guide to the 500-Millibar Chart" by Sienkiewicz, and Chesneau,* Mariners Weather Log, *Winter 1995, vol 39 (1), p. 4-14.*

[4]*A short-wave trough creates a counterclockwise change in the direction of the height contours. Its width is usually less than 50 degrees of longitude. Counter-clockwise wind rotation encourages surface low development and intensification.*

[5] *A ridge creates a clockwise change in the direction of the height contours. Clockwise wind flow in the upper air promotes surface high developments.*

[6]*Meridional pattern indicates a north-south or south-north direction of movement.*

[7]*NWS surface analyses also display the estimate +24hr central pressure and position of significant lows and highs. The prognosis charts actually display three different central pressures and position for each significant low and high. (the position 24 hours previous to valid time of chart, the actual valid time position, and the position 24 hours after the valid time).*

Readers can call Glen at 410-859-5700, ext. 3259, for more information about uses of the 500 millibar charts.

Texas A & M University at Galveston

Nancy O'Donnell
National Oceanographic Data Center

Students enrolled in the Corps of Cadets at Texas A& M University at Galveston (TAMUG) can hardly ignore their future– docked within walking distance of their classroom is the imposing bulk of the training ship, the ***Texas Clipper***. Farther out off the 13-acre campus on Pelican Island, the shipping channels of Port of Galveston and Port of Houston are busy traffic lanes these cadets may one day be traversing as professional mariners. The salty tang of the ocean permeates the coastal campus of the "Ocean Aggies" providing a fitting background for schooling in maritime careers.

TAMUG, a small and compact campus, is part of the larger College of Geosciences and Maritime Studies at Texas A & M in College Station, Texas. Located on the Mitchell Campus, it is comprised of academic facilities, three dormitories, a student center, classrooms and laboratories, a small boat basin, and a docking area for the Training Ship ***Texas Clipper***. The Jack K. Williams Library contains 43,000 books, 35,000 bound volumes of journals, and a large collection of nautical charts and maps, and marine source material. Founded in 1962, TAMUG merged with Texas A&M University at College in 1992 and the winning combination is making history. Two years later the undergraduate Marine Sciences Department in Galveston merged with the graduate Department of Oceanography in College Station to create a single department spanning both campuses. The campus offers undergraduate degrees in marine Biology, Marine Sciences (Oceanography), Marine Engineering, Transportation and Fisheries. Ocean engineering and Maritime Administration (business) are also offered. Students in the Marine Sciences and Marine Biology disciplines have the option of working towards a U. S. Maritime Service license as an officer of the American Merchant Marine.

Texas Institute of Oceanography (TIO) also on the Galveston campus focuses on important research of the Gulf Coast by working with scientists at Texas universities to provide the research and technical base for the development of marine-related businesses in the State of Texas and the Gulf of Mexico.

In TIO literature it takes special note of the words of historian Will Durant: "Civilization exists by geological consent, subject to change without notice," and in light of that warning TIO has concentrated important work on climate change.

Since the ocean plays a major role in the climate system by "removing about one-half of the man-made carbon dioxide released into the atmosphere each year," TIO students look at how human activities and natural forces influence climate and affect consequences. Global warming with its potential to destroy or damage wetlands and estaurine systems with its rising waters is an important area of study. TIO scientists have proved that a higher sea surface will magnify storm surges when a hurricane approaches, and the hurricane itself will be stronger because of warmer ocean surface.

Some research initiatives include: acid rain, global warning and policy studies relating to the consequences of both. TIO involvement in climate change resulted in the purchase of a MACSAT real-time satellite imaging computer system for monitoring weather and ocean temperatures.

The effect of human encroachment on seafood is also of concern to TAMUG and projects are under way to develop a new breed of oyster to help Texas seafood industry by building oyster reef substrate utilizing by-products of industrial processes and developing hardier species of oysters.

Today, Texas is the third largest seafood market in the nation.

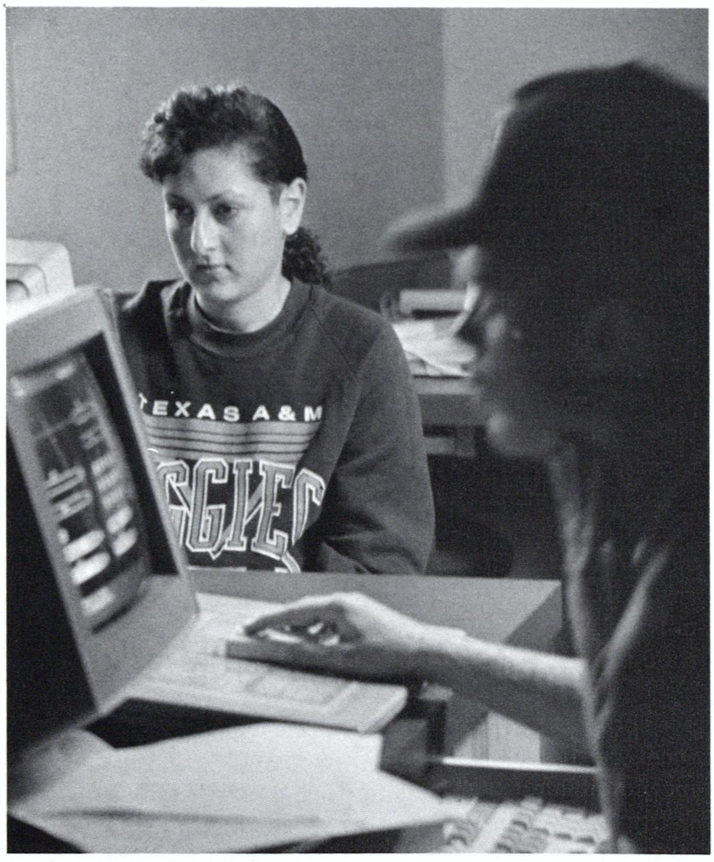
An article in a Texas *Bay Line*, a quarterly publication of the Galveston Bay National Estuary Program, stated that "The amount of seafood produced in 1989 from Galveston Bay was 8,774.5 millions, of which about 1,075.8 million pounds was harvested by the recreational fishery."

While Texas A&M scientists bring real help to surrounding communities in tackling beach erosion, industrial pollution and economic development, their studies have a direct impact on maritime interest nationwide.

In other ways students work on problem solving that will benefit the marine community worldwide. Students study ways to rehabilitate marine wildlife in the wake of disasters using over 1,654 acres of wetlands available nearby as their classroom.

Many mariners return to TAMUG to upgrade their skills. Its continuing education program offers a oil spill simulator and response center and bridge simulator for maritime training. Its Center for Marine Training and Safety provides instruction to maritime professionals of the National Maritime Union and also employees of private companies like Exxon, Shell, and Conoco.

TAMUG is described as a totally ocean-oriented campus, "the window on the Gulf of Mexico," offering academic degrees, research, continuing education programs and public service in all aspects of marine life. It is one of only six state maritime training academies and the only one located on the Gulf of



Above, women now make up over 30% of the Galveston campus studying all subjects with their male counterparts.

TAMUG cadets practice lifesaving techniques in a campus pool. Wearing Gumbeee suits, they re-enact emergency situations where quick thinking and good training can save a life. Photo courtesy of Mark Zegowitz, TAMUG.

Mexico.

TAMUG is especially proud of its U.S Corps of Cadets described as "a learning laboratory for leadership, management, and self-discipline." The current program prepares students to become licensed officers in the U.S. Merchant Marine while majoring in Marine Biology and the Marine Sciences. Students matriculated in Marine Transportation may seek a Third Mate's License while cadets in Marine Engineering may seek a Third Assistant Engineer (Steam and/or Motor Vessels, Unlimited) in the field of marine transportation.

While working on a degree from Texas A&M, students learn how operations, navigation, and maintenance of ocean going vessels. License preparation is for ships of unlimited tonnage operating in any of the worlds' oceans.

At sea training sends cadets on three summer cruises to ports in the U.S., Northern Europe, the Caribbean, and the Mediterranean, to gain practical knowledge of seamanship, navigation, seamanship, rules of the road, cargo and port procedures, and mooring operations. In addition, this "Military unit with muster" completes training in first aid, cardiopulmonary resuscitation techniques, and firefighting.

The Galveston campus boasts a 132% surge in enrollment in the past five years which includes a dramatic increase in women–the Corp of Cadets is well over 30 % female.

Most important to the cadets is their time spent on shipboard training in navigation and seamanship. TAMUG's fleet of ships consists of a 144–meter training Ship, ***Texas Clipper***, to the 15–meter ***Roamin' Empire***, as well as smaller power an sailing boats.

The original training ship T/S ***Texas Clipper*** was built in Bethlehem Steel Shipyard at Sparrows Point, Maryland in 1944 and entered service during WWII as a troop transport named the USS ***Queen.*** Its mission was to bring home troops from the South Pacific and would carry as many as 1500 per trip. After WWII, it was reconverted by American Export Lines, renamed the ***Excambion*** and operated between New York and Europe. In 1965, it was renamed the Training Ship ***Texas Clipper*** and assigned to the Texas Maritime Academy at Galveston where it has remained. This coming year will be a special celebration for the

The life of a cadet involves rigorous fitness training to prepare them for their field training. Each summer cadets sail to summer cruises in the U.S., Northern Europe, the Caribbean, and the Mediterranean to gain practical knowledge of seamanship.

university with the retirement of the original Texas Clipper and the inauguration of the ***Texas Clipper II***, formerly the USNS ***Chauvenet***.

In 1992 the ***Chauvenet***, a 120-meter U.S. Navy hydrographic research ship, was chosen as the replacement for the aging ***Texas Clipper*** which had plied the seas for over 50 years. According to TAMUG archives, the ***Chauvenet*** was named after a Yale graduate, William Chauvenet, who entered the U.S. Navy Schoolmaster system in 1841. A year later, he was in charge of the Naval School in Philadelphia which was established to educate midshipmen and junior officers. Continuing in a long and prestigious career, Chauvenet was appointed to the head of the faculty at the "newly established Naval school" at Annapolis, Maryland, in 1845.

The vessel, built in by Upper Clyde Shipbuilders of Glasgow, Scotland, first went into service in November 1970. The ***Chauvenet*** was designed to support coastal hydrographic surveys. On board were four 10-meter survey launches, two helicopters, a combined naval/civilian hydrographic survey detachment, chart production and printing facilities. A Marine Corps coastal survey complete with their landing vehicles, trucks, and jeeps made up the remainder of its complement. The ***Chauvenet*** is currently undergoing final refitting in Port Arthur, Texas and is slated to dock at the TAMUG dock before summer 1996.

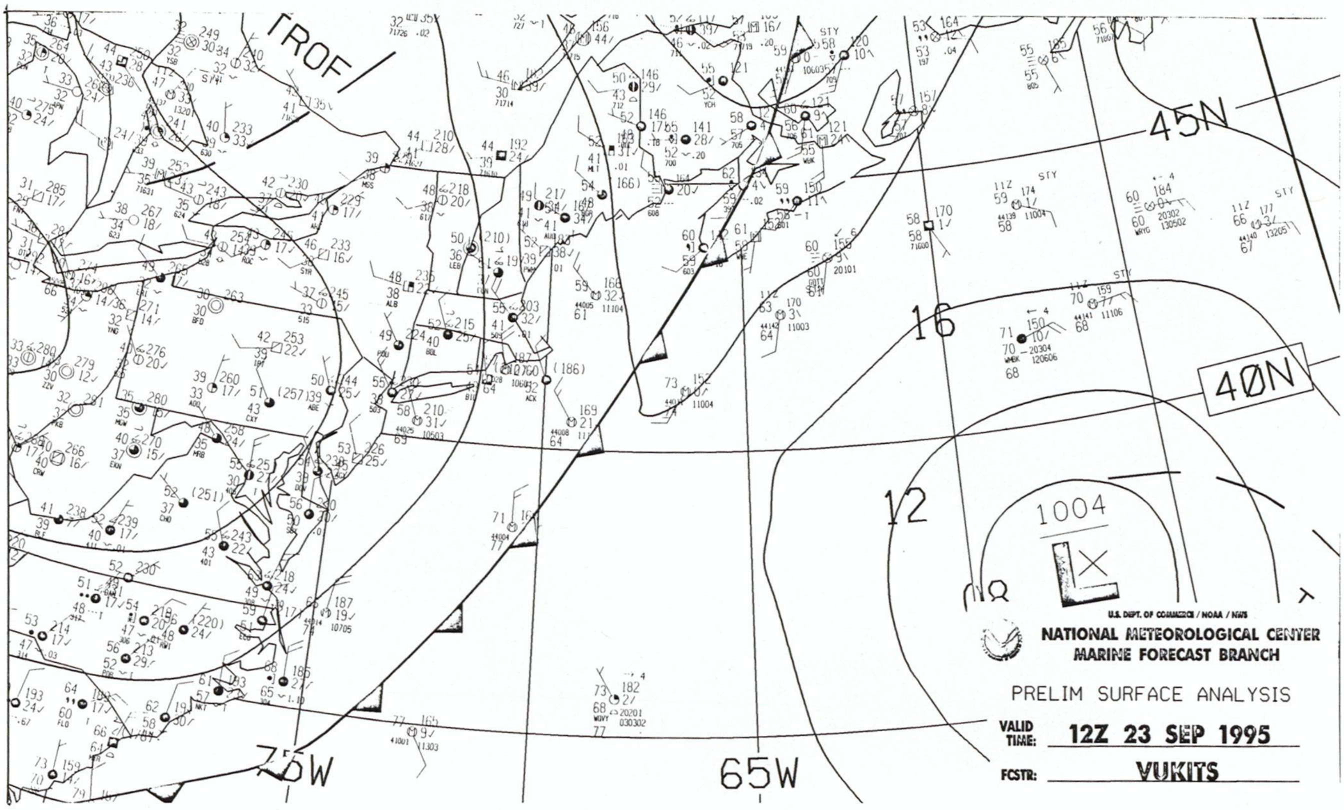
A university education includes far more than the acquisition of job skills. While the location of the TAMUG affords students the opportunity to use the local maritime and marine industries, it is the rigorous Texas A&M program that fully prepares them to serve the maritime needs of the United States into the 21st century.

Special thanks goes to Vince Zegowitz, NOAA National Marine Branch Office; Captain Robert B. Byrne, USMS; Annette Dean and Mark Zegowitz of Texas A&M University at Galveston.

This vessel, served for many years as TAMUG's floating university. It will soon be replaced by a newer version built by Upper Clyde Shipbuilders of Glasgow, Scotland. The future **Texas Clipper** *is currently berthed in Port Arthur, Texas.*

Expanded High Seas Atlantic HF Radiofacisimile Broadcast

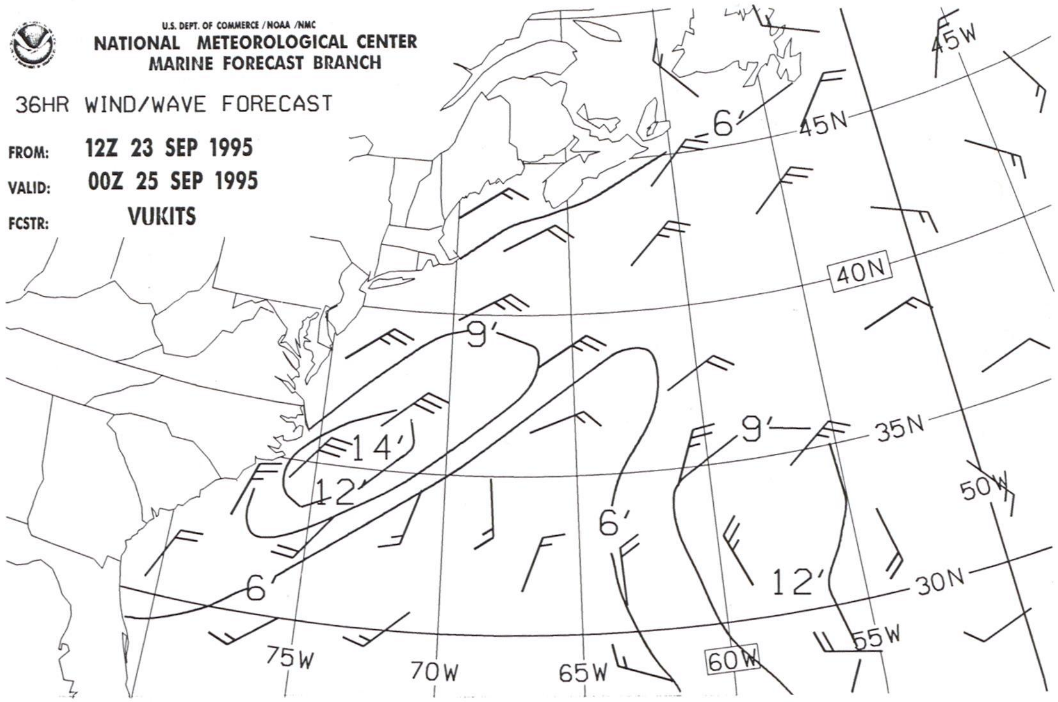
Lee Chesneau
Marine Forecast Branch, NWS



On August 1, 1995, the Marine Forecast Branch, in cooperation with the U.S. Coast Guard Communications Station, Marsfield, Massachusetts, upgraded and expanded its Atlantic high seas HF Radiofacsimile broadcast. The Coast Guard provided extra time slots allowing for the addition of four regional western Atlantic preliminary surface analyses, two regional western Atlantic 36-hour Surface Forecasts and two regional 36-hour western Atlantic Wind/Wave forecasts. These products complement existing two part coverage of Atlantic Surface Analyses and two 24-hour Surface and Wind/wave forecasts. These products were added to meet the requests of nearshore mariners who operate inside 300 nautical miles of the mid Atlantic and New England coastline.

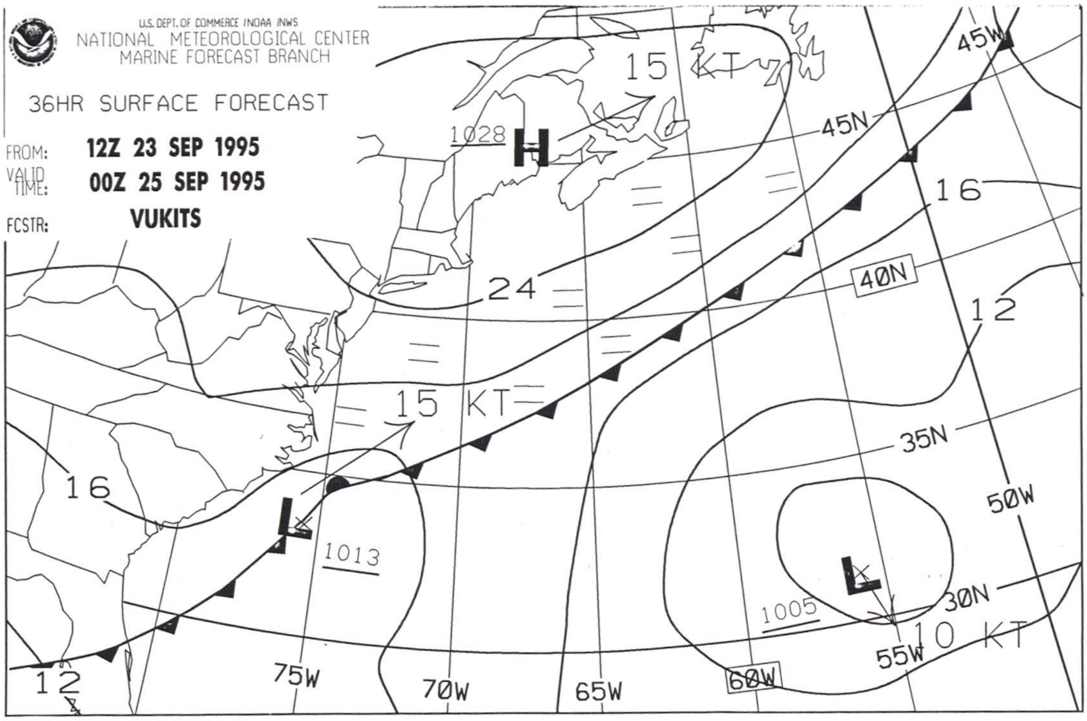
The four regional preliminary Surface Analyses are machine produced. The marine forecaster will manually manipulate or adjust frontal systems, isobars, positioning of highs and lows and alphanumeric text labeling (i.e., tropical cyclones) as required. Automated surface observations including land stations, ship reports, and buoys are also plotted. The preliminary Surface Analyses reflect synoptic conditions every 6-hrs., just as the two part oceanic Surface Analyses of the Atlantic transmitted one to two hours later.

The addition of the 36-hours Surface and Wind/Wave Forecast to the 24-hour products provides continuity of smaller scale synoptic conditions which impact marine users operating in coastal and offshore areas. Now mariners will be forewarned of events such as the Gulf Stream's North Wall episodes (extreme winds and seas). These episodes are highlighted in an effort to better pinpoints dangerous mesoscale marine events extending over relatively larger distances.



36-hr. wind/wave and 36 hr. surface forecast charts (top). These products depict isopleths of significant wave height in increments of .9144 meters, wind direction and speed barbs of every 5 knots. The surface pressure forecast (bottom) shows major low and high pressure systems and their central pressure values in millibars, category of systems, i.e. "gale" or "storm," system direction and speed of movement, along with associated frontal systems.

These Western Atlantic products are also consistent with the needs of coastal and offshore areas marine customers who were familiar with the earlier radiofacsimile broadcast prepared by the NWS Forecast Office in the old Boston office. The Marine Prediction Center (formerly the National Meteorological Center) Camp Springs, Maryland assumed forecast responsibility from the NWS WSFO Boston in January 1993. In addition to the regional area of coverage, the broadcast has been expanded to serve the wide variety of maritime customers engaged in transoceanic voyages.



Comments on schedule or quality of charts are welcomed. Please write the National Weather Service, Marine Forecast Branch, WWBG, Room 410, 5200 Auth Road, Washington, D.C. 20233. Or call (301) 763-8441 (8442). Fax (301) 899-8903 e-mail: dfeit@smtp-gate.ssmc.noaa.gov

UNITED STATES COAST GUARD
NATIONAL WEATHER SERVICE
MARINE RADIOFACSIMILE SCHEDULE
NMF–USCG MARSHFIELD, MA

6340.5, 12750 kHz (CONTINUOUSLY)

Effective August 1, 1995

TIME (UTC)	PRODUCT		VALID TIME
0230/1430	Test Pattern (Start of Broadcast)		
0233/1433	Preliminary Surface Analysis Area 1		0000/1200
0243/----	FAX Schedule Part 1		
0254/----	FAX Schedule Part 2		
0305/----	Request for Comments		
0315/----	Product Notice Bulletin		
----/1443	96 HR 500 Millibar Forecast	Area 4	0000
----/1453	96 HR Surface Forecast	Area 4	0000
----/1503	Satellite Image	Area 5	1200
----/1515	Sea State Anal (Meters)	Area 4	1200
0325/1525	Surface Analysis (E ATLC) Area 2		0000/1200
0338/1538	Surface Analysis (W ATLC)	Area 3	0000/1200
0351/----	Satellite Image	Area 5	0000
----/1551	End of Broadcast		
----/1720	Test Pattern (Start of Broadcast)		
0402/1723	Surface Analysis (E ATLC) Area 2		0000/1200
0415/1736	Surface Analysis (W ATLC)	Area 3	00001200
0428/1729	500 Millibar Analysis	Area 4	0000/1200
0438/1759	End of Broadcast		
----/1900	Test Pattern (Start of Broadcast)		
----/1903	Fax Schedule Part 1		
----/1914	Fax Schedule Part 2		
----/1925	Request for Comments/Product Notice Bulletin		
----/1935	Gulf Stream Analysis	Areas 7, 8	Latest
----/1945	Gulf Stream Anal (Part A) Areas 9, 10		Latest
----/1955	Gulf Stream Anal (Part B) Areas 7, 11, 12		Latest
0800/----	Test Pattern (Start of Broadcast)		
0805/2005	Preliminary Surface Analysis	Area 1	0600/1800
0815/2015	24 HR Surface Forecast	Area 1	0000/1200
0825/2025	24 HR Wind/Wave Forecast	Area 1	0000/1200
0835/2035	36 HR Surface Forecast	Area 1	1200/0000
0845/2045	36 HR Winde/Wave Forecast	Area 1	1200/0000
0855/2055	48 HR Surface Forecast	Area 4	0000/1200
0905/2105	48 HR Sea State Forecast	Area 4	0000/1200
0915/2115	48 HR 500 Millibar Forecast	Area 4	0000/1200
0925/2125	Surface Analysis (E ATLC)	Area 2	0600/1800
0938/2138	Surface Analysis (W ATLC)	Area 3	0600/1800
0951/2151	Satellite Imagery (ECI)	Area 6	0600/1800
1002/2202	Surface Analysis (E ATLC)	Area 2	0600/1800
1015/2215	Surface Analysis (W ATLC)	Area 3	0600/1800
1028/2228	End of Broadcast		

AREAS:

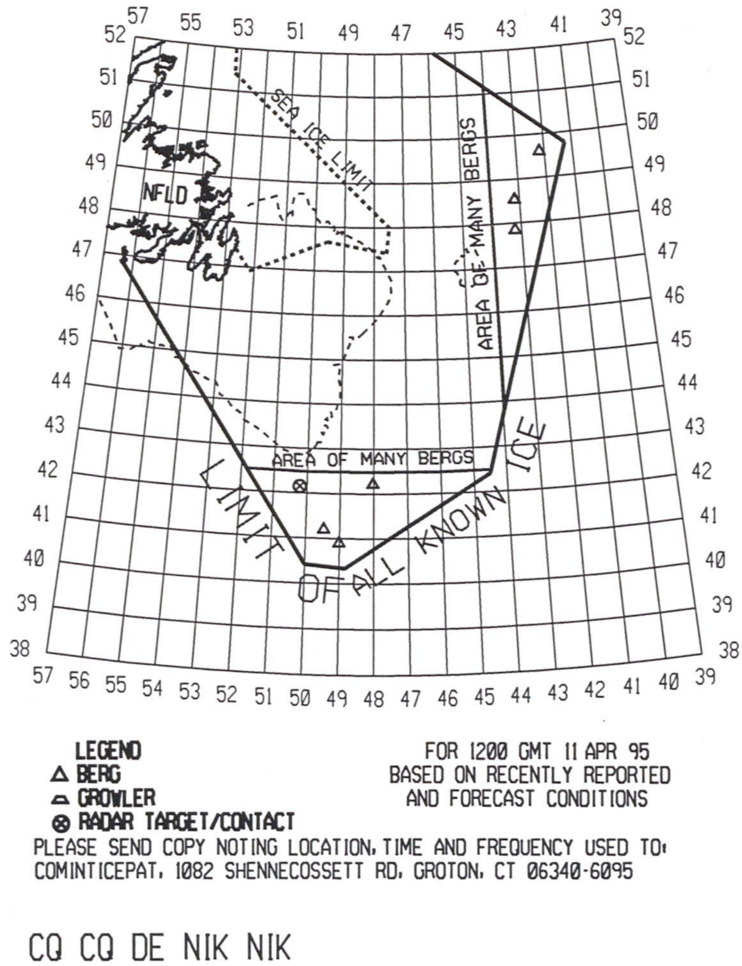
1– (28°N - 52°N, 45°W, 85°W)
2 - (15°N - 65°N, 10°E, 45°W)
3 - (15°N - 65°N, 40° - 95°W)
4 - (15°N - 65°N, 10°E - 95°W)
5 - (20°N - 55°N, 55°W - 95°W)
6 - (00- 60°N, 30°W - 100°W)
7 - (32°N - 50°N, 43°W - 80°W)
8 - (18°N - 38°N, 62°W - 98°W)
9 - (32°N - 50°N, 43°W - 80°W)
10- (18°N - 39°N, 65°W - 82°W)
11 - (30°N - 40°N, 65°W - 82°W)
12 - (33°N 47°N, 65°W - 77°W)

Tracking Iceberg Danger

R. Tuxhorn
Commander, International Ice Patrol

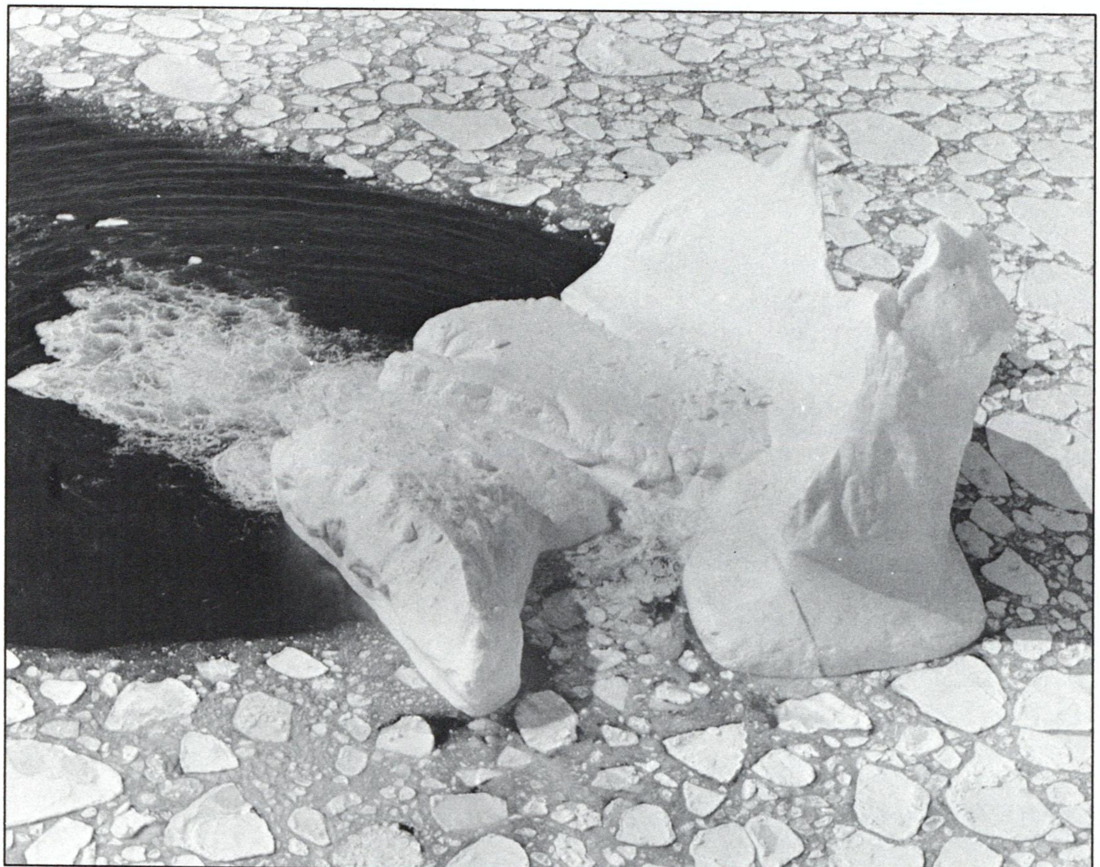
From March through July each year, U.S. Coast Guard aircraft, equipped with forward and side-looking radars, patrol the fog-shrouded and stormy North Atlantic Ocean searching for icebergs. From its beginning shortly after the sinking of the RMS ***Titanic***, International Ice Patrol (IIP), which is part of the U.S. Coast Guard, has been responsible for guarding the southeastern, southern, and southwestern limits of all known ice in the vicinity of the trans-Atlantic shipping lanes, and warning mariners of the location of icebergs that threaten safe navigation. The Ice Patrol service is managed by the United States Government under the terms of the International Convention for the Safety of Life at Sea (SOLAS).

The combination of persistent fog and the fact that icebergs are notoriously bad radar targets make navigating near the Grand Banks particularly worrisome in the spring and early summer. Ships' radars can usually detect large icebergs, such as might displace several hundred thousand tons. Small icebergs and growlers, the smallest size class, are another matter. A growler, which might displace a few thousand tons, is not a very impressive piece of ice, but it could inflict serious damage on any vessel unfortunate enough to strike it. In a significant seaway, say 3-4 meters, growlers are difficult to detect on radar.



Ice Patrol's primary goal is to define the limits of all known ice as accurately as possible, neither underestimating nor overestimating the extent of the iceberg threat. To do this, Ice Patrol seeks iceberg reports from many sources and undertakes its own aerial reconnaissance. Data sources include North Atlantic shipping and aerial reconnaissance conducted by and for several Canadian government agencies.

Despite extensive aerial reconnaissance, the large size of IIP's operations area prevents frequent and complete coverage of



International Ice Patrol archive photograph.

the entire areas where icebergs may be found. Our reconnaissance concentrates on the southern and eastern limits of the iceberg's extreme range while Canadian reconnaissance flights concentrate on the waters of their nation's coastal economic zone. This leaves wide areas that are not frequently visited. While we do not encourage vessels to transit through areas containing icebergs, and in fact recommend against it, we depend heavily on the cooperation and assistance of shipping in the Grand Banks area for iceberg and sea surface temperature reports.

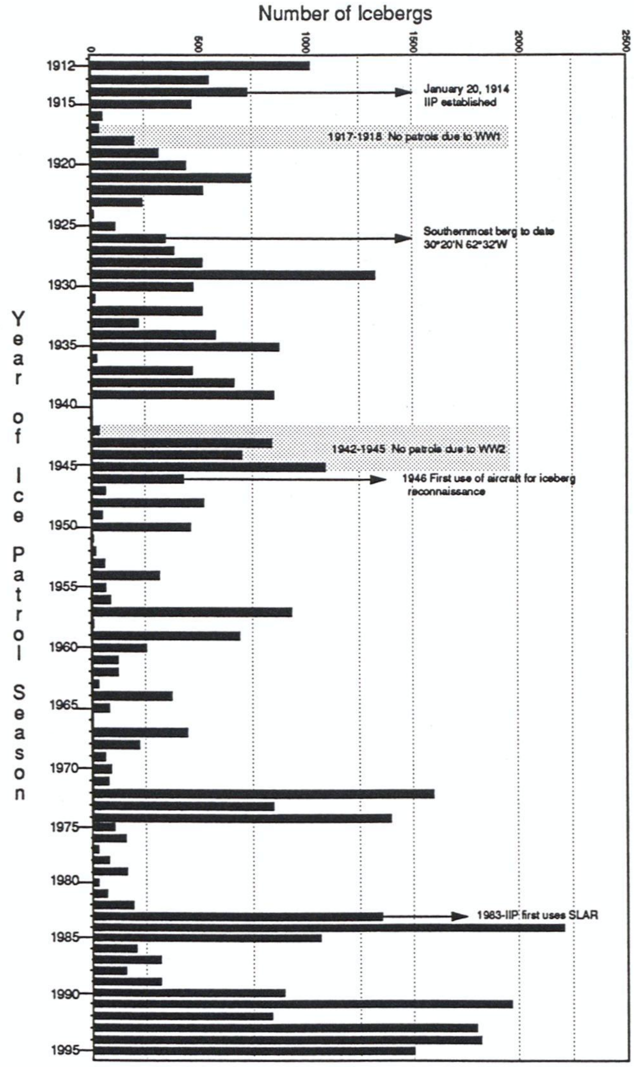
All iceberg sighting reports are forwarded to the IIP Operations Center in Groton, Connecticut where they are entered into a computer model that predicts iceberg drift. The ship reports are used to identify previously detected icebergs, confirm the position of icebergs already on IIP's plot, and to identify ice free areas. Sea surface temperature data help Ice Patrol estimate the deterioration of all the icebergs being tracked.

Ship reports usually account for 20–40% of the icebergs entered into IIP's drift model each year. For example, 19.5% of the 9446 iceberg targets entered in 1994 were provided by shipping. Reports from ships account for a significant number of iceberg sightings near the limits. These reports came from 303 ships of 45 different nations, a clear indication of support and importance that the international shipping community attaches to Ice Patrol's efforts.

Each year IIP recognizes the ship that provided the most ice reports during the iceberg season. In 1994, that award went to the m/v ***Atlant I***; the results of the 1995 season are currently being tabulated.

*The m/v **Atlant I**, a Croatian flag ship, received the '94 IIP award for 65 ice reports and 50 SST reports. Lt to rt. Commander Ross Tuxhorn USCG, Capt. Mato Bajo, Atlant I, Capt. Ivan I. Coric, Atlantic Conbulk Services.*

Annual Counts of Icebergs Crossing 48° North Latitude (1912-95)



If you are crossing the IIP operations area (40-52°N, 39-57°W) during the iceberg season we ask you to provide us reports containing the following information:

- your ship's name and call sign
- Position of any ice sighted (or vessel position if no ice sighted)
- Time of sighting
- Sighting method (visual, radar or both)
- Size and shape of iceberg
- Concentration and thickness of any sea ice present
- Sea surface temperature

Negative sighting reports with visibility limits are just as important as positive ones. A report of a stationary radar target is also important because these sometimes turn out to be large or medium icebergs. Reports can be made to any Canadian Coast Guard Marine Radio Station or U.S. Coast Guard Communications Station on the frequencies listed in Pub. 117 (Radio Navigational Aids), or directly to IIP using INMARSAT code 42 at no cost.

Using the results of the drift model, Ice Patrol determines the limits of all known ice and informs mariners of its location by transmitting a wide variety of products. During the iceberg season a daily facsimile chart is broadcast from U.S. Coast Guard Communications Station Boston. Twice daily bulletins describing the limits of all known ice are also broadcast to the mariner over the INMARSAT-C Safety NET and by high frequency radio. Trans-Atlantic mariners must extreme caution while passing through the dangerous waters of the western north Atlantic. IIP will continue to do its part to prevent loss of life or property due to encounters with icebergs by providing mariners with timely and accurate iceberg warnings. A complete description of the ice limit broadcasts may be obtained from the International Ice Patrol Announcement of Services.

In a typical season about 400 icebergs drift south across 48°N latitude, and becomes a threat to trans-Atlantic shipping. However, like the weather, the typical rarely happens. There is extraordinary variability in the number of icebergs passing south of 48°N, ranging from none to 1966 to 2202 in 1984. Amidst this variability, however, there seems to be a recent trend toward severe seasons. Thus far, all the season in the 1990s have been in the extreme severity class (600 icebergs passing south of the 48°N). In four of the last five years the count exceeded 1000.

Careful examinations of the data since 1963, conducted by Dr. John Marko of ASL Environmental Sciences, Inc. of Vancouver, B.C. and later by Lieutenant Geoffrey Trivers of IIP, reveal that the variability in the iceberg counts is consistent with the variability of the extent of the sea ice off of eastern Canada. This relationship makes considerable physical sense because large concentrations of sea ice protect icebergs from destruction as they move southward. Thus, larger numbers of icebergs survive their long journey to the shipping lanes. It seems, therefore, that the observed trend toward more severe iceberg seasons in the 1990s is real.

History suggests that periods of heavy years are sometimes followed by light years. However, all efforts to explain the observed variability in the icebergs counts in terms of climatological variables have failed. Similarly, efforts to develop long range predictive capability for iceberg season severity have met little success. It is left to the mariner and the International Ice Patrol to maintain continued and keen vigilance.

Announcement of 1995 International Ice Patrol Service

Table 1 — IIP Broadcasts

BROADCAST STATION	Time of Broadcast (z)	Frequencies (kHz)
NAVTEX BROADCAST		
U.S. Coast Guard Communication Station Boston/NIK	0045, 0445 1845, 1245 1645, 2045	518
Canadian CG Radio Station Sydney/VCO	1820	518
(Primarily sea ice in Gulf of St. Lawrence and North. Limits of icebergs sometimes given.)		
NBDP (FEC) BROADCAST		
U.S. Coast Guard Communication Station Boston/NIK	0030 1218	6314, 8416.5, 12579 8416.5, 12579, 16806.5
Canadian Coast Guard Marine Radio Station Halifax/VCS	0630 1630 2300	4213.5 8419.5 4213.5
CW BROADCASTS (On or about 1 April 1995, the U.S. Coast Guard will cease all CW broadcasts)		
U.S. Coast Guard Communication (Bcst to follow NBDP bcst)	0050 1250	5320, 8502, 12750 8502, 12750
Canadian Forces METOC Centre Halifax/CFH	0015, 1101 1201, 1301 2201, 2301	122.5 Continuous (off air 1200-1600 second Thurs. each month) 4271 (2200-(1000 UTC) 6496.4 Continuous 10536 Continuous 13510 (1000-2200 UTC)
Canadian Coast Guard Radio Station Halifax/VCS	1330 2200	4285, 6491.5, 8440 12874, 16948, 22619.5 (Broadcast on frequencies as advertized by CN marked tape)

ROADCAST STATION	Time of Broadcast (z)	Frequencies (kHz)
BLCMP BROADCAST (On or about 1 April 1995, the U.S. Coast Guard will cease as advertised by CN marker tape)		
Norfolk, VA NMN/NAR Radio Station	0800-0900	8090, 12135, 16180
	1500-1600	8090, 12135, 16180, 20225
	1600-1700	8090, 12135, 16180, 20225
	2100-2200	8090, 12135, 16180, 20225
KeyWest, FL/NAR	0800-0900	5870
	1500-1600	5870, 26725
	1600-1700	5870, 26725
	2100-2200	5870, 26725
RADIOFACSIMILE BROADCASTS	Time Z	Frequency kHz
U.S. Coast Guard Communication Station Boston/NIK	1600 1810	6340.5, 12750 (+/-400Hz)
Radio Station Bracknell United Kingdom/GFE (Eastern North Atlantic Sea Ice Observations)	1602	2618.5 (1800-0600 Oct. 1–Mar 31; 1900-0500 Apr 1–30 Sep 4782 Continuous 9203 Continuous 14436 Continuous 18261 (0600-1800 Oct. 1–Mar 31; 0500-1900 Apr 1–30 Sep)
Canadian Forces METOC Centre Halifax/CFH (Primarily Sea ice in Gulf of St. Lawrence and North. Limits of icebergs sometimes given.)	0015, 1101 1301, 1401 2201, 2301	122.5 Continuous (Off air 1200–1600 second Thursday each month) 4271 (2200-1000 UTC) 10536 Continuous 13510 (1000-2200 UTC)

ANNOUNCEMENT of 1995 INTERNATIONAL ICE PATROL SERVICE

The RADIOFACSIMILE chart is now available on an INMARSAT A FAXMAIL SERVER available through the COMSAT Corp. There is no charge for the chart. There is a charge for the telephone call. Telephone charges starts with the first dialing in the access sequence below. COMSAT estimates that the telephone time following the 'fax start' should be about 1 minute. Download specifics are as follows:

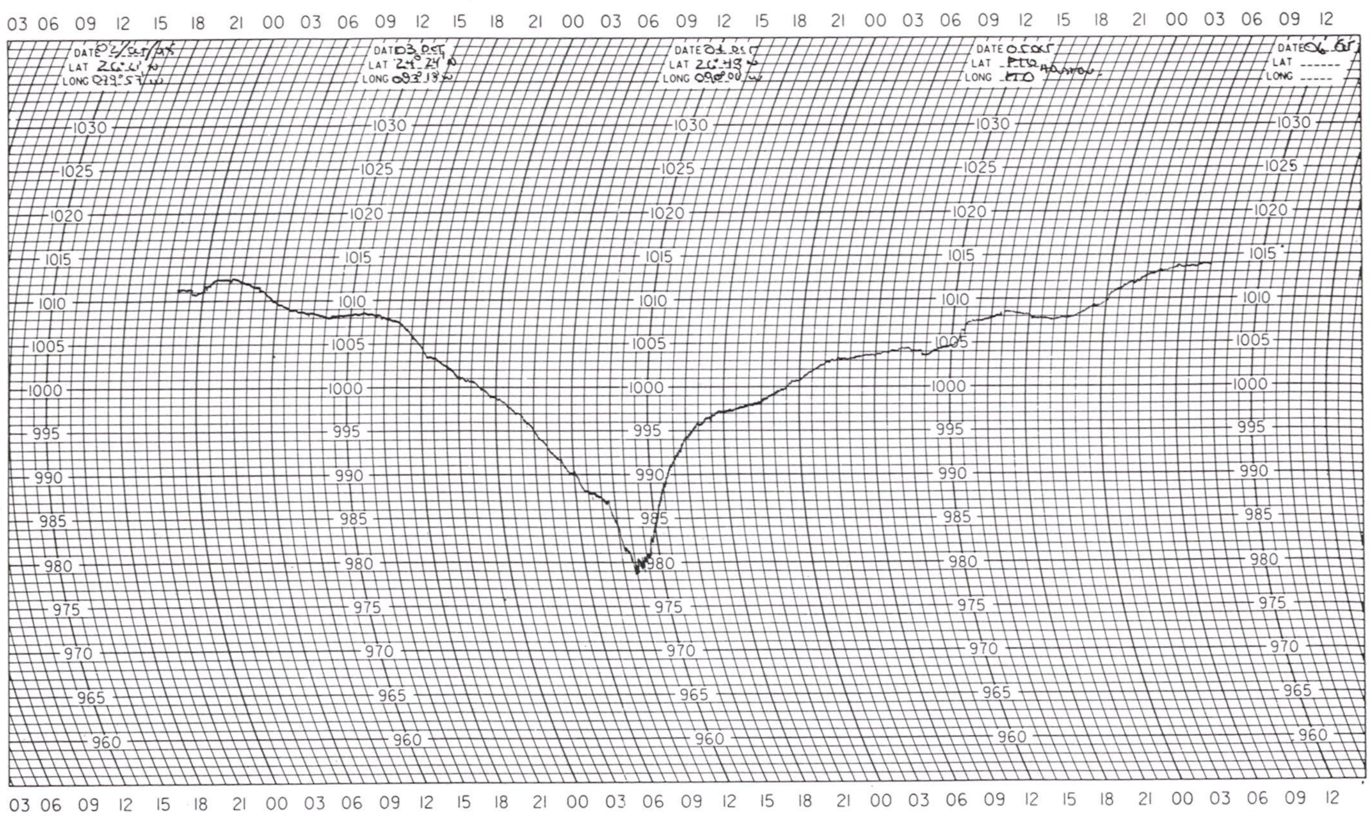
Access CES ID 01
then dial "2050#"
Enter the id number "2130001"
and enter "#"
Enter "7740" and enter "#"
Enter "*29" and enter "#"
After a tone, enter "#",
then hit the fax start button.

INMARSAT SafetyNET BROADCASTS

The OOZ and 12Z Ice Bulletins will be broadcast over the AOR–W Satellite at 00Z and 12Z daily, respectively. In addition, safety broadcasts regarding icebergs outside of the limits of All Known Ice will be sent over the AOR–W Satellite upon receipt.

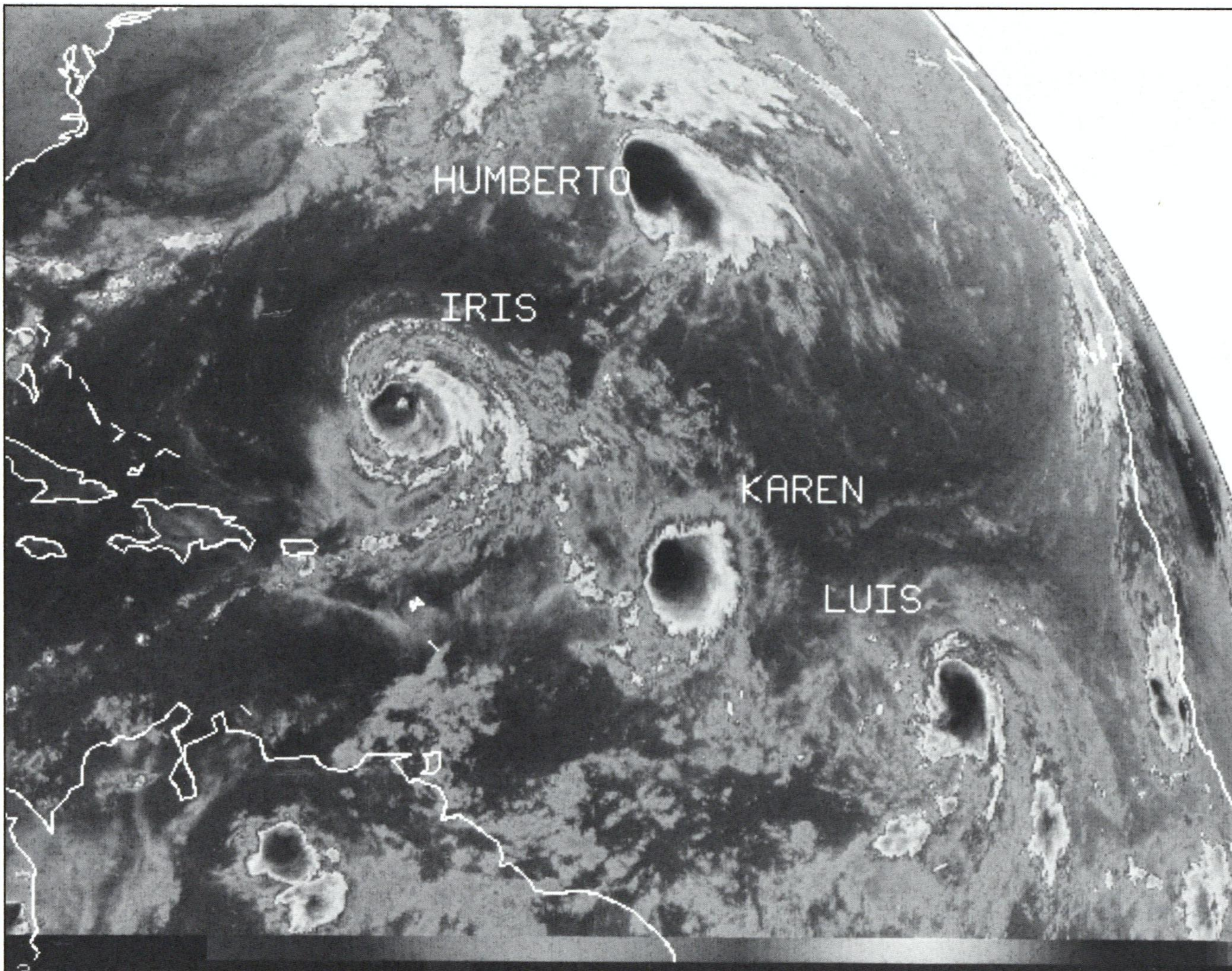
RADIO TELEPHONE	Time of Broadcast (z)	Frequencies (kHz)
Canadian Coast Guard Marine Radio Station Halifax/VCS	1335 2335	4408, 8785, 13113
SPECIAL BROADCASTS		
Canadian CG Radio Station St. John's/VON	as required when icebergs are sighted outside the limits of ice between regularly scheduled broadcasts.	2598 Radio–telephone preceded by Inter–Safety Signal (SECURITE) on 2182 kHz. NAVTEX upon receipt
SPECIAL BROADCASTS		
U.S. Coast Guard Communication Station Boston/NIK	As required when icebergs are sighted outside the limits of ice between regularly scheduled broadcasts	NAVTEX upon receipt or first avail broadcast NDBP (FEC) next scheduled broadcast.
International Ice Patrol Vessel/NIKK (when assigned)	When in the vicinity of ice in periods of darkness or fog	2670 Preceded by International Safety Signal (SECURITE) or 2182 kHz.

The *Nuevo Leon* encounters Hurricane Opal



The barograph chart above shows the progression of the *Nuevo Leon* as it transited the Gulf of Mexico with Hurricane Opal. The chart begins on October 2 at 2300 and ends on October 5 at 0800. The vessel encountered 75 knot (gusts to 90 K) and seas of 30 to 35 feet (9 to 11 meters). The lowest reading was 978.7 millibars at approximately 1000 UTC on Oct. 14. This placed the vessel about 600 miles to the west of Opal's eye.

The Parade of Storms



Courtesy of the National Oceanic and Atmospheric Administration

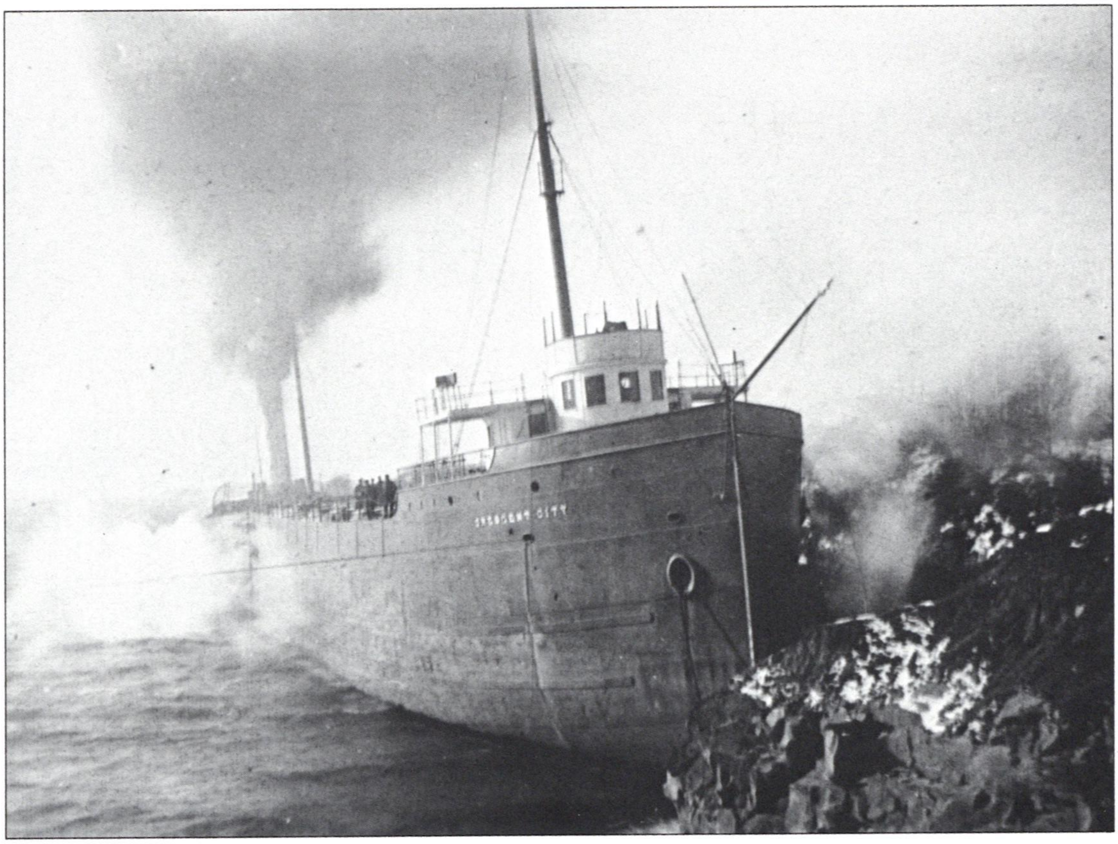
The Geostationary Operational Environmental Satellite (GOES-8) captured a parade of storms on August 30, 1995. The half disk view of the Northern Hemisphere shows (right to left) Tropical Storm Luis, Tropical Storm Karen, Hurricane Humberto, and Hurricane Iris. On the far left side of the frame are remnants of Tropical Storm Jerry.

The storms followed each other fast and furious: Luis (8/28-9/11), Karen (8/26-9/3), Humberto (8/22-9/1), Iris (8/23-9/4), and Jerry (8/23-8/25).

Operated by NOAA's National Environmental Satellite, Data and Information Service, the the Goes satellites (GOES-7 and GOES-8) stay above a fixed spot on the surface and provide a constant vigil for servere weather conditions— tornadoes, flash floods, hail storms and hurricanes.

The *Crescent City*

Skip Gillham
Vineland, Ontario, Canada



Renamed the Carl W. Meyers in 1950, the vessel sailed another decade until she was scrapped at Port Colborne, Ontario, Canada. Photo courtesy of Canal Park Museum Collection.

Over the years, some destructive November gales on the Great Lakes have reached almost legendary status. One of these famous storms hit Lake Superior November 29-30, 1905. Among the ship casualties was the ***Crescent City***.

Built in Chicago for the Zenith Transit Company, the vessel was launched February 2, 1897 and took her maiden voyage to Buffalo the following May. That summer ***Crescent City*** set an ore record of 5,560 tons for Lake Erie delivery.

Misfortune struck early. On June 13, 1898, a stream pipe burst off Kelley's Island, Lake Erie killing one sailor and injuring two more. On August 9, 1899, ***Crescent City*** got tangled in a towline that led to the steamer ***John B. Trevor*** being rammed and sunk by her barge.

The accident prone ***Crescent City*** was upbound and in ballast for Two Harbors when she was hit by high winds and waves in late November 1905. With temperatures in the zero range and visibility poor, the 130-meter bulk carrier was swept ashore in a cove some two miles east of Duluth. Although the hull was pinned against the rocks, fortunately all crew members were rescued.

When the seas subsided, salvage operations got underway for the many broken ships around the shores of Lake Superior, but ***Crescent City*** was not pulled free until June 4, 1906.

Her troubles were not over. On June 9, 1909, the ship washed through the Canadian Lock at Sault St. Marie when the lower gates were broken down by an upbounder that failed to stop. ***Crescent City*** was holed as it was swept downstream and grounded. The ship sank while being towed to dock.

The later years were less eventful for ***Crescent City***.

Ice *Breaker*

Teresa Fremaux
The Mariners' Museum
Newport News, Virginia

The two men, still good humored despite the job of ice breaking that awaits them, pose in front of the pilot house of the steam trawler, ***Breaker***, circa 1930. Another man, peering out from the curtain of ice on the deck below, has already begun the hard work.

The vessel was built in 1913 by the Fore River Ship Building Company in Quincy, Massachusetts and was owned by the Bay State Fish Company of Boston. The ***Breaker*** fished in the Georges Bank trawl fishery until 1934.

The photograph was taken by J. Jay Hirz, Hirz Graf Studios, in New York City. The Gelatin-silver print is housed in the permanent historical photograph collection of the Mariners' Museum, Newport News, Virginia.

Turn on the Light!

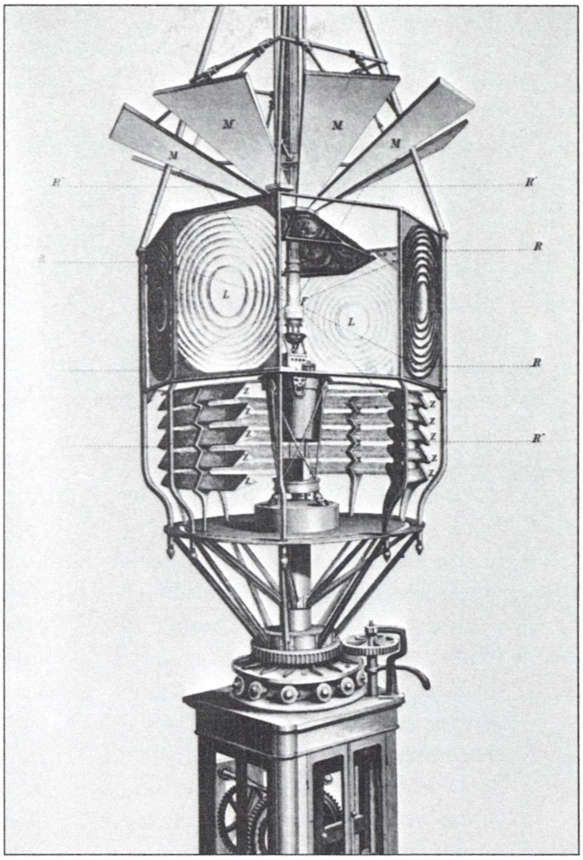
The Development of the Fresnel Lens

Elinor De Wire
Gales Ferry, Connecticut

The heart of a lighthouse– indeed, its very soul –is the great beacon beaming from its lantern. Like the Cyclops of Greek mythology, it surveys the sea with a single, gargantuan eye, sometimes winking sleepily, sometimes gazing with boredom, but always pre-empting the night with a brilliant, guiding ray.

Such sentinels evoke an aura of simplicity; yet, their origins are exceedingly complex. The lighthouse's thin pencil of blinding light, so captivating to painters, and poets, is no ordinary beam, but rather a technological achievement rooted in science and showcasing the talents of craftsmen and engineers.

The variety of lighted aids guiding today's navigator would have confused the ancient mariner, who felt fortunate to have the crudest wood braziers for beacons. The famous Pharos of Alexandria, a lighthouse that guarded the Nile River Estuary and one of the Seven Wonders of the World, had a huge brazier that was maintained by priests, whose slaves carried wood up the 152-meter tower.



An illustration of Augustin Fresnel's original 1823 lens is depicted above.

Candelabras were used in some early lighthouses; titanic in size, they required dozens of tapers and hours of work to maintain. The renowned Eddystone Light in the English Channel began its career in 1698 with tallow candles suspended from the ceiling of its lantern. The first Boston Light is believed to have been lit by a chandelier of 46 candles. In the 1500s, coal braziers came into use, but as with wood and candles, soot was a problem. In addition, these early beacons cast a feeble light upon the sea and were fire hazards. In fact, both the Eddystone Light

Above, an old postcard shows the Highland Lighthouse in N. Truro, Massachusetts where eclipsers were first used. Photograph courtesy of the Elinor DeWire collection.

and the Boston Light burned when their tallow-soaked, wooden floors caught fire.

Oil lamps followed in the 1700s, with numerous improvements in their designs to magnify the light and produce a cleaner and steadier beacon. The zenith of lamps came in the 1780s with Ami Argand's tubular-wick lamps, which produced a bright, smokeless flame equivalent to seven candles and was further intensified with reflectors pans placed behind the lamps. This design was improved by Winslow Lewis of Cape Cod, who added a parabolic, silvered reflector. Even so, only one-sixth of the light of each lamp was reflected out to sea.

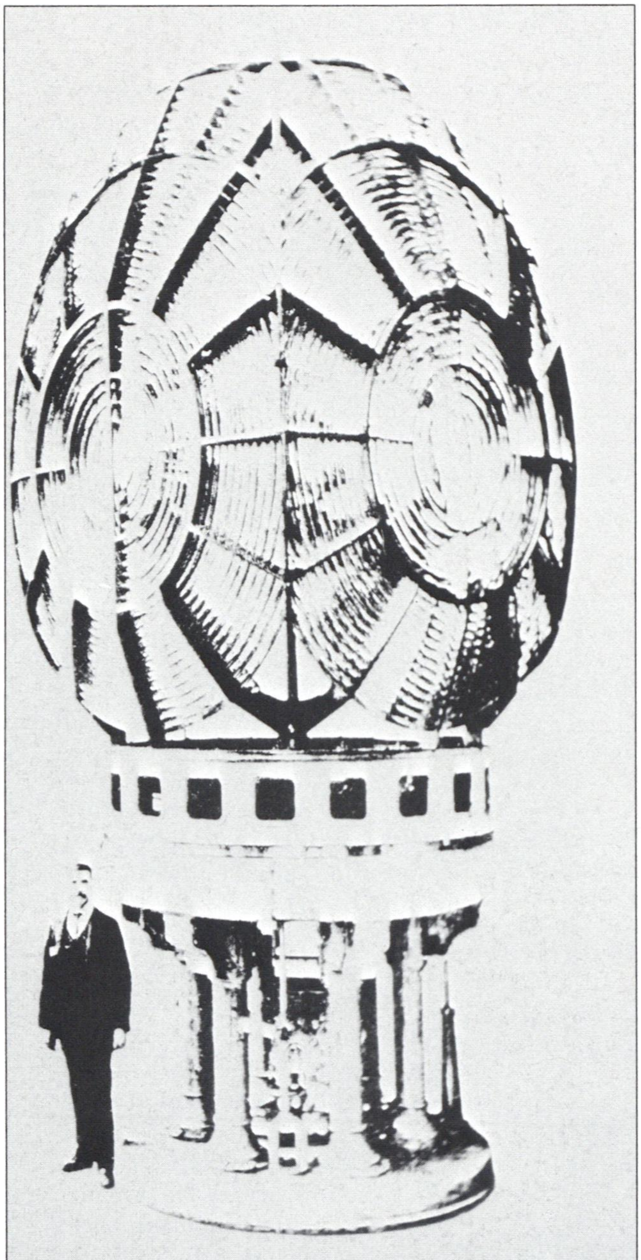
The problem remained of identifying beacons at night. Prior to the 1820s, all seacoast lights were white and fixed (did not flash). Colored lights were unsuitable for landfall navigation, as they drastically reduced the range, or distance a beacon could be seen, and engineers had found no effective means to make a beacon flash a signal. The American and European coasts were lit by a necklace of steady, white lights that sometimes confused the unwary mariner. Maine was typical, where one stretch of shore showed nine white, fixed lights, all visible from a single vantage point.

Efforts were made to produce flashing light characteristics as early as 1800. Highland Lighthouse on Cape Cod had a peculiar eclipser installed shortly after it went into service to distinguish it from the Boston Light. The apparatus consisted of a semicircular screen that revolved around the 15-lamp beacon once every eight minutes. Eight minutes was too long a signal period, and complaints were made about the beacon's range, which extended only about 10 miles from shore and less during bad weather. Ships nearly ran onto the shoals of the cape's backside trying to find Highland Light, so the eclipser was discontinued.

French physicist Augustin-Jean Fresnel (pronounced Fray-nel) in 1822 introduced a revolutionary optic that drastically improved lighthouse illumination and became the basis for all modern optics. Fresnel's design, though devised through complex physics and mathematics, was a creation of unparalleled beauty. A fragile aggregation of prisms and brass, shimmering like an ornate ballroom chandelier, it transformed the light of an ordinary oil lamp into a blinding beam.

Fresnel outraged the scientific community by boldly disputing the 150-year-old theories of Isaac Newton. Newton had vaguely defined light as a swarm of particles moving through space longitudinally, each with a different mass, according to its color, and each with identifying characteristics which allowed it to be refracted, reflected, or moved randomly. Fresnel, on the other hand, believed light traveled in waves in a transverse manner.

Fresnel's system did away with multi-lamps and reflectors and replaced them with a single larger lamp placed at the center, or focal plane, of the lens. His beehive-shaped lens was composed of a central panel of magnifying glasses surrounded above and below by concentric rings of prisms and mirrors properly angled to gather light and direct it toward the focal plane where it was intensified and projected seaward. The Fresnel lens was first tested at the celebrated Cordouan Lighthouse where the Gironde River flows into the Bay of Biscay. The beacon's excellence was quickly recognized by the maritime world, and demand for Fres-



nel lenses burgeoned.

Several types of Fresnel lenses were available by the mid-1820s. His fixed lens exhibited a steady beam of light by means of a smooth, central barrel of convex glass. The flashing lens had flash panels, called bullseyes, arranged around the focal plane of the lens to funnel light into separate beams.

A fixed-flashing combination lens was developed later that used both bullseyes and a smooth central band to give a versatile signal. Colored panels were also employed to warn of specific danger areas, such as underwater rocks or sandbars. Thus, Fresnel not only introduced an improved optic, but also a means of distinguishing one lighthouse from another at night.

The drawbacks of his system were its weight and cost. A first-order lens could easily weigh five tons, and on today's market it might fetch more than $1 million. The heavy lenses were lifted up to lighthouse lanterns in pieces, then assembled on large, ornate pedestals. Flashing lenses were rotated by clockworks with huge weights suspended in the towers to power the cogs. Some were mounted on chariot wheels or ball bearings; others floated in troughs of high-density, low-friction mercury. Lightkeepers had to wind up the clockworks several times a night and were kept busy polishing the brass and prisms. But the expense and ponderous nature of the apparatus seemed small compared to the savings in life and cargo it effected.

France and Britain embraced the design immediately and launched industries to manufacture Fresnel lenses. Americans were less enthusiastic. The parsimonious chief of the Lighthouse Service, Stephen Pleasanton, refused to dish out funds for the new system, citing the expense as inhibitive. He continued using the archaic lamp and reflector system patented by Winslow Lewis, who was his personal friend.

Fresnel died in 1827, but by 1835 nearly every major European lighthouse had been converted to his lenticular system. Meanwhile, sailors complained of the poor quality of American lighthouses and extolled Europe's brilliant sentinels. As criticism increased, particularly from shipping interests with government influence, Congress decided to investigate. Two Fresnel lenses were purchased from France and installed for testing in the south tower at New Jersey's Navesink Twin Lights in 1841. They were quickly dubbed the best lights in the nation.

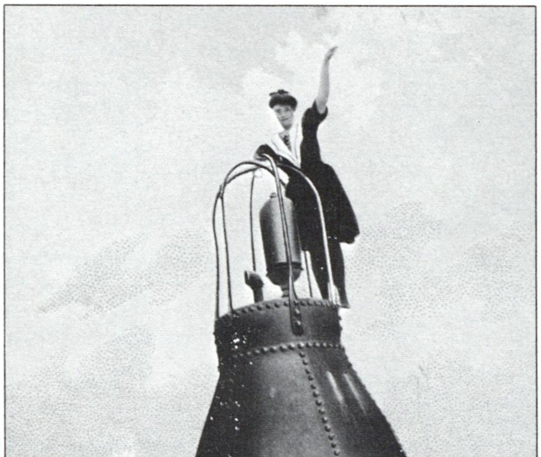
Immediate conversion to Fresnel lenses began. By 1860, practically every U.S. lighthouse exhibited a Fresnel lens. Conversion to gas illumination and, eventually, to electricity around the turn of the century only enhanced the power and beauty of the system. Though many of the old lenses were damaged during the Civil War and have since suffered from age and exposure, a number remain in use at lighthouses across the nation. The firms that manufactured them closed long ago, but their products shimmer timelessly along many coasts.

Rescued by a Buoy

Elinor De Wire
Gales Ferry, Connecticut

To the landsman, buoys are homely, rotund objects bobbing awkwardly in channels and harbors, making a monotonous racket with their ceaseless clanks, gongs, and whistles. Their colors and shapes give them the appearance of castaway circus clowns, but these important navigational aids perform a critical service as the road signs of the waterways. No one would argue that buoys save lives, but sometimes they serve us in unexpected ways.

A lighthouse family at Timbalier Bay, Louisiana was saved by an iron can buoy not far from their sea-swept home in 1867. The terrible March 29 hurricane of that year washed away the tall, brick lighthouse, then scoured clean the low sandy island on which it stood and left it submerged under a high storm tide.



"Girl and a B(u)oy on the Massachusetts Coast." Whistling buoy circa 1900. Elinor DeWire collection.

The castaway lightkeeper, his wife, and daughter "faithfully performed their duties, barely escaping with their lives." Awash in the storm surge, they clung to each other as the tide fortuitously carried them to the trusted buoy. They crawled inside and rode out the storm, remaining on board for several days until rescued by a passing ship.

More compelling is the 27-hour ordeal of fisherman, Robert Curtis, who owes his life to the Bay Ledge Buoy, located six miles south of Carver's Harbor, Maine. Curtis had gone clamming on a clear, cold Sunday morning in January 1984, motoring out of Rockland in his 15-foot boat, headed for the rich clam beds at Kent Cove. Though the weather forecast called for a sunny and mild day, the sky soon took on a drab gray pallor. Before long, Curtis was caught in an unexpected snow squall.

The wind picked up to 35 knots, and waves began swamping the little boat. Curtis bailed furiously and tried to steer for the nearest land. He motored aimlessly for more than an hour, his boat sloshing and bouncing like a toy in a bathtub. By noon the temperature had dropped into the single digits, and Curtis was 12 miles off course. His hands were numb, and ice encrusted his face and hair, but help was in sight.

Ahead of him bobbed the Bay Ledge Buoy with a big number 2 painted on its top. Though Coast Guard regulations prohibit climbing on a buoy or using it as a mooring, Curtis knew he had to tie up to the buoy or risk being blown out to sea. Carefully, he eased alongside, but just as his hand grasped the buoy, the boat was swept from under him.

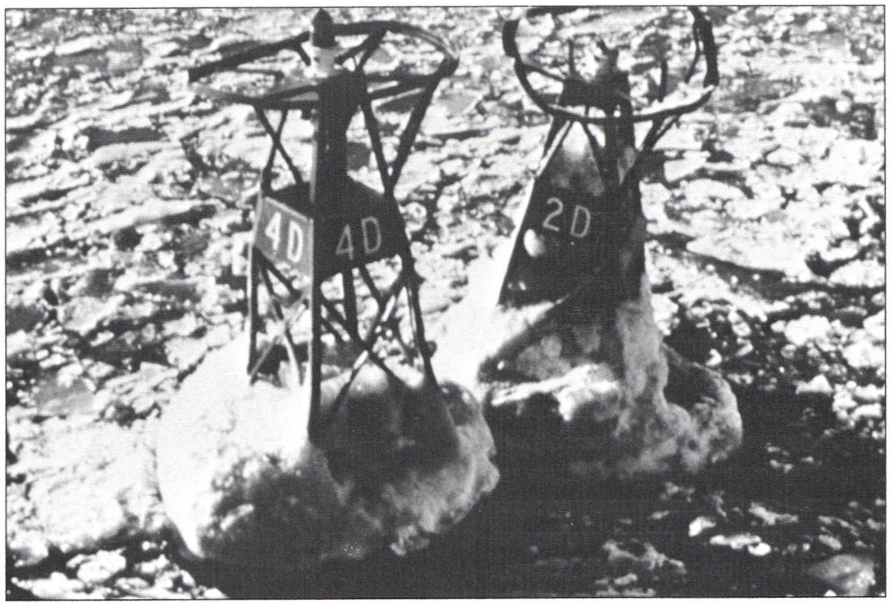
He scrambled onto the bobbing can, wet and chilled, and watched his boat slowly putter away. Waves drenched him, and his hands began to freeze to the metal. Wisely, he removed his belt and attached it to the buoy so that he would have a strap to hold. His down jacket became a sit-upon that kept him from freezing fast to the ice-shrouded buoy.

Curtis knew it was important to move about, so he began walking round and round on the buoy holding tightly to the belt. When night came and near unbearable cold set in, he tore off bits of his rubber boots and burned them with a Bic lighter to warm his hands and face. There was little heat generated, by the simple act gave him hope and "buoyed" him through the long, frigid night.

A helicopter passed over in the darkness, sweeping a spotlight, but though Curtis screamed and waved, he was not sighted. A friend had reported him missing, and crews from Coast Guard stations in Rockland, Portland, and Cape Cod were combing the waters by aircraft and rescue cutter. Local boaters turned out to look for Curtis, and even a 110-foot tug out of Portland joined the search.

At dawn Curtis desperately searched the horizon for signs of rescue, but saw none. He was convinced death awaited him on the lonely buoy. Around 2 PM, he heard engines approaching and spotted the Point Hannon out of Jonesport. The crew were amazed to find Curtis alive and cheering energetically as they pulled him off the frozen buoy. He was taken to a Bangor hospital suffering from minor frostbite of his hands.

Fortunately for Curtis, his rescuer had done what all good "Buoy Scouts" do when lost: It remained stationary, waiting to be found.



Above right two buoys enveloped in foam serve as markers to guide mariners. Below a man works on the maintenance of a buoy. Photos courtesy of Elinor DeWire.

Reporting Wet Bulb & Dew Point Temperature

Martin S. Baron
National Weather Service

As I've indicated in this column previously, wet bulb temperature is now reported in the weather message. Effective November 1994, the World Meteorological Organization added Group $8S_wT_bT_bT_b$ for reporting wet bulb temperature, after the ice accretion group, in ships synoptic code section 2. Incidentally, dew point temperature continues to be an important part of the weather message, in group $2S_nT_dT_dT_d$ of ships synoptic code section 1.

Wet bulb temperature is reported in Celsius degrees and tenths, with the sign (+,0, –) indicated by S_w. Some examples:

(1) For wet bulb temperature 11.8°, report $8S_wT_bT_bT_b$ as 80118 (S_w is 0 for positive, and $T_bT_bT_b$ is 118)

(2) For wet bulb temperature 4.1°, report $8S_wT_bT_bT_b$ as 80041 (Sw is 0 for positive, and TbTbTb is 041)

(3) For wet bulb temperature -3.6°, report $8S_wT_bT_bT_b$ as 81036 (Sw is 1 for negative, and $T_bT_bT_b$ is 036)

Dew Point temperature is computed from the dew point calculation table, using wet and dry bulb temperatures to compute wet bulb depression (difference between dry and wet bulb temperatures). The dew point is then read from the table at the intersection of the correct row for wet bulb and column for wet bulb depression. Unlike wet bulb temperature, which is reported in tenths, ships report dew point in whole degrees Celsius. The third T_d in $T_dT_dT_d$ is the tenths figure, and is always reported as /. Some examples:

(1) Observed temperatures are 8°C for wet bulb and 10°C for dry bulb. The wet bulb depression is 2°C. The dew point calculation table indicates a dew point of 6°C (at the intersection of the appropriate row for wet bulb and column for wet bulb depression. $2S_nT_dT_dT_d$ is coded as 2006/ (S_n is coded 0 for +), $T_dT_dT_d$ is coded 06/).

(2) For wet bulb temperature of –5°C, and dry bulb temperature of –2°C, the wet bulb depression is 3°C. From the table, the dew point is found to be –14°C. $2S_nT_dT_dT_d$ is coded as 2114/ (Sn is coded 1 for -, $T_dT_dT_d$ is coded 14/).

Common Observer Errors

The National Climatic Data Center (NCDC) just completed a study of common shipboard observer errors, summarized in table 1 (the NCDC archives ships weather observations, obtained from the Ships Weather Observations form B-81). The most frequent errors noted by NCDC are (1) mistakes in the reporting of dewpoint temperatures, (2) erroneous ships position information, (3) day/time group errors, (4) improperly coded visibility, and (5) errors in the reporting of pressure tendency and characteristic.

Dew point temperature errors frequently result from incorrect use of the dew point calculation table, in particular using dry bulb rather than wet bulb for the horizontal rows of the table. Remember that each horizontal row of the NWS supplied dew point calculation table corresponds to a value for wet bulb temperature, and each vertical column corresponds to a value for wet bulb depression.

Using the wrong value for sign, S_n, is another error sometimes seen in dew point temperatures. Remember, S_n is coded as 0 for positive or zero dew point temperature, and as 1 for negative dew point temperature.

When coding ships position, make sure you're specifying the proper quadrant (Q_c), and the correct values for latitude and longitude. Be particularly careful near quadrant boundaries, especially when your vessel crosses from one quadrant to another. Remember, for north latitudes, Q_c is coded as 7 for west longitude, or as 1 for east longitude. For south latitudes, Q_c

is coded as 5 for west longitudes, or as 3 for east longitudes. Longitude is reckoned from the Greenwich and 180th Meridians, latitude from the equator. If your ship is right on the Greenwich or 180th meridian ($L_oL_oL_oL_o$ = 0000 or 1800 respectively), you may code Q_c as either 1 or 7 for the northern hemisphere, or 3 or 5 for the southern hemisphere (the choice is left to you). If your vessel is right on the equator ($L_aL_aL_a$ = 000), Q_c = 1 or 3 (eastern longitude), or 5 or 7 (western longitude). Again, the choice is left up to you. When your vessel crosses the equator, the Greenwich, or 180th meridians, it is absolutely essential to change Q_c to the appropriate code. Otherwise, your ships position will not be correctly described.

Always be very careful when recording your latitude and longitude. A meteorological report is useless if it's precise location cannot be determined. Both latitude and longitude are coded in degrees and tenths. To change minutes to tenths of degrees, divide minutes by 6 and disregard the remainder, ie 45 minutes is 7 tenths of a degree, 30 minutes is 5 tenths of a degree, 05 minutes is 0 tenths of a degree, etc.

Don't forget to change the day at 0000 UTC. The day of the month (YY) and time of observation (GG) are reckoned according to UTC, not by local date/time.

When reporting visibility (VV), permissible code values range from 90 (for visibility less than 55 yards (50 meters)), to 99 (for visibility greater than or equal to 27 nautical miles (50 kilometers)). Some visibility reports are being coded outside the valid range, probably because some observers are reporting visibility in nautical miles, forgetting to use the code table.

When reporting 3-hour characteristic of pressure tendency (a) and amount of pressure tendency (ppp), remember that code 4 means the pressure has not changed at all during the 3-hour period (pressure has been steady with a flat or horizontal barograph tracue). Under this circumstance, appp is always coded as 4000 (ppp = 000 for net 3-hour pressure change of 0). In fact, whenever a is coded as 4, ppp must be coded 000. Otherwise, you are providing contradictory information about 3-hour pressure tendency. A steady characteristic of pressure tendency implies no net 3-hour pressure change. If pressure has risen, and then fallen during the 3-hour period, use a = 0. If pressure has fallen, and then risen, use a = 5. See the code table for a.

PMO Newark Departing, New York Vacancy filled

John Bollinger, PMO in Newark, N.J. since April 1995, has accepted a position at Weather Service Forecast Office Louisville, KY, as a Hydrometeorological technician. We wish John well in his new position.

I am pleased to report that Tim Kenefick (photo right) is the new PMO for New York City, reporting for duty September 18, 1995. He previously worked at Weather Service Office Cincinnati as an electronic technician in the weather and radar observation programs.

New Recruits — July - September, 1995

During the 3-month period ending September 30, 1995, PMOs recruited 110 vessels as weather observers/reporters in the National Weather Service (NWS) Voluntary Observing Ship (VOS) Program. Thank you for joining the program.

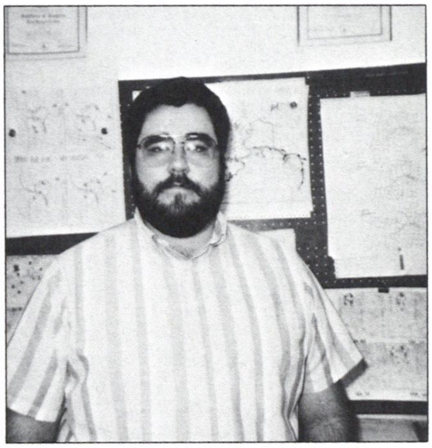
Please follow the worldwide weather reporting schedule as best you can – report weather four times daily at 0000, 0600, 1200, and 1800 ZULU or UTC time. The United States and Canada have a 3-hourly weather reporting schedule from coastal waters out 200 miles from shore, and from anywhere on the Great Lakes. From these coastal areas, please report weather at 0000, 0300, 0600, 0900, 1200, 1500, 1800, and 2100 ZULU or UTC, whenever possible.

To transmit your weather report to the NWS, use

(1) INMARSAT Standard A or Standard C,

(2) U.S. Coast Guard Simplex Teletype Over Radio (SITOR), or plain language (voice – recite the coded message using radiotelephone). The Coast Guard has discontinued all morse code services.

(3) Commercially operated shore radio stations (using SITOR or CW), as a back-up, if methods (1) or (2) are not available.



NATIONAL WEATHER SERVICE VOLUNTARY OBSERVING SHIP PROGRAM
NEW RECRUITS FROM 01-JUL-95 TO 30-SEPT-95

NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
ALICE ST. PHILIP	WYL6871	ST PHILIP TOWING COMPANY	MIAMI, FL
AMBASSADOR	KRFK	CCT	NEW ORLEANS, LA
ANASTASIS	9ZOH	MERCY SHIPS	MIAMI, FL
APL CHINA	V7AL5	AMERICAN PRESIDENT LINES	SAN FRANCISCO, CA
ARCTIC SUN	ELQB8	NATIONAL WEATHER SERVICE	LOS ANGELES, CA
ATLANTIC	3FYT	HOME LINES	MIAMI, FL
ATLANTIC BULKER	3FSQ4	SHOWA LINE ENGINEERING CO, SAKURADA BLDG.	MIAMI, FL
ATLANTIC SENTRY	NJAS	USCG MAP KEYWEST	MIAMI, FL
AUTOMOBIL ACE	3EVF8	SEIWA NAVIGATION CORP. LTD, ONARIMON-YUSEN	SEATTLE, WA
BAJKA	LITC	ELLER COMPANY INC	MIAMI, FL
BAKAR	LFSW	ELLER COMPANY INC	MIAMI, FL
BALAO	LKFH		MIAMI, FL
BANTA	LAUC	ELLER COMPANY INC	MIAMI, FL
BARO	LAOV	TORVALD KLAVENESS	MIAMI, FL
BARWA	LMRH	TORVALD KLAVENESS & CO A/S	MIAMI, FL
BAYOU BULL	WZA6172	MIAMI, FL	
BETTY CULBREATH	WCT2876	GULFCOAST TRANSIT CO.	MIAMI, FL
BETTY WOOD	WYZ8766	GULFCOAST TRANSIT CO.	MIAMI, FL
BEVERLY ANDERSON	WTH5600	GULFCOAST TRANSIT CO.	MIAMI, FL
BUNGA SAGA TIGA	9MBM8	MALAYSIAN INTERNATIONAL SHIPPLING CORP. BHD	SEATTLE, WA
CAPE DIAMOND	WMHJ	MARINE TRANSPORT LINES	SAN FRANCISCO, CA
CAPE MOHICAN	WDOP	OMI CORP.	JACKSONVILLE, FL
CAPE RACE	KAFJ	HASLER AND CO.	NORFOLK, VA
CAPE RAY	KAFI	OMI SHIP CORP.	NORFOLK, VA
CAPE RISE	KAFG	OMI SHIP MGT.	NORFOLK, VA
CAPE VICTORY	KAEY	KEYSTONE SHIPPING CO.	HOUSTON, TX
CAPE VINCENT	KAES	KEYSTONE SHIPPING CO.	HOUSTON, TX
CAROLE G. INGRAM	WYZ6149	TANKER MANAGEMENT, INC	MIAMI, FL
CASTOR	S6HG	KERR NORTON MARINE	MIAMI, FL
CHIQUITA MILANO	C6CE9	BANANA SUPPLY COMPANY	MIAMI, FL
CHOYANG GLORY	D9TA	CHO YANG (AMERICA), INC.	NORFOLK, VA
CHRISTIANE	C6HD5	ATLANTIC SHIP AGENCY, INC.	BALTIMORE, MD
CRISTINA 1	DUJG	EASTERN CAR LINES, ATAGO-TOYO BLDG	SEATTLE, WA
DEBBIE RANKIN	WTT9205	GULFCOAST TRANSIT CO.	MIAMI, FL
DOCEBRUMA	ELPB5	T. PARKER HOST	NORFOLK, VA
DRAGAMINAS	XCWU	CAPT. A. VAZQUEZ	MIAMI, FL
EDNA ST PHILIP	WS6560	ST PHILIP TOWING COMPANY	MIAMI, FL
ELLENA HICKS	WBX8151	GULFCOAST TRANSIT CO.	MIAMI, FL
ERNESTINA	WTK7000	SCHOONER ERNESTINA	MIAMI, FL
EUWIN ST. PHILIP	WA6617	ST PHILIP TOWING COMPANY	MIAMI, FL
EVER REACH	3FQO4	EVERGREEN AMERICA CORP.	NEWARK, NJ
EXXON LEXINGTON	KIYP	EXXON SHIPPING CO	MIAMI, FL
FEDERAL OSLO	LALO4	FEDNAV INTERNATIONAL LTD	NEWARK, NJ
FEDERICO C.	IBFW	COSTA/LAURO LINE	MIAMI, FL
FLORAL LAKE	3FFA5	HAKATA SHIPBUILDING CO.,	SEATTLE, WA
FMG AMERICA	V2SI	FAROVI SHIPPING	MIAMI, FL
FOREST CHAMPION	3FSH3	NYK LINE NORTH AMERICA INC	SEATTLE, WA
FRANCES S.	WTT9203	GULFCOAST TRANSIT CO.	MIAMI, FL

NATIONAL WEATHER SERVICE VOLUNTARY OBSERVING SHIP PROGRAM
NEW RECRUITS FROM 01-JUL-95 TO 30-SEPT-95

NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
GLORIOUS SUN	DVTR	ORIX MARITIME CORP.	SEATTLE, WA
GREAT LAKE	VRUB9	WORLDER SHIPPING LTD	SEATTLE, WA
GREEN RAINIER	3ENI3	INTERNATIONAL SHIPPING CO INC	SEATTLE, WA
GULF SENTRY	NSTY	USCG MAP MIAMI	MIAMI, FL
GULFCOAST	WAJ9818	GULFCOAST SHIPPING CO.	MIAMI, FL
HANDY LOGGER	DZBH	INTERNATIONAL SHIPPING CO, INC	SEATTLE, WA
HANJIN SHANGHAI	3FGI5	HANJIN SHIPPING CO., LTD.	NEWARK, NJ
HUNTER	WYK4729	CROWLEY MARITIME CORP	MIAMI, FL
HYNUDAI SEATTLE	P3SG5	HYUNDAI AMERICA SHIPPING INC	SEATTLE, WA
JAMIE BAXTER	KDFL	GULF COAST TRANSIT CO	MIAMI, FL
JANET GRAHAM	WTT9206	GULFCOAST TRANSIT CO.	MIAMI, FL
JANIS GUZZLE	WAI4094	GULFCOAST TRANSIT CO.	MIAMI, FL
KAPITAN BYANKIN	UAGK	FESCO AGENCIES N.A., INC	SEATTLE, WA
KAPTAIN SERYKH	UGOZ	FESCO AGENCIES N.A.	SEATTLE, WA
KATHRINE CLEWIS	WQ7310	GULFCOAST TRANSIT CO	MIAMI, FL
KEYSTONE RHODE ISLAND	WFDW	KEYSTONE SHIPPING CO	SAN FRANCISCO, CA
KONSTANTINOS A	SWPJ	NETROFIN LTD	SEATTLE, WA
LIBBY BLACK	WTG2210	GULFCOAST TRANSIT CO	MIAMI, FL
LOUISIANA BRIMSTONE	KQTM	SULPHUR TERMINALS CO	MIAMI, FL
MAERSK RECIFE	V2LC	MAERSK INC	MIAMI, FL
MAERSK SANTOS	VRUY5	C/O MAERSK INC.	BALTIMORE, MD
MAERSK VANCOUVER	SXNP	MAERSK INC, TERMINAL THREE	SEATTLE, WA
MARCONA CONVEYOR	ELDJ	UTAH TRANSPORT INC	MIAMI, FL
MARIA LAURA	C6MZ8	WEAVER MARINE AGENCIES LTD	NEWARK, NJ
MARINE UNIVERSAL II	3EJG6	NRS CO., INC, 2ND FLR, KYOMARU BLDG	SEATTLE, WA
MARK HANNAH	WYZ5243	GENERAL MARINE TOWING	CHICAGO, IL
MARTHA R. INGRAM	KCBO	TANKER MANAGEMENT, INC	MIAMI, FL
MEARSK NEWARK	9VXR	MAERSK LINE	NEWARK, NJ
MOBIL AERO	WLBY	GLENEAGLE SHIP MANAGEMENT INC	MIAMI, FL
NEW NIKKI	3FHG5	NYK LINE N.A. INC	SEATTLE, WA
NORD JAHRE TRANSPORTER	LACF4	RICE, UNRUH, REYNOLDS, CO	BALTIMORE, MD
NORTH EMPRESS	ZHEB4	NORTH EMPRESS SHIPPING CO., LTD	MIAMI, FL
OCEAN ORCHID	3ECQ9	KERR NORTON MARINE,WESTLAKE CTR OFFICE	SEATTLE, WA
PACIFIC SENTRY	NOKL	USCG MAP MIAMI	MIAMI, FL
PONCE	WPJR	PUERTO RICO MARINE MGMT INC	MIAMI, FL
PROSPERITY	ELNT9	TRANS ATLANTIC, INC	MIAMI, FL
PUFFIN ARROW	C6HQ7	WESTFLEET MGMNT	MIAMI, FL
RALEIGH BAY	KRHG	SEA-LAND SERVICE INC	NORFOLK, VA
ROCKIES HIGHWAY	3FIP4	K LINE AMERICA, INC	SEATTLE, WA
RUBIN KOBE	DYZM	SHINKO MARINE IND.,LTD	SEATTLE, WA
RUBIN STAR	3FIA5	MERIT STEAMSHIP AGENCY	SEATTLE, WA
SAN LAURE	ELKI8	M.O. SHIP MANAGEMENT CO, LTD	SEATTLE, WA
SANKO SOUTH	3FSK2	EASTERN SHIPPING CO	SEATTLE, WA
SANKO SPRUCE	3EZL3	CASCADE MARINE AGENCIES LTD	SEATTLE, WA
SAUDI HAIL	HZZF	NSCSA (AMERICA INC.)	NORFOLK, VA
SEA NOVIA	ELRV2	SEA-LAND SERVICES	MIAMI, FL
SEALAND CHAMPION	V7AM9	SEALAND SERVICE INC	SAN FRANCISCO, CA
SEALAND GUATEMALE	OUJV2	BRANDTSHIP USA,INC	NEW ORLEANS, LA
SHARON DEHART	WAM4073	GULFCOAST TRANSIT CO	MIAMI, FL

Marine Observations

NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
SIBOHELLE	LAQN4	TSCHUDI AND EITZEN AS	NORFOLK, VA
SOUTHERN ACE	DZLE	MMS CO. LTD, SURFEL	SEATTLE, WA
ST EMILION	WIJT	A CREST TANKERS, INC	MIAMI, FL
STAR OF MARIA	ELNE5	RAVENSCROFT SHIPPING INC	SEATTLE, WA
STELLA	9VXY	BARBER SHIP MNGT	SEATTLE, WA
STRONG CAJUN	WCD6594	ANDERS/WILLIAMS INC	NORFOLK, VA
TALISMAN	OWPG6	ARMADA SHIPPING CO	MIAMI, FL
TEQUI	3FDZ5	SHINKO MARITIME CO., LTD	SEATTLE, WA
USCGC PEA ISLAND	NCSR	COMMANDING OFFICER	NORFOLK, VA
USCGC WHITE SUMAC	NAED	COMMANDING OFFICER	MIAMI, FL
USNS PATUXENT	NPCZ	USNS PATUXENT T-AO 201	NEW ORLEANS, LA
WAVELET	DVDJ	ORIX MARITIME CORPORATION	SEATTLE, WA
WINDWARD SENTRY	NLYJ	USCG MAP MIAMI	MIAMI, FL

Subtract wet-bulb temperature from dry-bulb temperature to get "wet-bulb depression." Locate nearest depression across top of table and nearest wet-bulb temperature down the side. Read encoded dew point at intersection of wet-bulb temperature row and depression column. The dew point temperature, $T_dT_dT_d$, should always be less than the air temperature TTT. More extensive tables are in the NWS Observing Handbook No. 1.

Wet-Bulb Temp. (°C)	Wet-Bulb Depression °C																					
	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.5
-5	-6	-7	-8	-9	-11	-13	-14	-17	-19	-20	-27	-28											
-4	-5	-6	-7	-8	-9	-11	-12	-14	-16	-18	-22	-26	-33										
-3	-3	-4	-5	-7	-8	-9	-11	-12	-14	-16	-19	-22	-26	-32	-47								
-2	-2	-3	-4	-5	-6	-7	-9	-10	-12	-14	-16	-18	-21	-25	-30	-31							
-1	-1	-2	-3	-4	-5	-6	-7	-8	-10	-11	-13	-15	-17	-20	-23	-28	-36						
0	00	-1	-2	-2	-3	-4	-5	-7	-8	-9	-10	-12	-14	-16	-19	-22	-26	-32					
+1	01	00	-1	-1	-2	-3	-4	-5	-6	-7	-9	-10	-12	-13	-15	-18	-20	-24	-29	-39			
2	02	01	01	00	-1	-2	-3	-4	-5	-6	-7	-8	-9	-11	-12	-14	-17	-19	-22	-27	-34		
3	03	02	02	01	00	-1	-1	-2	-3	-4	-5	-6	-7	-9	-10	-12	-13	-15	-18	-21	-24	-30	-30
4	04	03	03	02	02	01	00	-1	-2	-2	-3	-4	-5	-7	-8	-9	-11	-12	-14	-16	-19	-22	-26
5	05	04	04	03	03	02	01	01	00	-1	-2	-3	-4	-5	-6	-7	-8	-9	-11	-13	-15	-17	-19
6	06	06	05	04	04	03	03	02	01	01	00	-1	-2	-3	-4	-5	-6	-7	-8	-10	-11	-13	-15
7	07	07	06	06	05	04	04	03	03	02	01	01	00	-1	-2	-3	-4	-5	-6	-7	-8	-10	-11
8	08	08	07	07	06	06	05	04	04	03	03	02	01	01	00	-1	-2	-3	-4	-5	-6	-7	-8
9	09	09	08	08	07	07	06	06	05	05	04	03	03	02	01	01	00	-1	-2	-3	-4	-5	-6
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11	11	11	10	10	09	09	09	08	08	07	07	06	06	05	04	04	03	03	02	01	00	00	-1
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35	35	35	35	35	35	34	34	34	34	34	34	34	34	34	33	33	33	33	33	33	33	33	32

COMMON OBSERVER ERRORS

DEWPOINT

Misuse of drybulb (not wetbulb) when using table
Correct value, wrong sign coded on wetbulb
Decimal shift, i.e. 019 instead of 190 (all/any temperatures)

POSITION

Decade error on latitude or longitude
Wrong quadrant, especially when Q changes
Latitude and longitude interchanged
Latitude repeated for longitude

DATE/TIME

Failure to change day at 00Z

VSBY

Not 90-99

APPP

A=4 + non zero ppp

COMMON TRANSMITTAL ERRORS

NON RECEIPT

???

NO CALL SIGN OR PARTIAL CALL SING

Who Needs Ship Weather Observances?

Jim Nelson
Port Meteorological Officer, NWS
Houston, Texas

When I go aboard a ship for a routine visit and ask the Captain if he would like to join the weather observing program, he often responds with "I don't have the time because I'm shorthanded," "I don't have a radio operator" "I go coastwise so you don't need weather from me" or "You don't need observation anymore, you have satellites to do that for you." It's true, satellites do show us where the sky is clear or cloudy and provide us with a thermal profile of the ocean water, but only you know what the weather is at your position! Satellites can't look through the cloud cover to tell us how hard the wind is blowing, what the pressure is, how high the seas are, how low the visibility is, or what type of precipitation is or isn't falling. Forecasters worldwide look for the synoptic report which might give them a clue as to whether a Low is getting stronger or weaker. Whether you are on the high seas or going coastwise, your reports are vital.

Over land, a great number of hourly observations are received at computer centers around the world and are exchanged with other countries by way of the Global Telecommunications System (GTS). These hourly observations are used extensively by civil aviation and meteorologists to keep up with ever-changing trends in the weather. In addition, there are 6 hourly synoptic observations taken by thousands of land sites around the world for use in the surface analysis. The generated weather analysis maps are then broadcast over land line computer and/or facsimile circuits, and radio facsimile.

Over water areas, we have a limited response for synoptic weather observations. Even though water covers much of the earth's surface, we still have a problem convincing ship personnel that their weather reports are valuable. It is not unusual to have an analysis over the ocean based on 100 ship observations. While 100 ships may seem large, if you put that many dots on a large base map, they get lost. Also, more than half of those 100 observations are usually along a regular trade route, leaving a vast expanse of uncovered ocean. So, without the synoptic weather observations generated by ships at sea, the synoptic weather maps over water would not be very accurate. If the maps are not accurate, the forecast then becomes degraded.

Prior to World War II, oceanic analysis was not done routinely, in real time, like it is done today. Even over land, it took hours for the weather to be received and plotted by hand. The Japanese used bad weather to successfully cloak their movements prior to, and during, their approach to the Hawaiian Islands for their attack on Pearl harbor on December 7th, 1941. They received special broadcasts with synoptic data and vital ship reports from their task force, which enabled them to move undetected across the Pacific.

The allies began to realize the importance of weather and many campaigns commenced on the basis of a weather forecast. The landings made on the beaches of Normandy, France on June 6th, 1944 were successful, in part, because of a forecasted brief lull in storm conditions. As Allies moved across the Pacific Ocean, a network of observation sites was established and maintained. Prior to many island invasions in the South Pacific area, Australian coast watchers would go ashore to spot enemy movements and to report the weather. Military and merchant marine vessels played a critical role in this overall scheme. Ships underway had to record weather observations for the deck log, but it was not until late in the war that most ships started transmitting weather. Compared to the sophisticated computer systems of today, this was somewhat crude, but it served its purpose.

This system continued after the war. Beginning in the fifties and sixties, computers started doing some of the data processing needed to build forecast models. These huge computer filled a room, but had only half the power of most of today's desktop computers. It was soon realized that the lack of ship reports often hampered this effort. Through the seventies and eighties, merchant fleets shrank as ship size increased, so that the number of observations decreased. Even with this decrease, an adequate number is theoretically available if everyone cooperates. Many tramp ships do not use regular routes and their observations are especially vital.

Today recruiting is the most important role of a Port Meteorologist. We talk to many ship's Captains who realize the value of taking and sending weather observations. Some believe that U.S. PMO's work strictly for their own program. In reality, all nations benefit when a PMO from any nation enlists a ship into the Voluntary Observing Ship program since this is actually a World Meteorological Organization program. All ship data are passed around the world via GTS, which is unique in that it has been in operation for many years. Within minutes of receipt, a weather observation is available for use at forecast centers worldwide.

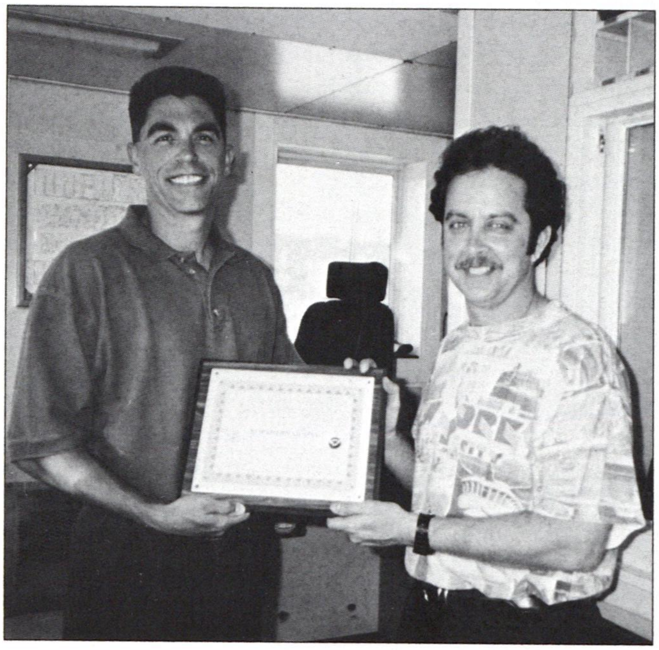
Ship observations are not only used to make forecasts, but also to verify forecasts and to aid climatological studies. Researchers use observations for a particular area or storm to understand why a system behaved in the manner it did. The hurricane season of 1995 will definitely be one of those seasons which provide valuable studies of storm behavior.

While advances in observation techniques and practices have taken place over the past 50 years, the basic structure has remained the same. However, with increasing automation of shipboard observations, weather services are looking for better ways to receive observations in the future. One idea is the automatic transmission of weather data direct to a weather satellite. Currently, the German Weather Service has some test sites out on a few ships, as they look for a viable course to take. The U.S. has a system called Shipboard Environmental Data Acquisition System (SEAS). Each SEAS ship has a time slot assigned for transmission of weather data directly to the weather satellite. Once the observer enters the weather data into the SEAS transmitter, the unit waits until a predetermined time and transmits. Currently, the U.S. has deployed 125 SEAS systems for use in transmitting environmental and oceanographic observations. Ships with these units have the capability of transmitting up to eight observations per day. The PMOs are also working to find ships who have INMARSAT Standard "C" on board and are willing to take and transmit weather through this medium. There are now approximately 10,000 ships equipped with Standard "C" and only a small percentage of them are taking and transmitting weather through this new, lower cost system.

Remember, when you see a PMO from any country coming aboard for a visit, he or she is there to help you. They are not trying to get something for free. The things the PMO wants you to do will pay you back by providing you with more accurate weather maps and forecasts. She will provide you with a barometer check to help ensure you a safe voyage. If you are in the Voluntary Observing Ship (VOS) program, he will make sure your supplies are up to operating levels. He will also be available to answer questions pertaining to observation techniques and use of instruments. The PMO will provide you with aids to help you take the observations.

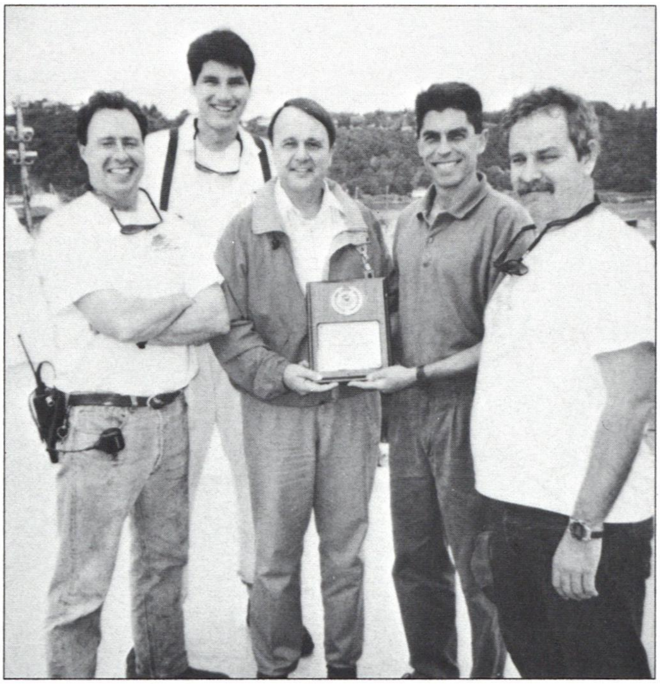
How can you go wrong? Not only are you provided with everything you need to do the job, you will also get a more accurate end result. By using the weather maps and forecasts provided via radio facsimile and telex, the forecast might save you time and money. Even if you have a weather routing service, they too benefit from your observations. Most weather routing services receive all ship observations from their local weather service and utilize the reports to build a forecast for you. So, if you don't belong to the VOS, please think about joining the next time you see a PMO come aboard.

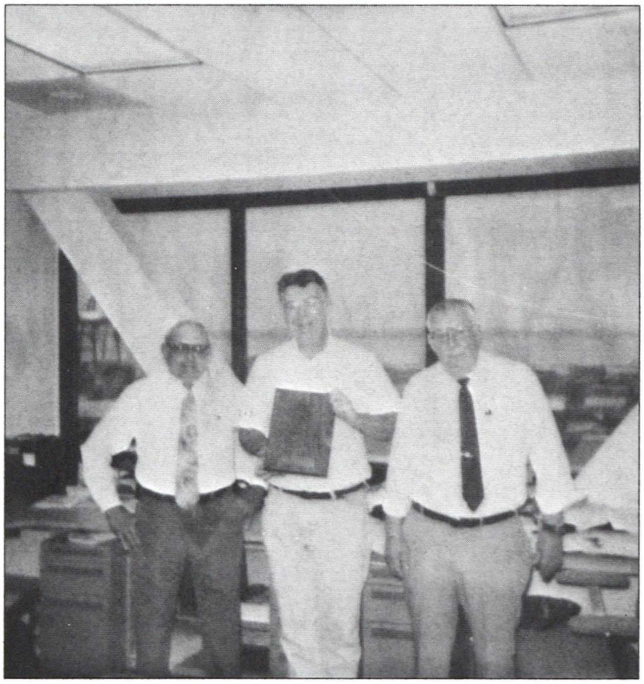
In addition to his PMO duties, Jim writes articles, keeps up with international radio facsimile schedules, and collects statistics for the U.S. PMO program.



Bob Decker, Seattle, presents a Seas "Top Ten" Award to the M/V Northern Lights' *two captains. On left is Captain Ron LaBarre, and on the right is Captain Michael Kucharski.*
Below left, Captain T.D. Almo of the m/s Federal Oslo *holds the VOS plaque for 1994 weather observations awarded to him by Newark PMO John Bollinger.*

Above right, PMO Newark John Bollinger presents the 1994 Outstanding VOS Award Plaque to Captain Frederick Cook of the S.S. Sea-Land Consumer. Below right, the Sea-Land Express receives the 1994 Top Honors for the VOS Observation Program for Seattle. Left to right: Tom MacKay, Jr., PMO Seattle Pat Brandow, Barry Costanzi and Timothy Hagan.





Above Seattle PMO Pat Brandow presents a VOS Observation Award to Northern Lights. *Left to right: Chief Mate Kirk M. Piper, Second Mate Ray Bladado, PMO Brandow, Captain Ron LaBarre, and Third Mate Mike Vanderhorst. Below left: Curtis VanHynning, Quartermaster of the Candian Coast Guard Ship* Simcoe, *won a jacket as an award for excellence in marine weather observing in 1994 from Ontario Region PMO Office.*

The VOS Observation Award was given to Vessel Operations, Norfolk, Virginia, International Terminals. From left to right: Bland Creekmore, PMO Norfolk Marty Bonk, and Ernie Dunn. Below right, Norman McKay of the SS **Mapleglen**, *a vessel of P & H Shipping, was one of the top 22 observers for 1994 in the Ontario Region VOS Fleet. McKay is wearing a jacket awarded by Environment Canada. Photo by Keith Clifford.*

Steve Kuhl, the new Supervisory Meteorologist at the National Weather Service Office in Kodiak, Alaska, has always had a keen interest in the weather. Steve is originally from New Jersey where he earned his Bachelors Degree in Geography and Masters Degree in Meteorology. Before coming to the NWS, Steve worked as a forecaster and radio broadcaster for a private meteorology firm in New Jersey from 1987 to 1992.

Steve began his NWS career as a Meteorologist Intern at Buffalo, NY in February 1992, transferred to the NWS Eastern Region Headquarters in Long Island, NY, during June 1993, and arrived in Kodiak in October 1995.

He brings with him an enthusiastic personality and hopes that he will be a positive addition to the WSO Kodiak team. In his own words Steve said that "I'm glad to be here in Alaska. This is a great opportunity for me to see this beautiful state and make a difference in providing our (NWS) customers with the best products and services possible."

Officers of the Coast Guard Cutter **Sweatbriar** *receive their award for outstanding performance in the Voluntary Observing Ship Program of the National Weather Service. Names of crew were not available at time of publication. Below left, PMO Norfolk Marty Bonk stands on the wing of the bridge aboard the OOCL* **Inspiration** *and presents an award (l-rt) C/M Mark Mahoney, Capt. Eric Franzen, R/O Paul Ferris and Marty. Mark Coultis, Commanding Officer of the Canadian Coast Guard Cutter* **Spray** *was one of the 22 winners of Environment Canada Ontario Region VOS observer awards in 1994.*

March, April, May and June 1995

CALL	PMO	SHIP NAME	RADIO	MAIL	TOTAL
WMFZ	Y	1ST LT ALEX BONNYMAN	069	030	099
WJKV	K	1ST LT BALDOMERO LOPEZ	019	022	041
WJLV	Y	1ST LT JACK LUMMUS	027	051	078
WJKH	N	2ND LT. JOHN P. BOBO	047	010	057
ZCAM9	K	A. V. KASTNER	019	000	019
CBAC	B	ACACIA	030	043	073
DULV	S	ACE ACCORD	011	000	011
GWAN	J	ACT 7	257	000	257
GYXG	J	ACT I	253	000	253
WPFZ	O	ADABELLE LYKES	089	102	191
WCF745	G	ADAM E. CORNELIUS	087	036	123
WPPO	N	ADVANTAGE	056	001	057
9VBW	M	AFFINITY	005	000	005
3ELE9	B	AGULHAS	154	082	236
9KWA	U	AL AWDAH	083	000	083
9KKF	U	AL SAMIDOON	249	000	249
9KKH	U	AL SHUHADAA	102	000	102
9KKY	U	AL TAHREER	254	000	254
3FTN4	M	AL WAALIYU	027	000	027
9KJP	B	AL WATTAYAH	000	034	034
ELAC5	U	ALBERNI DAWN	229	000	229
ELPG7	N	ALBERTO TOPIC	001	000	001
ELBM4	N	ALDEN W. CLAUSEN	100	085	185
9VDR	U	ALGENIB	254	000	254
JPAL	S	ALLIGATOR AMERICA	075	000	075
3FXX4	S	ALLIGATOR BRAVERY	049	020	069
3ETV8	S	ALLIGATOR COLUMBUS	106	074	180
3EIV8	T	ALLIGATOR EXCELLENCE	172	015	187
ELFK7	S	ALLIGATOR FORTUNE	147	000	147
ELJP2	S	ALLIGATOR GLORY	122	000	122
ELFN8	S	ALLIGATOR HOPE	039	182	221
3EDD8	F	ALLIGATOR JOY	134	018	152
JFUG	S	ALLIGATOR LIBERTY	123	000	123
3FAK5	S	ALLIGATOR STRENGTH	000	028	028
ELJO9	T	ALLIGATOR TRIUMPH	061	007	068
WAV464	C	ALPENA	074	054	128
WSD707	S	ALPHA HELIX	088	004	092
DZBD	T	ALTAMONTE	033	003	036
WJRG	J	AMERICAN CONDOR	119	133	252
KGOP	K	AMERICAN CORMORANT	024	006	030
KMJA	K	AMERICAN FALCON	080	016	096
LADX2	O	AMERICANA	043	027	070
ICBA	N	AMERIGO VESPUCCI	043	084	127
UINM	S	ANATOLIY KOLESNICHENKO	078	000	078
OXIT2	T	ANDERS MAERSK	088	118	206
LAGU4	K	ANNA	066	000	066
OYKS2	T	ANNA MAERSK	196	063	259
DPUF	N	ARABIAN SENATOR	111	000	111
KSBK	T	ARCO ALASKA	000	056	056
WCIO	T	ARCO ANCHORAGE	029	026	055
WMCV	T	ARCO CALIFORNIA	032	019	051
WGWB	T	ARCO FAIRBANKS	026	030	056
KLHV	T	ARCO INDEPENDENCE	004	060	064
KSBG	T	ARCO JUNEAU	014	024	
KHLD	T	ARCO SPIRIT	018	048	066
KNFD	T	ARCO TEXAS	052	005	057
ELQB8	T	ARCTIC SUN	036	127	163
4QUL	B	ARCTIC UNIVERSAL	341	000	341
KFDV	J	ARGONAUT	055	101	156
KGBD	Y	ARIES	001	000	001
OZBL2	M	ARKTIS LIGHT	050	009	059
WE6279	C	ARMCO	027	005	032
OZGI2	J	ARNOLD MAERSK	035	029	064
WE4805	G	ARTHUR M. ANDERSON	190	033	223
OXRS2	T	ARTHUR MAERSK	047	117	164
KSFJ	T	ATIGUN PASS	047	073	120
WRA906	U	ATLANTA BAY	063	000	063
3FYT	M	ATLANTIC	873	000	873
SKPE	J	ATLANTIC COMPANION	022	000	022
SKUN	N	ATLANTIC COMPASS	122	000	122
SKOZ	N	ATLANTIC CONCERT	040	000	040
ELIG8	J	ATLANTIC OCEAN	108	011	119
3EIK8	B	ATLANTIC STAR	056	004	060
GBSA	U	AUTHOR	029	000	029
OXSF2	F	AXEL MAERSK	221	020	241
WFQE	T	B.T. ALASKA	064	080	144
TCKG	Y	BALIKESIR	000	025	025
PCYO	B	BALTIC SUN	084	000	084
KASJ	U	BALTIMORE TRADER	068	118	186
WTC940	G	BARBARA ANDRIE	021	005	026
LAWJ2	M	BAUCHI	148	044	192
ELES7	S	BAY BRIDGE	102	116	218
ELFN7	J	BEBEDOURO	124	000	124
3FEA4	K	BELLONA	322	019	341
ELNZ7	B	BERNHARD OLDENDORF	007	000	007
KNJD	F	BLUE RIDGE	045	125	170
YDLR	S	BOGASARI LIMA	143	000	143
DGNB	U	BONN EXPRESS	123	000	123
3FMV3	F	BOSPORUS BRIDGE	197	137	334
ZCAK2	U	BP ADMIRAL	178	000	178
ZCAK3	S	BP ADVENTURE	170	000	170
3EKV5	F	BRAVERY	036	036	072
9VUM	N	BREMEN EXPRESS	067	000	067
OXVW4	F	BRIGIT MAERSK	020	048	068
3EZJ9	F	BROOKLYN BRIDGE	167	038	205
WSRP	T	BROOKS RANGE	026	008	034
ELOF4	F	BRUCE SMART	022	042	064
WAQ352	C	BUCKEYE	153	033	186
WWXB	N	BUFFALO SOLDIER	000	109	109
9MYK	T	BUNGA KANTAN	001	000	001
TCLN	Y	BURDUR	000	036	036
WQZ704	G	BURNS HARBOR	369	086	455
WB4520	G	CALCITE II	067	023	090
ELMG2	O	CALIFORNIA CURRENT	245	000	245

March, April, May and June 1995

CALL	PMO	SHIP NAME	RADIO	MAIL	TOTAL
ELJP6	S	CALIFORNIA HERMES	059	008	067
JGPN	S	CALIFORNIA MERCURY	320	000	320
3FSI3	T	CALIFORNIA ORION	100	068	168
3EPB6	F	CALIFORNIA PEGASUS	124	000	124
ELKU9	N	CALIFORNIA SATURN	030	000	030
ELJP8	S	CALIFORNIA ZEUS	043	029	072
KAKG	B	CALVIN P. TITUS	011	041	052
ELAD7	B	CANADIAN LIBERTY	038	017	055
3EFX5	S	CAPE CHARLES	025	000	025
ELFY8	O	CAPE HATTERAS	073	000	073
3ENQ9	N	CAPE HENRY	048	000	048
KMJS	N	CAPE HORN	002	000	002
JBCN	N	CAPE MAY	087	000	087
WFPJ	Y	CAPE ORLANDO	032	012	044
WRGH	B	CAPE WASHINGTON	024	021	045
3FFU4	M	CARIBBEAN MERCY	001	000	001
ELBG9	F	CARLA A. HILLS	094	091	185
3ESJ3	T	CARMEL	047	178	225
WYBI	K	CAROLINA	028	093	121
WE4879	G	CASON J. CALLAWAY	201	042	243
ELRJ5	M	CCNI ATACAMA	101	060	161
ELFT8	M	CELEBRATION	022	001	023
3FVN4	K	CENTURY HIGHWAY NO. 5	235	000	235
3FFJ4	U	CENTURY HIGHWAY NO. 1	114	000	114
3EJB9	T	CENTURY HIGHWAY #2	188	000	188
8JNP	U	CENTURY HIGHWAY_NO. 3	171	000	171
7LHH	U	CENTURY LEADER NO. 1	189	000	189
3EJT9	B	CHARLES LYKES	152	035	187
WL3108	C	CHARLES M. BEEGHLEY	103	023	126
5LPA	F	CHARLES PIGOTT	000	122	122
KNJF	J	CHARLESTON	001	000	001
WPHZ	U	CHARLOTTE LYKES	086	122	208
OXCD2	N	CHARLOTTE MAERSK	000	024	024
OWNJ2	Y	CHASTINE MAERSK	000	057	057
3FSL2	S	CHC NO.1	038	000	038
KAFO	U	CHEMICAL PIONEER	104	018	122
WIBK	T	CHERRY VALLEY	005	000	005
DEBB	U	CHESAPEAKE BAY	026	000	026
WCYS	F	CHESAPEAKE CITY	006	012	018
WGZK	U	CHESAPEAKE TRADER	088	049	137
KGBE	M	CHEVRON ARIZONA	001	003	004
KLHZ	F	CHEVRON COLORADO	027	063	090
VSBZ5	F	CHEVRON EDINBURGH	146	142	288
WXBR	F	CHEVRON MISSISSIPPI	044	005	049
ELCO5	F	CHEVRON PACIFIC	080	089	169
KFDB	F	CHEVRON WASHINGTON	008	006	014
3EME7	N	CHILEAN EXPRESS	028	000	028
ELQF5	S	CHINA HOPE	057	000	057
ELQF4	S	CHINA SPIRIT	053	000	053
ZCBB7	K	CHIQUITA JEAN	046	000	046

CALL	PMO	SHIP NAME	RADIO	MAIL	TOTAL
ELHM8	J	CHOAPA	096	003	099
DEGY	N	CHOYANG PRIDE	062	000	062
KGXA	U	CLEVELAND	039	075	114
OXME2	J	CLIFFORD MAERSK	132	008	140
WSDK	F	COAST RANGE	063	016	079
WHMK	U	COASTAL EAGLE POINT	004	000	004
KGXM	K	COASTAL MANATEE	086	002	088
KWFE	M	COLORADO	093	017	110
WRB400	U	COLUMBIA BAY	157	000	157
DVBH	S	COLUMBIA BAY	022	000	022
WSB201	C	COLUMBIA STAR	094	022	116
3ELQ9	B	COLUMBINE	175	008	183
DIIU	N	COLUMBUS AMERICA	118	000	118
DAFC	U	COLUMBUS AUSTRALIA	148	000	148
DHCM	T	COLUMBUS CALIFORNIA	264	000	264
ELQN3	S	COLUMBUS CANADA	122	000	122
DGNZ	J	COLUMBUS NEW ZEALAND	126	000	126
DICQ	N	COLUMBUS QUEENSLAND	193	000	193
DNKL	T	COLUMBUS VICTORIA	195	000	195
DGZV	T	COLUMBUS VIRGINIA	001	000	001
ELJS6	T	CONTIENTAL WING	075	000	075
3EIP3	N	CONTSHIP AMERICA	052	000	052
OXIF2	N	CORNELIA MAERSK	108	006	114
LXBY	B	CORNELIS VEROLME	065	000	065
KPJC	F	CORNUCOPIA	060	082	142
KPSB	K	CORONADO	001	000	001
WMRU	U	CORPUS CHRISTI	020	014	034
WTF331	N	CORWITH CRAMER	002	023	025
KCBK	U	COURIER	091	000	091
WE6970	C	COURTNEY BURTON	202	050	252
ZCAQ8	B	COURTNEY L.	204	032	236
WPHV	N	CPL. LOUIS J. HAUGE JR	024	123	147
ICYS	N	CRISTOFORO COLOMBO	041	014	055
3EPW9	M	CROWN JEWEL	000	301	301
ELGH5	M	CROWN PRINCESS	006	000	006
CGDG	N	CSS HUDSON	129	000	129
WTW672	N	DAN MOORE	003	000	003
WZF965	C	DAVID Z. NORTON	097	042	139
ELIU4	B	DEL MONTE CONSUMER	065	003	068
ELIT9	K	DEL MONTE PACKER	088	000	088
ELIU3	B	DEL MONTE TRADER	000	134	134
WXWL	T	DELAWARE TRADER	162	064	226
ELIT7	M	DELMONTE PLANTER	000	112	112
ELIU2	M	DELMONTE TRANSPORTER	064	001	065
WSVR	T	DENALI	178	017	195
DIDT	J	DEPPE FLORIDA	245	000	245
PPSL	N	DG COLUMBIA	129	286	415
PJRF	B	DOCK EXPRESS 20	085	000	085
PJRO	B	DOCK EXPRESS 10	159	000	159
3ELF9	B	DOCTOR LYKES	098	000	098

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CALL	PMO	SHIP NAME	RADIO	MAIL	TOTAL
WYQ795	M	DODGE ISLAND	000	001	001
ELPX9	S	DOROTHEA OLDENDORFF	089	010	099
VRUH6	U	DOUBLE GLORY	101	096	197
DQFS	N	DSR BALTIC	152	000	152
DQFT	N	DSR EUROPE	095	000	095
DQFW	T	DSR PACIFIC	130	000	130
DGDC	J	DUSSELDORF EXPRESS	829	000	829
LAYU2	K	DYVI OCEANIC	147	000	147
G3130	N	E.P. LE QUEBECOIS	001	000	001
WZE771	C	EARL W. OGLEBAY	025	017	042
6ZFB	T	EASTERN LION	055	000	055
ELNC5	M	ECSTASY	051	003	054
VRUM3	S	EDELWIESS	133	093	226
WQZ967	G	EDGAR B. SPEER	152	022	174
GVUS	U	EDINBURGH FRUID	111	000	111
WXQ451	G	EDWIN H. GOTT	398	036	434
WLT479	M	EDWIN LINK	000	048	048
ELOG8	S	EIBE OLDENDORFF	230	033	263
LXBU	B	ELLEN HUDIG	017	000	017
LAKZ4	N	ELLEN KNUDSEN	047	011	058
KKFW	Y	EMPIRE STATE	069	000	069
3FMF2	O	ENCHANTED SEAS	013	000	013
9VVI	U	ENIF	082	000	082
KAKF	B	ERIC G. GIBSON	010	036	046
BKJO	N	EVER GAINING	024	000	024
BKJN	N	EVER GALLANT	009	000	009
BKHB	N	EVER GARDEN	010	000	010
3EOB8	T	EVER GARLAND	022	005	027
BKHD	S	EVER GENTRY	008	015	023
3FRI2	T	EVER GIANT	007	006	013
BKJJ	T	EVER GIVEN	016	053	069
BKHM	S	EVER GLEAMY	026	006	032
3EMV8	S	EVER GLOBE	005	000	005
3FLB2	S	EVER GLORY	005	001	006
BKHN	S	EVER GOVERN	027	006	033
3FOW2	S	EVER GRADE	017	000	017
BKJI	T	EVER GROUP	010	000	010
BKHK	S	EVER GROWTH	002	002	004
3ESL2	S	EVER GUARD	013	003	016
3EVJ2	S	EVER GUIDE	004	000	004
BKHH	T	EVER LAUREL	001	006	007
3ERJ2	S	EVER LINKING	017	000	017
3FJL4	N	EVER RACER	024	011	035
3FFR4	T	EVER RENOWN	002	006	008
3FSB3	Y	EVER REWARD	049	000	049
3FQN3	T	EVER ROUND	014	004	018
WEZM	S	EWA	148	064	212
VROF	B	EXCELSIOR	178	000	178
WCJS	J	EXPORT FREEDOM	069	082	151
WCJY	J	EXPORT PATRIOT	053	072	125
PEBM	N	FAIRLIFT	104	000	104
PJLC	N	FAIRMAST	117	000	117
ELKI6	M	FANTASY	003	013	016
FARIS	F	FARALLON ISLAND	343	000	343
3EWK9	M	FASCINATION	115	045	160
WRYX	K	FAUST	078	086	164
LXBR	O	FEDERAL SKEENA	017	000	017
TCAF	N	FERIDA	103	030	133
LLEJ3	T	FERNCROFT	111	120	231
OXBM6	N	FETISH	219	000	219
WQVY	K	FIDELIO	086	082	168
ELDY9	M	FIORA TOPIC	013	000	013
YJXL2	S	FIR GROVE	061	202	263
ELIQ7	J	FOREST HAWK	073	054	127
KRGC	K	FRANCES HAMMER	183	039	222
WAR732	C	FRED R. WHITE JR	123	032	155
KNJN	U	FREDERICKSBURG	016	020	036
3FJH3	U	FRINES	063	000	063
KLPN	K	GALVESTON BAY	011	042	053
WPKD	U	GALVESTON BAY	192	025	217
WA5307	G	GEORGE A. SLOAN	105	019	124
WBK692	C	GEORGE A. STINSON	087	021	108
ELPG9	B	GEORGE SCHULTZ	095	038	133
JKCF	T	GEORGE WASHINGTON BRID	270	010	280
3ERJ8	K	GEORGIA RAINBOW II	109	031	140
JFKC	T	GINA MARU	053	000	053
WWDY	B	GLOBAL LINK	054	025	079
WWXA	B	GLOBAL MARINER	090	033	123
WRZU	B	GLOBAL SENTINEL	031	000	031
DUZH	S	GOLDEN APO	039	007	046
KIYG	F	GOLDEN BEAR	093	000	093
KIOH	T	GOLDEN GATE	000	023	023
WFDP	S	GREAT LAND	050	028	078
KGTH	T	GREEN BAY	024	010	034
KIBJ	O	GREEN HARBOUR	007	039	046
KIBK	O	GREEN ISLAND	030	052	082
KGTI	B	GREEN LAKE	130	161	291
3ETA5	S	GREEN MAYA	051	220	271
3ENI3	S	GREEN RAINIER	003	072	075
WRYL	S	GREEN RIDGE	000	216	216
3EUT5	S	GREEN SASEBO	032	024	056
3EVE5	S	GREEN SUMA	014	209	223
3FDY3	S	GREEN SYLVAN	025	000	025
KHAG	U	GREEN VALLEY	009	006	015
3ECN7	S	GROWTH RING	224	000	224
ELMH8	K	GUANAJUATO	001	000	001
WZJG	K	GUAYAMA	024	063	087
ELMF9	O	GULF CURRENT	270	000	270

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CALL	PMO	SHIP NAME	RADIO	MAIL	TOTAL	CALL	PMO	SHIP NAME	RADIO	MAIL	TOTAL
ELIH8	U	GULF SPIRIT	039	000	039	KCSA	U	INGER	040	000	040
ZCAN3	N	GYPSUM BARON	199	000	199	KNDM	U	IOWA TRADER	059	017	076
ZCAN2	M	GYPSUM KING	177	000	177	GBBM	T	ISLAND PRINCESS	015	000	015
WZD246	C	H. LEE WHITE	093	039	132	WXKM	B	ITB BALTIMORE	139	013	152
DVCJ	S	HANDY SILVER	058	037	095	KMJL	J	ITB GROTON	117	007	124
3EXX9	T	HANJIN BARCELONA	020	000	020	KXDB	Y	ITB MOBILE	061	013	074
D9FE	S	HANJIN CHUNGMU	052	000	052	WVDG	J	ITB NEW YORK	145	004	149
3FTF4	F	HANJIN COLOMBO	009	000	009	KSYP	B	ITB PHILADELPHIA	018	070	088
D9XB	F	HANJIN ELIZABETH	020	000	020	PEXX	U	IVER EXPRESS	001	000	001
D9TJ	S	HANJIN FELIXSTOWE	014	000	014	3ESU8	S	IWANUMA MARU	019	105	124
ELME3	T	HANJIN HONG KONG	014	000	014	ELLE2	B	J. DENNIS BONNEY	000	185	185
D9TW	S	HANJIN KAOHSIUNG	007	027	034	WNDG	B	JACKSONVILLE	182	018	200
ELME2	T	HANJIN KOBE	062	000	062	VCDR	O	JADE STAR	000	041	041
D9SY	S	HANJIN LE HAVRE	027	001	028	LAWS2	U	JAHRE SPIRIT	010	000	010
3FCU3	F	HANJIN MARSEILLES	048	000	048	ATSA	O	JALAGOVIND	023	000	023
3EPU4	T	HANJIN NEW YORK	060	000	060	XCBR	U	JALISCO	100	093	193
D9SG	T	HANJIN OAKLAND	018	000	018	ELRR6	O	JAMES LYKES	002	000	002
D9SR	S	HANJIN ROTTERDAM	010	004	014	ELPG8	B	JAMES N. SULLIVAN	000	076	076
D9MX	T	HANJIN SAVANNAH	048	000	048	WYP865	C	JAMES R. BARKER	241	016	257
D9SF	S	HANJIN SEATTLE	015	005	020	3EKL8	S	JAPAN RAINBOW 2	114	122	236
D9TX	T	HANJIN SINGAPORE	012	000	012	WUBV	U	JEAN LYKES	076	093	169
3ESM4	T	HANJIN YOKOHAMA	073	000	073	WRGQ	F	JEB STUART	083	047	130
VRUG6	K	HARMONY ACE	001	000	001	PJNF	B	JO CLIPPER	002	000	002
DQET	N	HAVELLAND	075	131	206	PJKI	B	JO ELM	128	000	128
LALA2	M	HAVJO	028	006	034	WE3806	G	JOHN G. MUNSON	214	036	250
DEDI	U	HEIDELBERG EXPRESS	115	000	115	WF2560	C	JOHN J. BOLAND	042	010	052
3EUE7	K	HEIJIN	003	002	005	KIHD	U	JOHN LYKES	028	000	028
JKLS	T	HENRY HUDSON BRIDGE	259	009	268	WCB582	G	JOHN PURVES	050	035	085
WL3972	C	HERBERT C. JACKSON	034	004	038	ELNG9	F	JOHN YOUNG	000	127	127
VSBN2	U	HERMOD	005	000	005	WA6575	C	JOSEPH H. FRANTZ	129	034	163
VSBN4	U	HESIOD	221	000	221	WXY621	G	JOSEPH L. BLOCK	022	028	050
ZHEN7	N	HOEGH DRAKE	017	034	051	ELKA7	K	JUBILANT	018	008	026
ZHFY4	N	HOEGH DUKE	021	029	050	ELFK6	T	JUBILEE	021	001	022
ZHEM7	T	HOEGH DYKE	000	024	024	KRGJ	K	JULIUS HAMMER	176	004	180
ELNG6	M	HORIZON	000	057	057	9VNA	B	JUPITER DIAMOND	033	000	033
WCIP	S	HOWELL LYKES	047	070	117	WZ2043	G	KAHO	000	039	039
LAVG4	K	HUAL ROLITA	027	000	027	KCGH	T	KAINALU	215	010	225
WZJB	N	HUMACAO	045	029	074	ELHX2	S	KAKUSHIMA	117	086	203
3EXG9	F	HYUNDAI COMMANDER	015	025	040	KSDF	U	KANSAS TRADER	072	057	129
3EYL9	T	HYUNDAI DUKE	032	008	040	UJCQ	S	KAPITAN MAN	137	000	137
3FAF3	T	HYUNDAI EMPERIOR	026	012	038	WBS527	G	KAREN ANDRIE	013	014	027
DIHL	S	HYUNDAI LONGVIEW	003	112	115	WSRH	F	KAUAI	108	203	311
ELOK6	S	HYUNDAI PORTLAND	042	000	042	WUR885	C	KAYE E. BARKER	140	027	167
ELHC2	S	HYUNDAI VANCOUVER	077	000	077	9KKL	U	KAZIMAH	124	000	124
EKYO	S	IGARKA	048	000	048	WSNB	U	KENAI	106	126	232
3EWJ9	M	IMAGINATION	007	006	013	JKPP	N	KENTUCKY HIGHWAY	105	000	105
ATRU	O	INDIAN GOODWILL	016	000	016	KSFK	T	KEYSTONE CANYON	012	032	044
ELIG7	J	INDIAN OCEAN	084	033	117	DHSB	U	KHALEEJ BAY	004	000	004
WXN319	C	INDIANA HARBOR	032	012	044	WAC455	C	KINSMAN ENTERPRISE	030	046	076

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CALL	PMO	SHIP NAME	RADIO	MAIL	TOTAL
WUZ781	C	KINSMAN INDEPENDENT	155	130	285
KGPK	N	KITTANING	017	021	038
EMEK	S	KOMSOMOLETS PRIMORYA	027	000	027
9HOO3	N	KOPER EXPRESS	022	000	022
GOYE	U	KOWLOON BAY	092	000	092
3EOF7	J	KURAMA	054	000	054
3FGN3	S	KURE	033	051	084
H9BV	O	LA TRINITY	046	004	050
WTV400	B	LADY MARYLAND	000	008	008
WA0908	G	LAKE GUARDIAN	034	069	103
WEZU	O	LASH ATLANTICO	010	001	011
WLBX	N	LAWRENCE H. GIANELLA	062	037	099
OULU2	T	LEDA MAERSK	001	000	001
5MDL	B	LEON	021	000	021
CG2959	N	LEONARD J. COWLEY	057	000	057
GUYC	U	LEONIA	183	000	183
ELMH5	T	LERMA	124	000	124
WHTU	U	LESLIE LYKES	029	000	029
WCPU	O	LIBERTY SPIRIT	008	001	009
WCBP	O	LIBERTY STAR	077	097	174
WCOB	N	LIBERTY SUN	054	068	122
DVHE	S	LIBERTY VICTORY	033	146	179
KRHZ	N	LIBERTY WAVE	023	002	025
ELEV8	U	LIRCAY	122	109	231
WSKJ	F	LNG AQUARIUS	017	127	144
KHLN	Y	LNG CAPRICORN	006	000	006
WDZB	Y	LNG LEO	069	028	097
WDZW	Y	LNG TAURUS	070	097	167
WDZX	Y	LNG VIRGO	021	014	035
MQWA5	U	LONDON ENTERPRISE	088	000	088
GCCC	B	LONDON SPIRIT	201	000	201
3FOU3	S	LONG BEACH	003	033	036
WATF	B	LONG LINES	053	000	053
KDZF	N	LOUISIANA	013	006	019
VTKG	C	LT ARGOSY	028	011	039
VTKB	C	LT. ODYSSEY	012	000	012
OWDX2	T	LUNA MAERSK	127	105	232
WLVD	F	LURLINE	086	095	181
JKES	T	MACKINAC BRIDGE	227	004	231
OVJB2	F	MADISON MAERSK	070	051	121
WRYJ	F	MAERSK CONSTELLATION	070	101	171
DHJW	U	MAERSK LA PLATA	183	000	183
OXOL2	T	MAERSK LIMA	012	060	072
9VYK	S	MAERSK YOKOHAMA	081	000	081
OWOG2	K	MAGIC	064	063	127
OUSH2	J	MAGLEBY MAERSK	074	096	170
CALL	PMO	SHIP NAME	RADIO	MAIL	TOTAL
WHRN	F	MAHIMAMI	172	113	285
WHAU	N	MAJ STEPHEN W PLESS MP	041	026	067
OUJH2	J	MAJESTIC MAERSK	044	097	141
VTJS	C	MANGAL DESAI	048	092	140
KNLO	F	MANUKAI	080	176	256
VWVY	T	MARATHA MAJESTY	020	000	020
OWDQ2	T	MARCHEN MAERSK	080	039	119
OWZU2	T	MAREN MAERSK	042	021	063
KRJL	U	MARGARET LYKES	049	052	101
OYSN2	T	MARGRETHE MAERSK	105	052	157
3EHF5	U	MARIA BONITA	014	000	014
5MPS	M	MARIA TOPIC	006	039	045
OULL2	J	MARIE MAERSK	080	050	130
DUNP	S	MARIF	031	010	041
OZFC2	F	MARIT MAERSK	104	047	151
3EHE3	S	MARITIME FIDELITY	015	021	036
MTC	S	MARITIME TRAINING CENT	005	000	005
KAXP	O	MARJORIE LYKES	005	000	005
6ZXG	O	MARLIN	000	250	250
LAKW4	B	MARTHA II	017	000	017
OUUU2	T	MATHILDE MAERSK	072	079	151
KHRC	F	MATSONIA	230	052	282
WSLH	T	MAUI	198	088	286
WLDZ	J	MAURICE EWING	111	095	206
WZJE	K	MAYAGUEZ	075	016	091
OWEB2	F	MAYVIEW MAERSK	060	037	097
OUZW2	J	MC-KINNEY MAERSK	071	062	133
OYEK2	K	MEDALLION	069	033	102
WA4659	C	MEDUSA CHALLENGER	222	042	264
WECB	T	MELVILLE	274	110	384
VROP	S	MERCHANT PREMIER	112	000	112
VRIO	S	MERCHANT PRINCIPAL	169	000	169
JFMO	N	MERCURY ACE	009	000	009
9VHJ	T	MERLION ACE	033	009	042
WYQ435	C	MESABI MINER	176	034	210
OXKT2	T	METTE MAERSK	024	076	100
CALL	PMO	SHIP NAME	RADIO	MAIL	TOTAL
XYLG	S	MICHELLE	045	016	061
WRB414	G	MICHIGAN	180	121	301
JKLQ	B	MICHIGAN HIGHWAY	006	000	006
ELAX2	T	MICRONESIAN PRIDE	040	000	040
WR3225	C	MIDDLETOWN	059	030	089
DQEB	N	MILDBURG	264	000	264
ELND2	M	MINERAL OSPREY	118	002	120
BLII	T	MING PLEASURE	196	000	196
BLIJ	Y	MING PROPITIOUS	054	000	054
XCNX	U	MITLA	151	055	206
CALL	PMO	SHIP NAME	RADIO	MAIL	TOTAL

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CALL	PMO	SHIP NAME	RADIO	MAIL	TOTAL
OWUO6	T	MOANA PACIFIC	123	000	123
WUS929	N	MOANA WAVE	029	000	029
WNRD	F	MOKIHANA	079	196	275
WBWK	F	MOKU PAHU	065	048	113
KDBG	F	MONOA	230	065	295
PGAF	T	MONTERREY	149	000	149
PGBB	T	MORELOS	239	070	309
WMBQ	Y	MORMACSKY	047	059	106
KGDF	U	MORMACSTAR	059	027	086
WMBK	N	MORMACSUN	036	034	070
ELRE5	N	MOSEL ORE	135	006	141
WA8463	G	MYRON C. TAYLOR	120	026	146
PGCJ	T	MYSTIC	001	000	001
XCSG	U	NACIONAL VITORIA	124	000	124
LXNF	N	NARA	023	010	033
DZRG	T	NATIONAL DIGNITY	048	003	051
DZDI	T	NATIONAL HONOR	037	027	064
DZPK	T	NATIONAL PRIDE	045	167	212
XCMM	U	NAUTICAS MEXICO	132	000	132
PGDP	S	NEDLLOYD CLARENCE	012	000	012
PGDD	U	NEDLLOYD DELFT	053	000	053
KRHX	U	NEDLLOYD HOLLAND	173	011	184
PHKG	U	NEDLLOYD RALEIGH BAY	008	000	008
PGEI	J	NEDLLOYD ROTTERDAM	125	000	125
PGEC	F	NEDLLOYD VAN NOORT	062	000	062
PGEB	F	NEDLLOYD VAN NECK	041	000	041
PGDB	U	NEDLLOYD VAN DAJIMA	099	000	099
PGFE	T	NEDLLOYD VAN DIEMEN	080	000	080
DPSI	T	NEDLLOYD VAN CLOON	110	000	110
DDOJ	T	NEDLLOYS MAURITIUS	102	000	102
JFLX	T	NEPTUNE ACE	154	000	154
9VNW	S	NEPTUNE CRYSTAL	016	000	016
3EIQ7	S	NEPTUNE DIAMOND	082	000	082
9VYT	T	NEPTUNE DIAMOND	027	000	027
9VOQ	S	NEPTUNE GARNET	039	037	076
9VNQ	N	NEPTUNE JADE	031	000	031
ELJP4	T	NEPTUNE RHODONITE	022	000	022
9VOP	S	NEPTUNE RUBY	006	000	006
DVUI	S	NEW CARISSA	080	118	198
WKWB	T	NEW HORIZON	079	094	173
WPKS	U	NEWARK BAY	160	032	192
3FGH3	F	NEWPORT BRIDGE	075	000	075
PJCH	T	NIEUW AMSTERDAM	065	000	065
WTDK	S	NOAA DAVID STARR JORDA	022	137	159
WMVF	N	NOAA SHIP ALBATROSS IV	296	047	343
WTED	O	NOAA SHIP CHAPMAN	159	061	220
WTEA	S	NOAA SHIP DISCOVERER O	371	275	646
WTEZ	N	NOAA SHIP FERREL	314	041	35

CALL	PMO	SHIP NAME	RADIO	MAIL	TOTA
WTER	M	NOAA SHIP M. BALDRIDGE	811	086	897
WTEJ	S	NOAA SHIP MCARTHUR	001	553	554
WTDM	S	NOAA SHIP MILLER FREEM	354	306	660
WTDO	O	NOAA SHIP OREGON II	429	040	469
WTEF	S	NOAA SHIP RAINIER	212	060	272
WTES	S	NOAA SHIP SURVEYOR	096	123	219
WTDF	S	NOAA SHIP T. CROMWELL	061	033	094
WTEW	B	NOAA SHIP WHITING	012	000	012
KRPP	U	NOBEL STAR	152	056	208
LAUU2	S	NOMADIC MERMAID	028	000	028
MTQU3	N	NOMZI	217	193	410
LACF4	B	NORD JAHRE TRANSPORTER	044	000	044
LAJO4	B	NORD JAHRE TARGET	094	000	094
WFJK	O	NORTHERN LIGHTS	243	069	312
LAON2	S	NOSAC EXPLORER	016	000	016
LAZA2	T	NOSAC EXPRESS	029	000	029
WRYG	N	NOSAC RANGER	123	076	199
LAIZ4	K	NOSAC STAR	025	000	025
ELCW2	J	NOSAC TAKAYAMA	112	092	204
XCKX	U	NUEVO LEON	070	095	165
KEOD	N	NUEVO SAN JUAN	028	123	151
DHNE	N	NURNBERG EXPRESS	612	000	612
ELNJ3	S	NYK SEABREEZE	121	000	121
JPGO	T	NYK STARLIGHT	101	000	101
JPAQ	S	NYK SUNRISE	159	000	159
ELOT3	S	NYK SURFWIND	047	000	047
PGLA	T	OAXACA	210	013	223
TCEY	T	OBO ENGIN	023	001	024
ELKD6	T	OCEAN HIGHWAY	046	000	046
3FLX4	S	OCEAN LAUREL	005	075	080
DPOH	N	OCEAN SPIRIT	434	000	434
ELLY4	M	OCEANBREEZE	008	002	010
3EQZ6	J	OCEANUS OSAKA	083	072	155
PJJU	J	OLEANDER	091	088	179
ELKD7	T	OLIVE ACE	066	028	094
3ETQ5	B	OLIVEBANK	142	000	142
WBKX	K	OMI MISSOURI	083	178	261
ZCKE	N	OOCL BRAVERY	077	000	077
ELIC9	F	OOCL EDUCATOR	118	031	149
ELNV7	S	OOCL ENVOY	099	005	104
ELNV8	S	OOCL EXPLORER	136	035	171
ELIO8	S	OOCL EXPORTER	107	000	107
ELFV2	T	OOCL FAIR	229	000	229
ELFU9	N	OOCL FAITH	173	000	173
BMEJ	U	OOCL FAME	021	001	022
ELFV8	T	OOCL FIDELITY	119	022	141
ELFU8	T	OOCL FORTUNE	184	037	221
VRCV	N	OOCL FREEDOM	319	000	319
ELFV3	T	OOCL FRIENDSHIP	043	000	043

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CALL	PMO	SHIP NAME	RADIO	MAIL	TOTAL
WPWH	U	OOCL INNOVATION	096	111	207
KRPB	U	OOCL INSPIRATION	234	054	288
ELPX7	J	ORANGE WAVE	001	047	048
3FOB4	K	OREGON RAINBOW III	077	081	158
DZDB	M	ORIENTAL FERM	012	000	012
3FOU4	S	ORIENTE PRIME	007	146	153
ELJT7	K	ORION HIGHWAY	157	053	210
GOYG	J	OSAKA BAY	180	000	180
ELPP9	B	OURO DO BRASIL	120	000	120
WEHV	S	OVERSEAS ALASKA	017	009	026
KLEZ	O	OVERSEAS ARCTIC	067	057	124
WRFJ	U	OVERSEAS HARRIET	094	026	120
WUQL	K	OVERSEAS JOYCE	047	096	143
WFQB	U	OVERSEAS MARILYN	015	000	015
WFKW	U	OVERSEAS NEW ORLEANS	084	018	102
WJBG	F	OVERSEAS OHIO	031	004	035
WFGV	U	OVERSEAS WASHINGTON	002	000	002
ELKM7	S	PACASIA	044	016	060
XYKS	S	PACDUKE	014	000	014
ELJQ2	S	PACIFIC ARIES	136	000	136
3ETF4	S	PACIFIC EMERALD	005	000	005
GBCF	Y	PACIFIC PRINCESS	122	000	122
XYKH	S	PACMERCHANT	046	000	046
ELED7	S	PACPRINCE	025	000	025
ELED8	U	PACPRINCESS	018	000	018
XYKM	S	PACSUN	033	000	033
PGQC	B	PALMGRACHT	011	000	011
VROV	S	PAPAGO	084	011	095
KGBQ	U	PATRIOT	036	000	036
KDGR	U	PAUL BUCK	020	061	081
WTM901	C	PAUL H. TOWNSEND	087	017	104
WYR448	C	PAUL R. TREGURTHA	351	031	382
VRUN4	K	PEARL ACE	111	000	111
WXQ733	N	PETER W. ANDERSON	052	003	055
ZCKC	N	PETERSFIELD	001	000	001
ELKZ4	M	PETROBULK RACER	000	106	106
WHAQ	N	PFC EUGENE A. OBREGON	021	010	031
WJXG	J	PFC JAMES ANDERSON JR	018	019	037
KRPW	N	PFC WILLIAM B. BAUGH	058	028	086
DDQS	N	PHAROS	085	000	085
WE3592	G	PHILIP R. CLARKE	128	006	134
3EGS6	N	PHOENIX DIAMOND	024	000	024
CG2678	N	PIERRE FORTIN	200	000	200
ZEOD	S	PISCES PIONEER	142	000	142
ZEOE	U	PISCES PLANTER	144	000	144
WXVH	O	PLATTE	075	085	160
LAJJ4	J	POCAHONTAS	008	000	008
ELPT3	T	POLAR EAGLE	029	174	203
PGUP	B	POOLGRACHT	238	000	238
KXEE	U	POTOMAC	027	000	027
WXBZ	U	POTOMAC TRADER	008	000	008
WRYW	F	PRESIDENT ADAMS	155	081	236
WGLA	F	PRESIDENT ARTHUR	071	185	256
WGMJ	F	PRESIDENT BUCHANAN	032	106	138
KRJG	T	PRESIDENT EISENHOWER	146	118	264
KRJF	T	PRESIDENT F. ROOSEVELT	278	024	302
WGXN	F	PRESIDENT GARFIELD	025	041	066
WEZD	S	PRESIDENT GRANT	099	039	138
WEZH	S	PRESIDENT HARRISON	153	000	153
WGXO	F	PRESIDENT HARDING	088	131	219
WTST	S	PRESIDENT HOOVER	051	159	210
WRYC	S	PRESIDENT JACKSON	057	206	263
WPGE	S	PRESIDENT JEFFERSON	042	083	125
WRYE	F	PRESIDENT KENNEDY	201	029	230
WRYD	F	PRESIDENT POLK	021	230	251
WNDP	F	PRESIDENT TRUMAN	117	082	199
WZE492	C	PRESQUE ISLE	139	090	229
WUW212	B	PRIDE OF BALTIMORE II	029	035	064
3EC09	S	PRINCE OF OCEAN	119	232	351
3EUU6	S	PRINCE OF TOKYO 2	106	142	248
WSDX	T	PRINCE WILLIAM SOUND	042	097	139
ELJT9	S	PRINCESS DIAN	028	004	032
PJAG	B	PROJECT ORIENT	065	000	065
WMFW	N	PVT FRANKLIN J. PHILLI	028	008	036
ZBWE	N	PYTCHLEY	299	000	299
3EF03	K	QUALITY OF LIFE	015	000	015
GBTT	Y	QUEEN ELIZABETH 2	238	000	238
WRJP	T	R.J. PFEIFFER	054	190	244
3EGR6	U	RECIFE	058	000	058
ELGH6	M	REGAL PRINCESS	044	020	064
MQYA3	U	REPULSE BAY	180	000	180
WE7207	C	RESERVE	146	059	205
KFDZ	N	RESOLUTE	051	128	179
ELF03	O	RHINE FOREST	121	112	233
WLBV	K	RICHARD G MATTIESEN	010	003	013
WBF237	C	RICHARD REISS	060	008	068
WRA792	U	RICHMOND BAY	058	000	058
KCRD	O	ROBERT E. LEE	028	025	053
3FIP4	S	ROCKIES HIGHWAY	020	000	020
WZP816	G	ROGER BLOUGH	237	042	279
ELAJ6	S	ROSINA TOPIC	022	245	267
LATL2	M	ROSITA	089	012	101
KCBH	U	ROVER	065	016	081
GBRP	T	ROYAL PRINCESS	097	000	097
3FAP5	S	RUBIN STELLA	000	004	004
WTP496	C	S.T. CRAPO	149	043	192
WNPD	O	S/S WILSON	036	042	078
3EPF3	S	SALINAS	029	000	029

March, April, May and June 1995

CALL	PMO	SHIP NAME	RADIO	MAIL	TOTAL
KDGA	U	SAM HOUSTON	046	053	099
KCDJ	F	SAMUEL L. COBB	037	004	041
CG2960	N	SAMUEL RISLEY	753	000	753
DIOR	N	SAN ISIDRO	158	000	158
ELND4	K	SAN MARCOS	066	073	139
DHHO	N	SAN PEDRO	018	000	018
DNGV	N	SAN VINCENTE	018	000	018
3EXQ3	S	SANKO LAUREL	038	071	109
3EVE3	S	SANKO POPPY	022	025	047
3EZK3	O	SANKO SPLENDOUR	039	053	092
DGSM	N	SANTA MONICA	082	000	082
XYER	U	SAPAI	034	000	034
9HOP3	B	SARAJEVO EXPRESS	063	000	063
3EWQ	K	SATURN DIAMOND	039	000	039
DILS	N	SAVANNAH	063	000	063
ELGH7	M	SEA COMMERCE	126	127	253
VRUQ2	M	SEA EXCELLENCE	032	003	035
3EKI3	O	SEA FLORIDA	128	005	133
KBGK	K	SEA FOX	172	018	190
WCYQ	U	SEA ISLE CITY	087	071	158
KJLV	K	SEA LION	455	061	516
ELQN2	N	SEA MERCHANT	453	019	472
FNXB	N	SEA PREMIER	068	000	068
KRCP	O	SEA PRINCESS	059	000	059
ELQI8	K	SEA RACER	003	000	003
WRXN	J	SEA SPRAY	002	000	002
ELGH4	N	SEA TRADE	193	033	226
KNFG	K	SEA WOLF	262	029	291
ELRV6	K	SEABOARD SUN	000	024	024
ELRU3	M	SEABOARD UNIVERSE	046	000	046
KGTX	S	SEALAND ANCHORAGE	089	091	180
KRLZ	N	SEALAND ATLANTIC	177	023	200
WZJC	J	SEALAND CHALLENGER	071	090	161
WCHF	T	SEALAND CONSUMER	122	172	294
OUVV2	O	SEALAND COSTA RICA	153	016	169
WZJF	K	SEALAND CRUSADER	114	034	148
KGJB	F	SEALAND DEFENDER	129	115	244
KHRH	S	SEALAND DEVELOPER	066	130	196
WZJD	K	SEALAND DISCOVERY	066	035	101
KGJX	S	SEALAND ENDURANCE	090	060	150
KRGB	F	SEALAND ENTERPRISE	251	065	316
WPGJ	K	SEALAND EXPEDITION	060	047	107
WGJF	T	SEALAND EXPLORER	165	053	218
KGJD	S	SEALAND EXPRESS	164	013	177
KIRF	F	SEALAND HAWAII	262	025	287
OUQP2	O	SEALAND HONDURAS	006	000	006
WGJC	S	SEALAND INDEPENDENCE	062	144	206
WGKF	F	SEALAND INNOVATOR	117	033	150
WPVD	U	SEALAND INTEGRITY	307	048	355
KGTZ	S	SEALAND KODIAK	014	020	034
KHRP	F	SEALAND LIBERATOR	104	136	240
KGJF	S	SEALAND MARINER	009	000	009
WPGK	T	SEALAND NAVIGATOR	294	066	360
WSRL	T	SEALAND PACIFIC	266	092	358
KHRF	F	SEALAND PATRIOT	052	091	143
KRPD	N	SEALAND PERFORMANCE	164	056	220
WJBJ	T	SEALAND PRODUCER	186	022	208
KRNJ	K	SEALAND QUALITY	088	091	179
WFLH	T	SEALAND RELIANCE	179	070	249
WFLG	F	SEALAND SPIRIT	132	179	311
KGTY	S	SEALAND TACOMA	051	109	160
KIRH	F	SEALAND TRADER	249	028	277
KHRK	S	SEALAND VOYAGER	082	001	083
WAFA	F	SEARIVER BATON ROUGE	034	012	046
KPKL	T	SEARIVER BENICIA	036	021	057
WBVY	U	SEARIVER CHARLESTOWN	004	003	007
WHCA	T	SEARIVER LONG BEACH	008	009	017
WHCB	T	SEARIVER MEDITERRANEAN	008	001	009
WNFJ	F	SEARIVER PHILADELPHIA	022	005	027
KAAC	F	SEARIVER SAN FRANCISCO	026	006	032
WBVZ	U	SEARIVER WILMINGTON	005	000	005
WST975	M	SEAWARD JOHNSON	075	159	234
WNJG	M	SENATOR	130	000	130
LADN4	M	SENORITA	000	095	095
3ESE9	M	SENSATION	095	047	142
ELBZ2	B	SERAFIN TOPIC	018	000	018
ELLW5	B	SERENITY	040	004	044
DULR	S	SEVEN OCEAN	043	013	056
WJLX	N	SGT WILLIAM A BUTTON	032	000	032
WHAC	N	SGT. METEJ KOCAK	020	045	065
KRJP	U	SHELDON LYKES	087	034	121
3EKH3	M	SHELLY BAY	111	019	130
3ECM7	S	SHIRAOI MARU	196	060	256
WSDJ	T	SIERRA MADRE	026	001	027
3FFG3	S	SINCERE GEMINI	043	044	087
LAJV4	S	SKAUBRYN	163	000	163
LADB2	S	SKAUGRAN	192	000	192
GYYP	M	SKY PRINCESS	111	000	111
ELIG5	B	SOKOLICA	042	000	042
ELQQ4	B	SOL' DO BRASIL	049	019	068
ELJS7	K	SOLAR WING	058	000	058
XCTJ	U	SONORA	105	074	179
VTFM	C	SOREN TOUBRO	024	000	024
DUCF	J	SOUTHERN PRINCESS	000	309	309
LAEB2	M	SOVEREIGN OF THE SEAS	043	047	090
ZELP	U	STAFFORDSHIRE	049	000	049

March, April, May and June 1995

CALL	PMO	SHIP NAME	RADIO	MAIL	TOTAL
LAVV4	K	STAR AMERICA	032	073	105
LAJG2	S	STAR DAVANGER	079	000	079
LAEP4	S	STAR DOVER	019	000	019
LAWO2	U	STAR EAGLE	057	006	063
LAHE2	K	STAR EVVIVA	075	071	146
LAVW4	U	STAR FLORIDA	143	045	188
LAVY4	U	STAR FRASER	153	000	153
ELFI8	T	STAR GEIRANGER	083	000	083
LAJY2	M	STAR SKARVEN	048	047	095
LASS2	U	STAR SKOGANGER	018	052	070
LAHG2	U	STAR STRONEN	052	022	074
VTBQ	U	STATE OF GUIARAT	025	000	025
WTWY	Y	STATE OF MAINE	032	029	061
WJGH	U	STELLA LYKES	032	051	083
DZSB	S	STELLAR BENY	021	000	021
DUMF	S	STELLAR VENUS	008	000	008
UYPO	S	STEPAN KRASHENINNIKOV	112	000	112
WYZ393	G	STEWART J. CORT	171	120	291
KDDW	O	STONEWALL JACKSON	029	011	040
KSPH	F	STRONG VIRGINIAN	046	041	087
LIZA3	M	SUN VIKING	009	000	009
LAOO4	K	SYNNOVE KNUSTEN	006	027	033
SQGI	U	TADEUSZ OCIOSZYNSKI	012	000	012
BHFL	S	TAI CHUNG	042	000	042
BOAB	T	TAI HE	203	000	203
BHFR	S	TAI SHING	020	008	028
WRA482	U	TALLAHASSEE BAY	039	000	039
VROT	U	TAMAMONTA	012	000	012
VRIP	U	TAMATHAI	201	000	201
MSYY9	J	TAMATIKI	002	050	052
LMWO3	T	TAMPA	027	000	027
KNJA	U	TAMPA BAY	016	008	024
LAOQ2	B	TAPIOLA	021	000	021
KTDQ	S	THOMAS G. THOMPSON	000	204	204
WVHS	U	THOMPSON LYKES	040	085	125
WSRY	S	THOMPSON PASS	000	012	012
WMLH	U	TILLIE LYKES	040	096	136
ELKA6	K	TOHZAN	026	090	116
9VUY		TOKIO EXPRESS	111	000	111
DDSK	T	TOKYO SENATOR	009	000	009
3EFY7	T	TOLUCA	140	043	183
KJDG	U	TONSINA	035	001	036
OXDF3	N	TORM FREYA	071	054	125
ELJL3	S	TOWER BRIDGE	056	000	056
ELJJ5	S	TRANSWORLD BRIDGE	164	007	171
ELDU4	F	TRIGGER	045	130	175
WRGL	U	TRINITY	024	013	037
WTU231	G	TRITON	138	173	311
3EZK9	M	TROPIC SUN	336	014	350
3FGQ3	M	TROPIC TIDE	086	061	147
ELBM9	O	TROPICALE	020	000	020
MSQQ8	B	TRSL ARCTURUS	049	065	114
ELGM4	N	TSL GALLANT	025	000	025
ATUJ	N	TULSIDAS	003	000	003
WMLG	U	TYSON LYKES	041	093	134
UVTE	U	ULAN BATOR	044	000	044
DHRU	J	ULF RITSCHER	050	000	050
VRIW	N	ULLSWATER	199	000	199
WHDI	U	ULTRAMAX	048	114	162
WJCG	O	ULTRASEA	077	102	179
NODY	G	USCGC ACACIA (WLB406)	016	046	062
NRTF	S	USCGC ACTIVE WMEC 618	025	012	037
NNHA	F	USCGC ACUSHNET WMEC 16	094	000	094
NZVE	S	USCGC ALERT (WMEC 630)	128	077	205
NODG	S	USCGC BASSWOOD (WLB 38	008	000	008
NRKN	N	USCGC BEAR (WEMC 901)	078	013	091
NYCQ	S	USCGC BOUTWELL WHEC 71	059	057	116
NODK	C	USCGC BRAMBLE (WLB 392	002	015	017
NRDC	N	USCGC CAMPBELL	016	000	016
NLPM	T	USCGC CHASE (WHEC 718)	105	024	129
NHKW	K	USCGC CONFIDENCE WMEC6	046	000	046
NCRG	N	USCGC COURAGEOUS	027	000	027
NPCR	Y	USCGC DALLAS (WHEC 716	001	000	001
NDTS	B	USCGC DAUNTLESS WMEC 6	010	025	035
NUHC	M	USCGC DECISIVE WMEC 62	043	015	058
NRUN	U	USCGC DURABLE (WMEC 62	038	000	038
NRCB	M	USCGC EAGLE (WIX 327)	003	000	003
NNAS	N	USCGC ESCANABA	006	000	006
NODL	A	USCGC FIREBUSH WLB 393	020	000	020
NICB	N	USCGC FORWARD	059	000	059
NJOR	Y	USCGC GALLATIN	115	068	183
NMAG	T	USCGC HAMILTON WHEC 71	000	060	060
NHNC	N	USCGC HARRIET LANE	025	000	025
NRPN	A	USCGC IRONWOOD (WLB 29	014	000	014
NAQD	S	USCGC JARVIS (WHEC 725	098	000	098
NRPJ	F	USCGC LAUREL (WLB 291)	001	013	014
NRPM	N	USCGC LEGARE	026	010	036
NRKP	G	USCGC MACKINAW	021	043	064
NODO	S	USCGC MALLOW (WLB 396)	007	000	007
NODP	S	USCGC MARIPOSA	018	001	019
NMEL	S	USCGC MELLON (WHEC 717	160	001	161
NHWR	S	USCGC MIDGETT (WHEC 72	049	002	051
NRUF	K	USCGC MOHAWK WMEC 913	017	000	017
NDWA	F	USCGC MORGENTHAU	092	000	092
NGDF	Y	USCGC MUNRO	108	001	109
NLGF	N	USCGC NORTHLAND WMEC 9	092	024	116

March, April, May and June 1995

CALL	PMO	SHIP NAME	RADIO	MAIL	TOTAL
NBTM	S	USCGC POLAR STAR (WAGB	244	000	244
NRUO	S	USCGC POLAR SEA__(WAGB	084	008	092
NLVS	F	USCGC RUSH	133	000	133
NODT	F	USCGC SASSAFRAS	049	000	049
NODU	S	USCGC SEDGE (WLB 402)	005	000	005
NFMK	N	USCGC SENECA	008	000	008
NMMJ	F	USCGC SHERMAN	035	040	075
NWHE	N	USCGC SPENCER	082	000	082
NSTF	S	USCGC STEADFAST (WMEC	130	071	201
NRUC	S	USCGC STORIS (WMEC 38)	315	017	332
NODW	G	USCGC SUNDEW (WLB 404)	014	054	068
NCBE	N	USCGC TAHOMA	068	000	068
NIKL	N	USCGC TAMPA WMEC 902	000	019	019
NYWL	K	USCGC THETIS	000	041	041
NVAI	M	USCGC VALIANT (WMEC 62	008	009	017
NHIC	M	USCGC VIGILANT WMEC 61	025	000	025
NQSP	B	USCGC VIGOROUS WMEC 62	088	056	144
NNHB	S	USCGC YOCONA (WMEC 168	080	032	112
NABL	N	USNS ABLE	002	000	002
NPEJ	K	USNS ANTARES	002	000	002
NIGP	N	USNS APACHE (T-ATF 172	058	022	080
NACK	N	USNS CONCORD	000	030	030
NDSP	J	USNS DENEBOLA	011	008	019
NLUP	O	USNS GUADALUPE	013	000	013
NRLW	K	USNS HAYES	000	136	136
NHJK	N	USNS HENRY J. KAISER	019	000	019
NJLN	N	USNS JOHN LENTHALL	000	103	103
NJMD	O	USNS JOHN MCDONNELL (T	139	051	190
NZSK	J	USNS KANE TAGS 27	043	000	043
NNLG	N	USNS LEROY GRUMMAN	001	166	167
NLIT	O	USNS LITTLEHALES (T-AG	071	160	231
NFMC	F	USNS MARS	127	000	127
NMER	F	USNS MERCY	006	000	006
NCRP	N	USNS MOHAWK (T-ATF 170	018	050	068
NVBK	T	USNS NARRAGANSETT	159	057	216
NOYK	T	USNS NAVAJO_(TATF-169)	068	000	068
NRPP	F	USNS OBSERVATION ISLAN	074	000	074
NGKK	O	USNS PATHFINDER T-AGS	035	070	105
NKXR	N	USNS POWHATAN TATF 166	049	032	081
NNCD	N	USNS SAN DIEGO	037	045	082
NADH	N	USNS SATURN T-AFS-10	000	117	117
NQST	U	USNS SEALIFT ARCTIC	004	000	004
NKRV	U	USNS SEALIFT CARIBBEAN	012	000	012
NTYT	U	USNS SEALIFT ANTARCTIC	015	000	015
NIKA	U	USNS SEALIFT ATLANTIC	037	011	048
NNUD	F	USNS SILAS BENT T-AGS	022	112	134
NJOV	F	USNS SIOUX	002	000	002
NPGA	N	USNS SIRIUS (T-AFS 8)	000	037	037
NIDR	J	USNS VANGUARD TAG 194	127	042	169
NWSD	F	USNS WALTER S. DIEHL	000	094	094
NYUK	O	USNS YUKON (T-AO 202)	161	002	163
NEVV	O	USS RUSSELL DDG-59	071	000	071
9VJS	U	VEGA	083	000	083
9VRR	U	VENUS DIAMOND	144	000	144
3EAG4	S	VERA ACORDE	020	070	090
CBVM	U	VINA DEL MAR	059	000	059
VRIV	N	VINE	257	000	257
3EBW4	S	VIRGINIA	078	324	402
DZVP	B	VISAYAS VICTORY	000	262	262
LACU2	N	VIVA	017	073	090
JKHH	S	WASHINGTON HIGHWAY	074	000	074
ZCAQ9	N	WEST MOOR	035	000	035
LACZ4	M	WESTERN FRIEND	000	167	167
WZL819	M	WESTWARD	004	061	065
KHJB	S	WESTWARD VENTURE	016	111	127
DVDM	S	WESTWOOD ANETTE	232	011	243
LATV4	S	WESTWOOD CLEO	130	036	166
DVPV	S	WESTWOOD MARIANNE	094	167	261
WC5932	G	WILFRED SYKES	029	005	034
ELOR2	F	WILLIAM E. CRAIN	000	157	157
WZC451	C	WOLVERINE	002	000	002
3EPK5	S	YOHFU	004	041	045
YJZH9	S	YOUNG SPROUT	024	065	089
XCUY	U	YUCATAN	115	094	209
UAGJ	S	YURI OSTROVSKIY	100	011	111
9HPL3	N	ZAGREB EXPRESS	017	000	017
VRRE	N	ZETLAND	176	000	176
4XGR	J	ZIM AMERICA	179	000	179
4XGS	N	ZIM CANADA	126	000	126
4XLR	J	ZIM HONGKONG	001	000	001
4XLZ	J	ZIM HOUSTON	019	000	019
4XIO	T	ZIM IBERIA	044	000	044
4XGX	M	ZIM ISRAEL	057	000	057
4XGT	M	ZIM ITALIA	092	017	109
4XGV	B	ZIM JAPAN	120	000	120
4XII	J	ZIM KEELUNG	082	000	082
4XGU	M	ZIM KOREA	095	000	095
4XIE	J	ZIM MARSEILLES	010	000	010
4XIL	T	ZIM SAVANNAH	052	000	052

	VIA RADIO	VIA MAIL	TOTAL
GRAND TOTALS	80441	33404	113845

April, May and June 1995

Wave 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 AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
APRIL 1995													
SUPN6	44.5N	075.8W	0742	12.4	9.4				9.0	S	24.3	29/18	1012.9
SVLS1	32.0N	080.7W	0689	23.1	23.3				13.6	S	47.1	16/02	1014.9
THIN6	44.3N	076.0W	0742	12.2									
TPLM2	38.9N	076.4W	0742	17.2	16.9				10.7	S	27.4	08/05	1014.6
TTIW1	48.4N	124.7W	0740	10.7					9.5	SW	24.9	01/13	1016.3
VENF1	27.1N	082.5W	0739	26.2	28.9				8.6	E	21.8	20/12	1015.4
WPOW1	47.7N	122.4W	0741	12.9					4.2	NE	21.9	02/21	1015.2
32302	18.0S	085.1W	0059	22.2	22.9	2.3	4.3	01/17	11.5	SE	16.9	01/00	
41002	32.3N	075.2W	0709	19.9	20.5	1.5	4.2	06/21	11.5	E	33.0	06/22	1015.8
41004	32.5N	079.1W	0715		21.4	1.1	4.3	06/18	11.9	SW	32.3	06/16	
41009	28.5N	080.2W	1437	23.0	23.4	1.0	2.3	02/18	11.5	SE	23.9	06/03	1014.9
41010	28.9N	078.5W	1436	22.9	25.0	1.3	3.7	06/14	11.4	E	27.2	06/16	1014.7
41016	24.6N	076.5W	0692	24.4	25.3	0.5	2.0	28/15	10.6	E	21.7	12/00	1015.7
41021	31.9N	080.9W	0442	20.1	20.1				9.8	S	20.8	14/10	1014.6
42001	25.9N	089.7W	0716	23.3	24.0	1.3	4.8	11/11	14.0	SE	37.5	11/06	1013.0
42002	25.9N	093.6W	0714	22.8	23.2	1.5	3.9	11/19	14.2	SE	32.4	05/10	1012.1
42003	25.9N	085.9W	0716	24.3	26.8	1.2	3.6	28/03	15.1	SE	35.4	05/22	1012.7
42007	30.1N	088.8W	0718	20.3	21.4				12.7	SE	31.9	11/14	1014.4
42020	27.0N	096.5W	0717	22.2		1.5	3.9	11/12	14.0	SE	29.3	05/01	1011.2
42025	24.9N	080.5W	0718	25.1	25.9	0.5	1.7	12/06					
42035	29.3N	094.4W	0669	20.5	21.0	1.0	2.7	10/22	11.6	SE	29.9	11/09	1012.5
42036	28.5N	084.5W	0714	21.1	20.6	0.8	2.1	06/06	9.4	E	23.9	06/02	1015.6
42037	24.5N	081.4W	0717	25.0	25.5	0.7	2.0	12/08	9.3	E	19.8	06/23	1014.1
44004	38.5N	070.7W	0712	12.7	15.4	1.7	5.1	13/21					1015.0
44005	42.9N	069.0W	0675	4.3	4.5	1.3	4.8	05/21	11.6	NW	38.1	05/21	1013.5
44006	36.3N	075.5W	0719	12.5	11.3	0.9	2.4	05/10	10.2	S	27.4	24/10	1015.4
44007	43.5N	070.2W	0713	4.4	4.6	0.7	1.9	04/03	9.1	S	31.1	05/13	1012.2
44008	40.5N	069.4W	0677		5.7	1.4	5.5	05/23	10.6	W	33.2	05/2	1014.6
44009	38.5N	074.7W	0714	9.5	8.5	1.0	2.8	05/07	10.7	NW	29.3	05/04	1014.9
44010	36.0N	075.0W	0716	14.1	14.1	1.2	3.0	23/10	10.7	N	26.0	23/09	1015.0
44011	41.1N	066.6W	0713	5.4	4.7	1.6	7.4	06/02	11.5	NW	37.7	06/00	1013.1
44013	42.4N	070.7W	0712	5.5		0.6	2.2	05/22	10.1	W	35.0	05/00	1013.2
44014	36.6N	074.8W	0654	12.6					10.4	S	25.1	05/06	
44019	36.4N	075.2W	0716	11.9	10.4				10.2	S	23.9	24/10	1015.6
44025	40.3N	073.2W	0703	7.7	7.3	1.0	3.0	04/14	11.1	S	31.1	05/02	1014.1
44028	41.4N	071.1W	0714	6.8	6.1	0.7	2.4	04/18	12.7	SW	37.5	05/22	1013.7
45001	48.1N	087.8W	0410	1.9	1.5	0.6	2.5	19/03	10.3	NE	25.1	19/02	1016.2
45002	45.3N	086.4W	0715	2.1	2.5	0.8	2.7	04/05	12.3	NE	29.9	04/12	1013.6
45003	45.3N	082.8W	0718	1.5	2.2	0.9	4.3	04/08	13.0	E	34.8	04/09	1013.5
45004	47.6N	086.5W	0419	2.1	2.1	0.6	2.4	19/17	11.4	N	27.8	18/19	1015.9
45005	41.7N	082.4W	0459	5.9	4.2	0.5	1.2	18/11	9.9	NE	21.2	19/05	1013.8
45006	47.3N	089.9W	0395	2.2	1.3	0.8	3.0	18/21	8.8	NE	25.0	18/21	1016.2
45007	42.8N	087.1W	0716	3.9	5.0	0.5	1.9	27/14	7.8	NE	21.4	27/12	1013.2
45008	44.3N	082.4W	0147	2.9	1.8	0.8	2.8	28/04	10.7	SW	27.0	28/01	1014.2
45010	43.0N	087.8W	0270	5.0	4.0	0.5	1.5	27/21	8.7	N	22.7	27/09	1013.9
46001	56.3N	148.2W	0712		4.2	2.7	6.4	10/20					1005.2
46002	42.5N	130.3W	0719	9.9	10.8	2.9	7.4	08/02	12.9	NW	29.3	15/22	1017.6
46005	46.1N	131.0W	0713	8.4	9.0	3.0	5.8	08/02	13.1	S	29.9	15/15	1016.1
46006	40.9N	137.5W	0711	10.3	10.6	3.1	7.5	07/17					1018.8
46011	34.9N	120.9W	0707	12.4	13.0	2.3	5.7	19/01	10.8	NW	25.8	09/01	1016.0
46013	38.2N	123.3W	0716	10.9	11.0	2.4	5.4	08/17	15.0	NW	34.0	19/03	1017.4

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
46014	39.2N	124.0W	0719	10.9	11.5	2.4	5.1	08/21	12.6	NW	31.3	18/23	1017.6
46022	40.8N	124.5W	0712	11.0	12.0	2.5	6.0	08/12	11.5	N	31.3	12/18	1018.3
46023	34.3N	120.7W	0512	12.4	12.0	2.8	5.7	09/02	18.0	NW	35.8	19/01	1015.7
46025	33.8N	119.1W	0661	14.0	14.5	1.1	3.5	19/03	9.4	NW	29.1	19/03	1014.9
46026	37.8N	122.8W	0713	11.2	11.2	2.0	4.6	19/00	13.7	NW	31.9	19/03	1017.0
46027	41.9N	124.4W	0716	10.5	11.6	2.2	4.9	08/19	9.8	NW	29.1	12/21	1017.1
46028	35.7N	121.9W	0715	11.8	12.1	2.5	5.9	19/03	14.5	NW	29.7	18/16	1017.5
46029	46.2N	124.2W	0197	11.0	11.5	1.4	2.2	25/00	7.4	N	18.1	23/04	1015.4
46030	40.4N	124.5W	0715	10.5	11.1	2.3	6.0	08/14					1017.2
46035	57.0N	177.7W	0708	0.2	1.6	2.6	6.6	16/07	15.7	NW	33.5	16/10	1003.4
46041	47.4N	124.5W	0717	9.1	10.9	2.2	4.8	08/20					1015.5
46042	36.8N	122.4W	0713	11.8	12.4	2.4	5.7	19/07	13.3	NW	31.7	18/15	1017.1
46045	33.8N	118.5W	0716	13.9	14.0	0.9	3.1	19/01					1014.7
46050	44.6N	124.5W	0692	9.9	11.8	2.5	4.7	08/08	5.7	NW	15.0	28/08	1015.6
46053	34.2N	119.9W	0719	13.0	12.5	1.4	3.2	08/21	13.9	W	34.4	09/00	1015.9
46054	34.3N	120.5W	0719	12.4	11.8	2.2	5.5	19/01	16.9	NW	33.2	09/00	1016.3
46059	38.0N	130.0W	0708	12.4	13.4	2.5	6.5	08/05	11.8	NW	29.9	12/11	1020.1
51001	23.4N	162.3W	0713	22.1	23.6	2.7	4.6	17/09	16.0	NE	26.1	21/22	1017.8
51002	17.2N	157.8W	0717	24.4	24.9				15.6	NE	28.5	16/15	1014.0
51003	19.1N	160.8W	0719	24.5	25.6	2.5	4.3	17/22	12.8	E	23.5	16/19	1015.0
51004	17.4N	152.5W	0712	24.5	25.4	2.6	5.5	17/12	14.8	E	26.1	17/03	1015.7
51026	21.4N	156.9W	0706	22.5	23.5	2.4	4.8	17/07	14.2	E	26.8	18/09	1016.9
51027	20.5N	157.1W	0709	23.7	24.6	1.6	3.2	19/05	13.7	E	29.7	18/16	1015.2
91222	18.1N	145.8E	0598	26.5					7.4	NE	17.0	01/17	1013.5
91251	11.4N	162.4E	0704	27.2					17.6	NE	32.2	27/20	1009.3
91328	8.6N	149.7E	0712	27.8					10.2	NE	18.1	11/03	1010.4
91338	5.3N	153.7E	0534	27.7					5.7	NE	15.5	01/03	1008.2
91343	7.6N	155.2E	0715	27.8					13.8	NE	23.7	02/15	1008.1
91352	6.2N	160.7E	0703	27.4					10.6	NE	23.1	23/11	1009.7
91355	5.4N	163.0E	0713	27.3					8.2	NE	22.7	24/01	1007.1
91377	6.1N	172.1E	0711	27.6					9.7	NE	26.6	07/22	1010.5
ABAN6	44.3N	075.9W	0666	4.5	3.6				3.8	S	22.2	21/21	1014.1
ALSN6	40.5N	073.8W	0716	8.5	7.7				14.8	NW	38.9	05/02	1014.4
BURL1	28.9N	089.4W	0710	21.1					12.1	SE	30.4	04/22	1013.9
CARO3	43.3N	124.4W	0715	9.6					9.3	S	34.2	08/03	1016.5
CHLV2	36.9N	075.7W	0714	12.1					15.6	S	34.6	08/23	1015.5
CLKN7	34.6N	076.5W	0718	17.5					11.6	SW	27.0	23/10	1016.3
CSBF1	29.7N	085.4W	0714	19.8					6.9	SE	26.7	12/14	1015.9
DBLN6	42.5N	079.4W	0718	4.6					13.4	SW	35.6	04/18	1014.3
DESW1	47.7N	124.5W	0718	9.0					11.0	NW	38.8	10/20	1015.6
DISW3	47.1N	090.7W	0715	0.9					12.3	NE	40.0	18/19	
DPIA1	30.3N	088.1W	0714	20.0					11.4	SE	28.1	11/18	1015.4
DRYF1	24.6N	082.9W	0712	24.8	25.7				11.3	E	21.1	12/00	1013.9
DSLN7	35.2N	075.3W	0713	17.5					18.4	SW	42.9	23/07	1016.5
FBIS1	32.7N	079.9W	0716	19.4					9.1	SW	25.6	06/13	1015.6
FFIA2	57.3N	133.6W	0715	7.6					9.9	N	31.6	11/06	1012.8
FPSN7	33.5N	077.6W	0710	19.5					15.3	SW	39.2	14/08	1015.3
FWYF1	25.6N	080.1W	0640	24.7	25.8				11.9	SE	25.2	12/00	1014.8
GDIL1	29.3N	090.0W	0712	21.2	22.7				11.2	SE	27.3	24/05	1014.7
GLLN6	43.9N	076.5W	0717	3.4					12.6	W	40.5	04/20	1013.7
IOSN3	43.0N	070.6W	0714	5.3					12.8	NW	43.5	05/13	1012.7
LKWF1	26.6N	080.0W	0715	23.9	25.4				11.8	SE	29.3	06/07	1015.5
LONF1	24.9N	080.9W	0710	25.1	26.5				11.0	SE	23.0	21/05	
MDRM1	44.0N	068.1W	0717	3.6					14.0	NW	46.0	05/12	1012.0
MISM1	43.8N	068.9W	0711	3.6					13.6	NW	43.6	05/14	1012.5
MLRF1	25.0N	080.4W	0705	25.0	26.0				11.0	SE	23.4	12/07	1014.2
NWPO3	44.6N	124.1W	0711	9.2					8.9	E	29.2	07/10	1016.1
PILM4	48.2N	088.4W	0714	0.3					11.9	N	33.3	04/06	1015.4
PTAC1	39.0N	123.7W	0711	10.5					10.8	N	28.5	18/23	1017.3
PTAT2	27.8N	097.1W	0711	20.9	21.9				12.9	SE	33.7	11/06	1012.0
PTGC1	34.6N	120.7W	0713	12.2					17.0	N	43.5	09/03	1015.8
ROAM4	47.9N	089.3W	0712	0.6									1015.0

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
SANF1	24.5N	081.9W	0712	24.9	25.5				11.4	E	24.3	03/12	1013.7
SAUF1	29.9N	081.3W	0710	20.0	20.0				8.7	N	24.4	06/23	1015.9
SBIO1	41.6N	082.8W	0714	6.1					12.6	NE	35.8	04/10	1014.5
SGNW3	43.8N	087.7W	0712	3.6	6.3				10.9	N	30.3	10/02	1014.9
SISW1	48.3N	122.9W	0708	9.0					10.3	W	38.1	11/02	1015.4
SMKF1	24.6N	081.1W	0710	25.3	26.1				12.4	SE	25.1	12/07	1014.5
SPGF1	26.7N	079.0W	0717	24.1	26.2				7.2	SE	21.8	14/09	1015.0
SRST2	29.7N	094.1W	0712	20.1					12.2	SE	28.6	10/22	1013.2
STDM4	47.2N	087.2W	0716	0.8					15.2	E	45.4	04/01	1014.3
SUPN6	44.5N	075.8W	0718	4.2	3.9				9.6	SW	31.9	19/20	1012.7
SVLS1	32.0N	080.7W	0705	19.2	19.3				12.5	S	39.6	06/16	015.5
THIN6	44.3N	076.0W	0717	4.1									
TPLM2	38.9N	076.4W	0717	11.5	11.0				11.3	NW	31.4	05/02	1015.1
TTIW1	48.4N	124.7W	0716	8.6					10.7	SW	29.6	13/11	1015.7
VENF1	27.1N	082.5W	0712	22.1	24.9				8.4	NE	26.4	06/06	1015.1
WPOW1	47.7N	122.4W	0715	9.4					6.3	S	26.1	13/11	1015.7
MAY 1995													
TPLM2	38.9N	076.4W	0714	22.0	22.7				10.4	S	34.8	12/00	016.0
TTIW1	48.4N	124.7W	0712	12.4					9.7	W	28.3	07/00	1017.4
VENF1	27.1N	082.5W	0717	26.3	28.9				8.8	NE	28.5	04/23	1015.1
WPOW1	47.7N	122.4W	0718	14.4					4.6	NE	17.6	17/18	1016.4
41001	34.7N	072.6W	0519	20.4	20.5	1.5	3.1	11/12	11.4	S	24.3	11/11	1015.6
41002	32.3N	075.2W	0741	22.7	24.2	1.5	3.3	03/01	11.5	E	23.5	20/02	1015.3
41004	32.5N	079.1W	0743		23.3	1.0	2.3	02/11	11.3	SW	25.5	19/22	
41006	29.3N	077.3W	0363	25.3	26.0	1.2	2.2	20/09	9.1	E	22.7	20/04	1015.0
41009	28.5N	080.2W	1484	25.7	25.6	0.8	1.9	24/02	10.5	SE	29.1	20/13	1015.0
41010	28.9N	078.5W	1484	25.3	26.3	1.1	2.5	20/16	9.1	E	24.3	12/09	1014.9
41016	24.6N	076.5W	0730	26.4	27.4	0.3	0.9	10/11	8.4	E	28.7	22/11	1016.5
41021	31.9N	080.9W	0739	23.3	23.4	0.7	1.3	20/20	11.4	S	38.1	16/01	1014.6
42001	25.9N	089.7W	0738	26.4	26.6	1.0	2.7	14/13	12.5	SE	23.9	13/05	1013.3
42002	25.9N	093.6W	0742	25.7	25.8	1.3	2.7	08/09	13.7	SE	26.8	08/07	
42003	25.9N	085.9W	0736	27.3	28.2	0.7	1.7	09/14	10.9	SE	26.2	05/18	1013.5
42007	30.1N	088.8W	0743	24.6	25.7				12.2	S	26.4	12/15	1013.9
42016	30.1N	088.2W	0219	25.9	26.6	0.5	1.4	24/18	8.8	SE	24.9	29/05	
42020	27.0N	096.5W	0742	25.5		1.5	3.8	08/07	12.9	SE	26.6	08/03	1010.1
42025	24.9N	080.5W	0742	26.5	27.8	0.4	1.6	05/12					
42035	29.3N	094.4W	0723	24.5	25.4	1.0	2.7	08/07	12.6	SE	30.1	08/14	1011.9
42036	28.5N	084.5W	0726	26.0	25.4	0.7	2.0	20/04	8.3	SE	21.8	24/04	015.3
42037	24.5N	081.4W	0740	27.1	27.6	0.5	1.8	05/11	7.7	E	26.4	05/09	014.9
44004	38.5N	070.7W	0737	16.2	17.1	1.9	5.4	03/14					
1014.0													
44005	42.9N	069.0W	0734	7.7	6.7	1.5	3.9	08/06	9.6	S	32.4	08/04	1013.4
44006	36.3N	075.5W	0740	17.4	16.6	1.0	2.4	03/02	9.3	S	24.9	17/22	1015.1
44007	43.5N	070.2W	0741	8.7	7.6	1.0	3.5	04/21	7.7	S	27.4	07/20	1012.5
44008	40.5N	069.4W	0735		7.5	1.7	5.1	01/20	10.8	S	32.1	01/18	1013.4
44009	38.5N	074.7W	0733	14.1	13.0	1.2	3.1	03/02	9.8	S	27.4	02/18	1014.4
44010	36.0N	075.0W	0740	17.2	16.5	1.6	2.6	03/02	9.6	S	25.5	02/20	1015.0
44011	41.1N	066.6W	0741	9.0	9.8	2.2	6.6	03/17	12.7	N	41.0	03/18	1012.1
44013	42.4N	070.7W	0736	10.2		0.9	2.1	04/18	8.9	SE	25.6	08/05	1013.1
44014	36.6N	074.8W	0723	15.0					8.3	S	23.9	02/08	
44019	36.4N	075.2W	0741	16.2	14.9				9.1	S	24.1	02/09	1015.3
44025	40.3N	073.2W	0738	11.7	10.4	1.1	2.8	01/12	9.7	S	28.4	03/02	1013.6
44028	41.4N	071.1W	0729	11.0	9.8	0.7	2.3	30/05	12.0	SW	29.3	08/01	1013.5
45001	48.1N	087.8W	0740	4.3	2.3	0.6	1.9	23/04	9.2	SW	24.5	16/14	1013.4
45002	45.3N	086.4W	0740	5.7	3.3	0.4	2.0	16/22	8.2	S	20.6	09/10	1013.1
45003	45.3N	082.8W	0740	5.3	2.9	0.5	2.2	14/06	9.2	W	27.6	14/05	1013.2
45004	47.6N	086.5W	0744	4.3	2.6	0.6	2.3	17/10	9.5	W	26.6	17/07	
1013.9													
45005	41.7N	082.4W	0742	12.2	11.1	0.5	1.5	28/00	8.9	SW	21.4	24/18	
1013.7													

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
45006	47.3N	089.9W	0742	4.8	2.1	0.7	1.9	09/18	8.3	NE	19.3	13/23	1013.9
45007	42.7N	087.0W	0739	6.8	4.2	0.4	1.6	09/05	8.0	N	20.2	09/06	1013.6
45008	44.3N	082.4W	0741	5.5	.3.0	0.4	1.5	14/10	7.6	SW	20.4	14/07	1013.6
45010	43.0N	087.8W	0646	9.0	7.1	0.5	1.6	09/08	8.6	N	19.8	28/00	1013.3
46001	56.3N	148.2W	0742		5.7	2.3	6.3	06/07					1010.2
46002	42.5N	130.3W	0740	11.1	11.9	2.2	4.6	11/20	13.5	N	27.2	10/19	1019.7
46005	46.1N	131.0W	0742	10.0	10.6	2.1	5.1	11/19	12.1	NW	24.7	10/16	1020.0
46006	40.9N	137.5W	0738	11.7	12.2	2.0	5.2	09/13	7.8	S	17.9	26/10	1023.3
46011	34.9N	120.9W	0740	12.0	12.0	1.9	4.0	13/21	10.0	NW	21.0	28/21	1014.6
46013	38.2N	123.3W	0741	11.3	10.9	2.1	5.3	13/08	14.7	NW	30.9	05/01	1015.0
46014	39.2N	124.0W	0743	11.0	10.5	2.2	4.7	13/20	11.6	NW	25.3	01/05	1015.1
46022	40.8N	124.5W	0742	11.5	11.5	2.3	5.1	14/03	13.3	N	28.0	13/11	1016.4
46023	34.3N	120.7W	0341	11.8	11.5	1.7	2.8	24/19	14.2	NW	23.9	27/03	1014.5
46025	33.8N	119.1W	0668	13.9	14.8	1.1	2.5	06/00	7.3	W	26.4	13/05	1014.3
46026	37.8N	122.8W	0742	11.6	11.2	1.7	4.3	13/09	11.3	NW	29.3	05/04	1014.7
46027	41.9N	124.4W	074										
46028	35.7N	121.9W	0739	12.1	12.5	2.2	4.7	13/17	13.4	NW	24.7	12/03	1015.7
46029	46.2N	124.2W	0739	11.6	12.4	1.8	3.5	11/06	10.5	N	23.3	11/02	1016.7
46030	40.4N	124.5W	0744	10.7	10.1	2.2	4.6	13/16					1015.2
46035	57.0N	177.7W	0740	2.4	3.2	1.5	4.2	20/18	13.2	NE	24.7	20/05	1006.5
46041	47.4N	124.5W	0742	11.0	11.9	1.7	3.4	12/13	8.9	NW	22.3	11/07	1016.0
46042	36.8N	122.4W	0738	12.0	12.0	2.1	4.9	13/13	10.9	NW	22.0	05/05	1015.1
46045	33.8N	118.5W	0740	13.9	14.7	0.9	2.5	13/07	6.7	W	24.7	13/06	1014.2
46050	44.6N	124.5W	0742	12.0	12.1	1.9	3.8	12/06	12.0	N	27.6	11/06	1016.2
46053	34.2N	119.9W	0744	12.8	12.6	1.0	2.4	11/23	11.4	W	32.8	12/00	1014.9
46054	34.3N	120.5W	0744	12.4	12.0	1.7	3.6	11/09	16.2	NW	29.3	12/17	1015.0
46059	38.0N	130.0W	0741	12.8	13.8	2.3	5.0	14/10	14.1	N	27.4	14/00	1020.8
46060	60.6N	146.8W	0748	7.2	7.5	0.6	1.8	26/04					1015.6
46061	60.2N	146.8W	0760	7.1	7.7	1.4	3.2	26/07	13.0	E	33.2	24/12	1015.5
51001	23.4N	162.3W	0740	23.2	24.2	1.9	5.0	06/18	12.0	E	20.1	26/07	1018.5
51002	17.2N	157.8W	0741	25.1	25.6				15.2	NE	22.8	11/22	1015.1
51003	19.1N	160.8W	0744	24.9	25.7	2.0	3.9	07/03	12.0	E	20.2	06/23	1016.2
51004	17.4N	152.5W	0736	24.9	25.7	2.1	3.5	10/12	13.7	E	22.9	11/14	1016.8
51026	21.4N	156.9W	0742	23.2	23.8	1.8	3.4	07/04	13.8	E	22.3	12/07	1018.1
51027	20.5N	157.1W	0741	24.2	25.0	1.5	2.5	07/04	11.7	E	23.7	11/00	1016.6
91222	18.1N	145.8E	0418	27.5					7.6	E	17.8	06/00	1011.9
91251	11.4N	162.4E	0738	27.4					15.4	E	26.9	01/19	1010.0
91328	8.6N	149.7E	0742	28.2					7.0	NE	15.5	27/02	1010.9
91338	5.3N	153.7E	0563	28.3					4.1	NE	17.5	11/05	1009.1
91343	7.6N	155.2E	0740	28.1					9.4	NE	21.3	31/21	1008.8
91352	6.2N	160.7E	0724	27.9					8.0	NE	22.2	07/01	1010.8
91355	5.4N	163.0E	0742	27.5					5.9	E	22.5	05/14	1008.5
91377	6.1N	172.1E	0599	28.0					8.5	NE	27.2	21/19	1011.6
ABAN6	44.3N	075.9W	0737	12.6	8.7				4.4	S	18.2	28/17	1013.5
ALSN6	40.5N	073.8W	0741	13.9	12.3				13.3	S	31.9	01/04	1013.9
BLIA2	60.9N	147.9W	0574	7.4					7.3	SW	31.1	26/06	1015.7
BURL1	28.9N	089.4W	0737	24.7					11.2	S	24.5	19/14	1013.8
CARO3	43.3N	124.4W	0739	11.0					10.6	N	28.4	11/08	1016.2
CDRF1	29.1N	083.0W	0492	26.3					8.4	SW	24.7	23/22	1015.1
CHLV2	36.9N	075.7W	0743	17.0	18.5	0.8	1.6	18/01	13.6	SW	33.9	02/08	1015.2
CLKN7	34.6N	076.5W	0740	21.3					11.3	SW	24.1	20/12	1016.3
CSBF1	29.7N	085.4W	0739	24.5					7.0	SE	26.5	12/02	1015.5
DBLN6	42.5N	079.4W	0742	12.2					10.6	SW	27.3	21/20	1013.6
DESW1	47.7N	124.5W	0716	11.0					10.0	NW	33.9	13/23	1016.0
DISW3	47.1N	090.7W	0739	7.4					12.0	SW	28.4	09/12	1017.0
DPIA1	30.3N	088.1W	0743	24.4					10.5	S	27.1	10/17	1014.9
DRYF1	24.6N	082.9W	0738	27.3	28.1				8.8	E	23.8	21/00	1014.7
DSLN7	35.2N	075.3W	0736	20.5		1.1	2.3	19/08	16.8	NE	46.7	02/11	1016.5
FBIS1	32.7N	079.9W	0741	23.5					10.3	SW	21.0	02/08	1015.2
FFIA2	57.3N	133.6W	0741	10.5					6.8	S	32.2	11/02	1016.9
FPSN7	33.5N	077.6W	0717	22.5	22.8	0.9	1.7	31/13	15.1	SW	33.1	02/13	1015.0
FWYF1	25.6N	080.1W	0739	27.2	27.7				10.7	E	31.1	05/10	1015.3

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
GDIL1	29.3N	090.0W	0742	25.5	27.5				10.2	S	23.9	18/10	1014.3
GLLN6	43.9N	076.5W	0740	9.8					11.6	W	28.7	29/00	1012.7
IOSN3	43.0N	070.6W	0744	10.3					11.2	S	33.1	07/22	1012.9
KTNF1	29.8N	083.6W	0408	25.4					8.5	SW	27.8	19/22	1015.3
LKWF1	26.6N	080.0W	0738	26.5	27.4				9.4	E	21.8	19/22	1015.9
LONF1	24.9N	080.9W	0734	27.4	29.4				9.1	SE	34.3	05/11	1014.9
MDRM1	44.0N	068.1W	0740	7.5					11.8	S	37.8	08/06	1013.1
MISM1	43.8N	068.9W	0736	7.7					12.1	S	36.6	07/04	1013.2
MLRF1	25.0N	080.4W	0703	27.2	27.7				9.2	E	33.3	05/11	1015.0
NWPO3	44.6N	124.1W	0738	10.8					9.4	NW	26.1	31/02	1015.8
PILM4	48.2N	088.4W	0742	5.8					11.1	W	29.2	16/15	1013.7
POTA2	60.3N	147.3W	0244	7.2					6.7	NE	19.3	27/14	1007.8
PTAC1	39.0N	123.7W	0738	11.1					10.1	N	28.0	01/06	1014.9
PTAT2	27.8N	097.1W	0727	25.0	26.1				14.6	SE	36.6	29/16	1010.6
PTGC1	34.6N	120.7W	0743	11.8					15.4	N	30.0	12/10	1014.5
ROAM4	47.9N	089.3W	0743	7.7					13.2	NE	32.8	22/20	1013.2
SANF1	24.5N	081.9W	0741	27.2	28.1				9.6	E	25.6	05/11	1014.4
SANF1	24.5N	081.9W	0741	27.2	28.1				9.6	E	25.6	05/11	1014.4
SAUF1	29.9N	081.3W	0738	24.4	24.4				9.9	SW	25.3	22/20	1015.5
SBIO1	41.6N	082.8W	0743	14.1					10.4	NE	27.5	28/13	1013.9
SGNW3	43.8N	087.7W	0741	10.8	11.0				10.5	S	28.4	14/17	1014.5
SISW1	48.3N	122.9W	0742	11.2					9.1	W	28.8	31/04	1015.2
SMKF1	24.6N	081.1W	0738	27.6	28.3				10.1	E	40.3	05/11	1015.2
SPGF1	26.7N	079.0W	0736	26.6	28.1				5.3	SE	16.6	24/00	1015.5
SRST2	29.7N	094.1W	0742	24.5					13.1	SE	32.2	08/06	1012.3
STDM4	47.2N	087.2W	0742	7.7					15.9	W	33.8	30/21	1013.0
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41001	34.7N	072.6W	0710	23.5	21.6	1.5	5.7	07/05	10.7	S	30.7	07/06	1015.4
41002	32.3N	075.2W	0710	24.6	25.0	1.4	5.8	07/01	9.9	S	29.1	06/19	1014.7
41004	32.5N	079.1W	0716		25.7	1.1	4.6	06/11	9.9	SW	32.4	06/05	
41006	29.3N	077.3W	0716	26.2	26.6	1.3	2.9	06/05	11.4	SW	27.8	06/03	1014.2
41009	28.5N	080.2W	1436	26.4	26.7	0.8	2.0	17/23	10.6	S	26.4	04/22	1014.6
41010	28.9N	078.5W	1434	26.5	27.3	1.3	3.4	06/00	10.6	SW	28.2	26/00	1014.5
41016	24.6N	076.5W	0219	27.4	28.2	0.8	3.8	04/08	12.5	SE	22.1	04/08	1016.5
41021	31.9N	080.9W	0715	25.6	26.5	0.6	2.3	06/03	10.3	SE	32.8	06/04	1014.1
42001	25.9N	089.7W	0712	27.2	28.1	0.8	1.9	05/15	10.8	NE	27.6	26/17	1013.9
42002	25.9N	093.6W	0714	27.3	27.9	0.9	2.2	06/05	10.8	SE	21.4	09/09	1013.4
42003	25.9N	085.9W	0710	27.2	28.8	0.8	2.0	25/23	10.5	E	52.8	04/15	1013.2
42007	30.1N	088.8W	0718	26.7	28.4				9.9	SW	23.9	29/18	1014.3
42016	30.1N	088.2W	0180	27.5	28.8				8.4	SW	16.1	29/23	1013.4
42020	27.0N	096.5W	0714	27.3		1.1	2.8	11/13	11.3	SE	29.9	11/12	1013.0
42025	24.9N	080.5W	0631		28.5	0.5	2.0	21/21					
42035	29.3N	094.4W	0701	27.2	28.4	0.7	2.0	30/15	11.5	SE	31.5	01/08	1013.8
42036	28.5N	084.5W	0709	26.9	26.9	0.9	5.3	05/07	9.5	SW	38.3	05/11	1014.9
42037	24.5N	081.4W	0715	27.6	28.4	0.6	2.0	04/15	8.5	E	19.8	02/04	1014.8
44004	38.5N	070.7W	0714	20.4	20.1	1.3	5.5	07/12					1016.0
44005	42.9N	069.0W	0714	13.4	11.8	1.0	3.5	08/03	9.2	SW	21.0	08/03	1015.5
44006	36.3N	075.5W	0238	22.1	21.8	0.8	2.0	06/23	8.8	NE	25.6	07/01	1014.1
44007	43.5N	070.2W	0713	14.8	13.1	0.6	1.6	08/06	7.6	S	17.1	05/18	1014.5
44008	40.5N	069.4W	0711		10.6	1.1	4.9	07/21	8.8	SW	26.4	07/22	1016.1
44009	38.5N	074.7W	0714	19.7	19.3	0.9	2.7	28/05	9.2	NE	22.7	27/21	1015.7
44010	36.0N	075.0W	0252	23.1	22.8				9.2	S	26.8	07/04	1014.0
44011	41.1N	066.6W	0712	12.4	10.1	1.3	6.4	08/00	9.7	SW	26.8	07/23	1015.6
44013	42.4N	070.7W	0713	16.3		0.5	2.0	27/12	7.8	SW	20.4	07/21	1015.4
44014	36.6N	074.8W	0670	21.5	21.6	1.1	2.4	28/18	7.1	NE	27.8	07/04	1016.7
44019	36.4N	075.2W	0262	21.0	19.6				8.6	NE	24.3	06/13	1014.4
44025	40.3N	073.2W	0710	17.6	17.1	1.0	3.0	27/16	10.7	S	24.7	27/16	1015.5
44028	41.4N	071.1W	0706	16.1	15.1	0.6	1.8	07/16	11.0	SW	27.0	04/06	1015.9
45001	48.1N	087.8W	0717	6.1	3.2	0.4	2.7	07/11	7.8	SE	26.6	07/08	1015.1
45002	45.3N	086.4W	0715	12.8	10.5	0.3	1.1	07/17	7.2	S	20.6	07/16	1014.5

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
45003	45.3N	082.8W	0716	10.2	6.8	0.3	1.4	08/01	7.4	E	19.2	07/19	1015.3
45004	47.6N	086.5W	0718	6.3	3.3	0.4	2.3	07/14	7.2	E	18.8	07/11	1015.7
45005	41.7N	082.4W	0715	19.4	18.9	0.4	1.3	21/16	7.6	E	22.0	27/04	1014.4
45006	47.3N	089.9W	0719	6.9	3.3	0.5	2.5	07/16	6.7	NE	21.9	07/17	1015.2
45007	42.7N	087.0W	0715	15.6	13.8	0.4	2.2	08/07	6.5	S	25.8	08/01	1014.3
45008	44.3N	082.4W	0710	12.3	10.2	0.4	1.8	08/02	6.7	N	21.4	08/06	1015.1
45010	43.0N	087.8W	0225	21.1	21.3	0.3	0.6	26/11	6.4	NE	17.7	30/23	1011.5
46001	56.3N	148.2W	0712		8.0	1.8	5.7	03/20					1011.5
46002	42.5N	130.3W	0717	13.1	13.7	2.4	6.1	10/11	13.8	NW	24.3	18/13	1019.4
46003	51.9N	155.9W	0714	6.7	6.8	2.1	5.4	19/06	11.7	S	23.7	19/01	1009.1
46005	46.1N	131.0W	0715	12.1	12.6	2.2	6.0	10/07	13.2	NW	26.4	09/20	1018.5
46006	40.9N	137.5W	0711	13.2	13.4	2.4	8.3	09/19	12.8	S	28.4	03/14	1022.3
46011	34.9N	120.9W	0710	12.3	12.3	2.0	5.1	07/01	12.0	NW	29.5	06/00	1013.6
46013	38.2N	123.3W	0713	11.7	10.7	2.1	4.5	06/23	14.8	NW	32.1	06/21	1015.4
46014	39.2N	124.0W	0215	10.9	9.8	2.3	5.0	07/03					1017.1
46022	40.8N	124.5W	0242	11.5	11.2	2.1	4.3	10/19	11.2	NW	27.0	07/02	1018.9
46023	34.3N	120.7W	0710	12.6	12.6	2.1	5.2	06/09	16.0	NW	32.6	05/22	1013.1
46025	33.8N	119.1W	0624	15.5	16.6	1.0	2.3	07/01	6.3	W	23.5	16/07	1013.3
46026	37.8N	122.8W	0711	11.8		1.8	3.9	07/00	11.7	NW	30.3	06/04	1015.0
46027	41.9N	124.4W	0169	11.0	10.7	2.0	3.3	06/07	8.9	NW	25.5	08/00	1018.1
46028	35.7N	121.9W	0712	12.7	13.0	2.3	5.3	07/03	15.7	NW	33.2	06/00	1015.0
46029	46.2N	124.2W	0717	13.1	13.3	1.9	4.5	07/09	11.0	N	23.1	12/11	1017.7
46030	40.4N	124.5W	0714	11.0	10.2	2.1	4.1	11/02	7.8	S	14.8	29/20	1016.4
46035	57.0N	177.7W	0717	4.7	6.0	1.2	2.6	26/19	10.9	N	21.4	27/07	1017.8
46041	47.4N	124.5W	0718	12.3	12.4	1.7	4.6	07/06	7.9	NW	23.3	12/14	1017.0
46042	36.8N	122.4W	0716	12.2	11.8	2.1	5.0	07/03	11.4	NW	25.1	06/19	1015.2
46045	33.8N	118.5W	0712	15.7	16.9	0.9	2.1	07/04	5.6	SW	18.8	16/20	1013.1
46050	44.6N	124.5W	0715	11.5	12.9	2.0	4.1	07/11	12.3	N	24.9	17/14	1016.9
46053	34.2N	119.9W	0719	14.4	14.8	1.2	2.9	06/10	9.5	W	32.1	06/22	1013.8
46054	34.3N	120.5W	0719	13.0	13.1	2.1	4.7	07/03	17.8	NW	33.6	05/07	1013.9
46059	38.0N	130.0W	0711	14.6	14.9	2.3	4.7	10/17	13.9	N	21.8	16/00	1021.4
46060	60.6N	146.8W	1428	9.9	10.4	0.4	1.8	08/04	7.6	SW	19.6	23/08	1015.3
46061	60.2N	146.8W	1434	9.6	9.9	1.1	4.1	04/20	9.4	E	36.1	07/06	1015.7
51001	23.4N	162.3W	0716	24.7	25.7	1.7	2.6	11/19	12.2	E	23.4	15/17	1018.1
51002	17.2N	157.8W	0719	25.4	25.9	1.4	1.9	22/21	15.4	NE	22.8	12/08	1015.0
51003	19.1N	160.8W	0717	25.7	26.5	1.8	2.7	13/00	10.6	E	18.3	21/04	1016.0
51004	17.4N	152.5W	0710	25.3	26.4	2.1	3.3	14/01	14.6	E	22.7	14/10	1016.6
51026	21.4N	156.9W	0716	24.3	24.8	1.6	2.5	11/19	14.4	E	22.2	05/11	1017.7
51027	20.5N	157.1W	0714	25.0	25.6	1.4	2.8	13/05	13.3	E	23.9	14/19	1016.2
91222	18.1N	145.8E	0307	28.2					5.1	E	17.7	04/13	1012.5
91251	11.4N	162.4E	0714	27.9					14.8	E	27.9	05/02	1010.3
91328	8.6N	149.7E	0710	28.0					7.1	NE	16.1	12/03	1011.3
91338	5.3N	153.7E	0496	28.1					5.5	NE	23.3	25/06	1009.5
91343	7.6N	155.2E	0714	28.1					10.2	NE	23.5	25/14	1009.3
91352	6.2N	160.7E	0709	27.6					8.2	NE	22.4	07/00	1011.3
91355	5.4N	163.0E	0716	27.3					6.1	E	20.8	20/00	1008.8
91377	6.1N	172.1E	0451	27.7					8.5	NE	17.5	01/11	1012.0
ABAN6	44.3N	075.9W	0711	18.4	15.0				3.3	S	13.9	20/20	1015.4
ALSN6	40.5N	073.8W	0717	18.9	15.7				13.9	S	35.1	27/14	1016.0
BLIA2	60.9N	147.9W	1424	9.7					5.6	NW	21.8	23/09	1016.1
BURL1	28.9N	089.4W	0175	26.3					8.4	NE	28.8	01/17	1013.9
CARO3	43.3N	124.4W	0716	11.7					9.4	N	25.6	09/20	1017.0
CDRF1	29.1N	083.0W	0716	26.2					9.0	W	33.7	05/13	1014.7
CHLV2	36.9N	075.7W	0717	21.7	21.8	0.8	2.3	28/20	10.9	E	27.1	07/08	1015.7
CLKN7	34.6N	076.5W	0714	24.6					9.8	E	31.8	06/23	1016.0
CSBF1	29.7N	085.4W	0715	26.0					8.2	W	36.7	05/15	1015.1
DBLN6	42.5N	079.4W	0716	19.1					6.9	SW	22.3	20/23	1015.0
DESW1	47.7N	124.5W	0717	12.7					10.6	NW	29.4	10/20	1017.1
DISW3	47.1N	090.7W	0715	12.8					8.2	NE	30.1	07/20	1015.1
DPIA1	30.3N	088.1W	0717	26.4					8.1	SW	21.4	12/23	1015.1
DRYF1	24.6N	082.9W	0711	27.6	28.7				9.9	SE	30.8	04/10	1014.5
DSLN7	35.2N	075.3W	0710	24.4		1.1	4.3	07/02	13.5	SW	43.5	07/01	1016.3
FBIS1	32.7N	079.9W	0718	25.4					8.6	SE	30.4	06/09	1014.9
FFIA2	57.3N	133.6W	0709	12.0					6.3	S	21.7	22/21	1016.5
FPSN7	33.5N	077.6W	0716	24.7	22.7	1.1	4.6	06/17	11.8	SW	42.4	06/17	1014.8
FWYF1	25.6N	080.1W	0714	27.3	28.3				11.6	SE	32.4	06/20	1015.2

April, May and June 1995

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
GDIL1	29.3N	090.0W	0716	26.9	29.2				8.3	S	29.1	24/23	1015.0
GLLN6	43.9N	076.5W	0717	17.5					8.7	S	21.0	11/06	1014.8
IOSN3	43.0N	070.6W	0713	17.4					11.2	S	25.9	02/03	1015.0
KTNF1	29.8N	083.6W	0714	25.4					9.5	W	38.6	05/14	1014.3
LKWF1	26.6N	080.0W	0716	26.7	27.9				9.9	SE	34.6	22/01	1015.8
LONF1	24.9N	080.9W	0715	27.8	29.5				9.7	SE	26.9	20/23	1014.8
MDRM1	44.0N	068.1W	0713	12.0					12.3	SW	27.6	15/23	1014.7
MISM1	43.8N	068.9W	0715	13.0					12.4	SW	23.9	02/02	1014.9
MLRF1	25.0N	080.4W	0718	27.6	28.5				9.7	SE	31.4	21/20	1014.8
NWPO3	44.6N	124.1W	0716	12.0					9.6	NW	27.2	26/03	1016.7
PILM4	48.2N	088.4W	0714	9.2					10.3	E	29.1	01/04	1015.3
POTA2	60.3N	147.3W	1426	10.1					6.8	SW	27.6	10/16	1015.4
PTAC1	39.0N	123.7W	0716	11.6					11.4	N	28.5	26/19	1015.7
PTAT2	27.8N	097.1W	0715	27.1	28.8				13.1	SE	27.8	11/11	1013.4
PTGC1	34.6N	120.7W	0714	12.3					16.6	N	35.1	05/13	1013.6
ROAM4	47.9N	089.3W	0713	12.2					12.0	NE	34.3	07/05	1014.6
SANF1	24.5N	081.9W	0715	27.6	29.1				10.7	E	27.1	21/19	1014.2
SAUF1	29.9N	081.3W	0715	25.5	27.1				8.9	SW	30.7	10/06	1015.0
SBIO1	41.6N	082.8W	0718	20.6					7.1	E	23.7	14/05	1014.7
SGNW3	43.8N	087.7W	0718	18.1	14.3				7.8	N	33.0	08/02	1015.5
SISW1	48.3N	122.9W	0714	12.6					10.6	SW	29.3	03/03	1016.3
SMKF1	24.6N	081.1W	0719	28.0	29.0				11.2	SE	28.5	21/20	1015.0
SPGF1	26.7N	079.0W	0714	27.3	28.7				5.8	SW	23.3	21/06	1015.3
SRST2	29.7N	094.1W	0715	26.5					10.7	SE	26.1	29/02	1014.1
STDM4	47.2N	087.2W	0713	14.1					14.2	SE	31.5	17/03	1014.6
SUPN6	44.5N	075.8W	0714	19.0	15.9				7.3	S	22.4	26/19	1015.7
SVLS1	32.0N	080.7W	0699	25.4	26.4				12.4	E	39.8	06/06	1014.7
THIN6	44.3N	076.0W	0717	18.6									

Port Meteorological Services

SEAS Field Representatives

Mr. Robert Decker
Seas Logistics/PMC
7600 Sand Point Way, N.E.
Seattle, WA 98115
206-526-4280
FAX: 206-526-6365
TELEX 6735154/BOBD

Mr. Steven Cook
SEAS Operation Manager
8604 LaJolla Shores Drive
LaJolla, CA 92037
619-546-71-3
FAX: 619-546-7003
TELEX 7=6735179/COOK

Mr. Robert Benway
National Marine Fisheries Service
28 Tarzwell Drive
Narragansett, RI 02882
401-782-3295
FAX: 401-782-3201

Mr. Jim Farrington
SEAS Logistics/A.M.C.
439 West York Street
Norfolk, VA 23510
804-441-3062
FAX: 804-441-6495
TELEX 6735011/MAPA

Mr. Warren Krug
Atlantic Oceanographic & Met. Lab.
4301 Rickenbacker Causeway
Miami, FL 33149
305-361-4433
FAX: 305-361-4582
TELEX 6735213 LORI

DMA Representatives

Tom Hunter DMA/HTC Rep.
ATTN: MCC 4 (Mail Stop D44)
4600 Sangamore Road
Bethesda, MD 20816
301-227-3370
FAX: 301-227-4211

Walt Holtgren
DMA/HTC Gulf Coast Rep.
One Canal Place
365 Canal St., Suite 2300
New Orleans, LA 70130
504-589-2642
FAX: 504-589-2686

Gary Rogan
DMA/HTC West Coast Rep.
Eleven Golden Shore
Suite 410
Long Beach, CA 90802
310-980-4471
FAX: 310-980-4472

Australia
Michael J. Hills, PMA
Pier 14, Victoria Dock
Melbourne, Vic.
Tel: +613 6291810 TELEX: AA151586

Captain Alan H. Pickles, PMA
Stirling Marine, 17 Mews Road
Fremantle, WA 6160 Tel: +619 3358444
Fax: +619 3353286. Telex: AA92821

E.E. (Taffy) Rowlands, PMA
NSW Regional Office
Bureau of Meteorology, 580 George St.
Sydney, NSW 2000 Tel:+612 2698555
Fax: +612 2698589 Telex AA24640

China
YU Zhaoguo
Shanghai Meteorological Bureau
166 Puxi Road, Shanghai, China

Denmark
Commander Lutz O. R. Niegsch
PMO, Danish Meteorological Instit.
Lyngbyvej 100, DK-2100
Copenhagen, Denmark
Tel:+45 39157500 FAX:+45 39157300

England
Bristol Channel
Captain Austin P. Maytham, PMO
Rm 3.52, Companies House
Crown Way, Cardiff CF4 3UZ
Tel:+ 44 1222 221423 FAX:+44 1222 225295

East England
Captain John Steel, PMO
Customs Bldg, Albert Dock
Hull HU1 2DP Tel: +44 1482 320158
FAX: +44 1482 328957

Northeast England
Captain Gordon Young, PMO
Able House, Billingham Reach
Industrial Estate, Cleveland TS23 1PX
Tel: +44 1642 560993 FAX:+44 1642 562170

Northwest England
Captain Jim Williamson, PMO
Room 313, Royal Liver Building
Liverpool L3 1JH
Tel:+44 151 2366565 FAX: +44 151 2274762

Scotland and Northern Ireland
PMO
Navy Buildings, Eldon St.
Greenock, Strathclyde PA16 7SL
Tel: +44 1475 724700 FAX:+44 1475 892879

Southeast England
E.J. O'Sullivan, PMO
Daneholes House, Hogg Lane
Grays, Essex RM17 5QH
Tel:+44 1375 378369 FAX:+ 44 1375 379320

Southwest England
Captain Douglas R. McWhan, PMO
8 Viceroy House, Mountbatten Centre
Millbrook Rd. East,
Southampton SO15 1HY
Tel:+44 1703 220632 FAX: +44 1703 337341

France

Yann Prigent, PMO
Station Mét., Noveau Semaphore
Quai des Abeilles, Le Havre
Tel: +33 35422106 Fax: +33 35413119

P. Coulon
Station Météorologique
de Marseille-Port
12 rue Sainte Cassien
13002 Marseille
Tel: +33 91914651 ext. 336

Germany

Henning Hesse, PMO
Wetterwarte, An der neuen Schleuse
Bremerhaven
Tel: +49 47172220 Fax: +49 47176647

Jurgen Guhne, PMO
Deutscher Wetterdienst
Seewetteramt
Bernhard Nocht-Strasse 76
20359 Hamburg
Tel: (040) 3190 8826

Greece
George E. Kassimidis, PMO
Port Office, Piraeus
Tel: +301 921116 Fax: +3019628952

Hong Kong

H. Y. Chiu, PMO
Royal Observatory Ocean Centre Office
Room 1454, Straight Block
14/F Ocean Centre, 5
Canton Road Tsim Sha Tsui,
Kowloon, Hong Kong
Tel: +852 29263113 FAX:+852 23757555

Japan
Port Meteorological Officer
Kobe Marine Observatory
14-1, Nakayamatedori-7-chome
Chuo-ku, Kobe, 650 Japan
FAX: 078-361-4472

Port Meteorological Officer
Nagoya Local Meteorological Obs.
2-18, Hiyori-cho, Chikusa-ku
Nagoya, 464 Japan
FAX: 052-762-1242

Port Meteorological Officer
Yokohama Local Met. Observatory
99 Yamate-cho, Naka-ku,
Yokohama, 231 Japan
FAX: 045-622-3520

Kenya

Ali J. Mafimbo, PMO
PO Box 98512
Mombasa, Kenya
Tel: +254 1125685 Fax: +254 11433440

Malaysia
NG Kim Lai
Assistant Meteorological Officer
Malaysian Meteorological Service
Jalan Sultan, 46667 Petaling
Selangor, Malaysia

Mauritius
Mr. S Ragoonaden
Meteorological Services
St. Paul Road, Vacoas, Mauritius
Tel: +230 6861031 FAX: +230 6861033

Netherlands
John W. Schaap, PMO
KNMI,/Stationszaken
Wilhelminalaan 10, PO Box 201
3730 A.E. DeBilt, Netherlands
Tel: +3130 206391 FAX: +3130 210849

New Zealand
Julie Fletcher, MMO
Met. Service of New Zealand Ltd.
Tahi Rd., PO Box 1515
Paraparaumu Beach 6450, New Zealand
Tel: +644 2973237 FAX: +644 2973568

Norway
Tor Inge Mathiesen, PMO
Norwegian Meteorological Institute
Allègaten 70, N-5007 Bergen, Norway
Tel: +475 55236600 FAX: +475 55236703

Poland
Jozef Kowalewski,PMO
Waszyngtona 42, 81-342 Gdynia
Tel: +4858 205221 Fax: +4858 207101

Saudi Arabia
Mahmud Rajkhan, PMO
National Met. Environment Centre
eddah
Tel:+ 9662 6834444 ext. 325

Singapore
Edmund Lee Mun San, PMO
Meteorological Service, PO Box 8
Singapore Changi Airport
Singapore 9181
Tel: +65 5457198 FAX: +65 5457192

South Africa
C. Sydney Marais, PMO
C/O Weather Office
D.F. Malan Airport 7525
Tel: + 2721 9340450 ext. 213 Fax: +2721 9343296

Gus McKay, PMO
Meteorological Office
Louis Botha Airport Durban 4029
Tel: +2731 422960 Fax: +2731 426830

Sweden
Morgan Zinderland
SMHI
S-601 76 Norrköping, Sweden

Atlantic Ports

Charles E. Henson, PMO
National Weather Service, NOAA
2550 Eisenhower Blvd, No. 312
PO Box 165195, Port Everglades, FL 33316
305-463-4271 FAX/Tel: 305-462-8963

Lawrence Cain, PMO
National Weather Service, NOAA
13701 Fang Rd.
Jacksonville, FL 32218
904-741-5186

Martin Bonk, PMO, Norfolk
National Weather Service, NOAA
Norfolk International Airport
Norfolk, VA 23518
804-858-6194 FAX: 804-853-6897

James Saunders, PMO
National Weather Service, NOAA
BWI Airport, Baltimore, MD 21240
410-850-0529 FAX: 410-859-5129

John Bolinger, PMO
National Weather Service, NOAA
Bldg. 51, Newark International Airport
Newark, NJ 07114 Tel: 201-645-6188

PMO, New York
National Weather Service, NOAA
Bldg. 51, Newark International Airport
Newark, NJ 07114 Tel: 201-645-6188

Randy Sheppard, PMO
Environment Canada
1496 Bedford Highway, Bedford
(Halifax) Nova Scotia B4A 1E5
902-426-6703

Denis Blanchard
Environment Canada
100 Alexis Nihon Blvd., 3rd Floor
Ville St. Laurent, (Montreal) Quebec
H4M 2N6 Tel: 514-283-6325

D. Miller, PMO
Environment Canada
Bldg. 303, Pleasantville
P.O. Box 21130, Postal Station "B"
St. John's, Newfoundland A1A 5B2
709-772-4798

Gulf of Mexico Ports

John Warrelmann, PMO
National Weather Service, NOAA
Int'l Airport, Moisant Field, Box 20026
New Orleans, LA 70141
504-589-4839

James Nelson, PMO
National Weather Service, NOAA
Houston Area Weather Office
1620 Gill Road, Dickinson, TX 77539
713-534-2640 FAX: (713) 337-3798
Internet:Jnelson@smtpgate.ssmc.noaa.gov

Pacific Ports

PMO, W/PRx2
Pacific Region, NWS, NOAA
Prince Kuhio Fed. Bldg., Rm 411
P.O. Box 50027
Honolulu, HI 96850
808-541-1670

Robert Webster, PMO
National Weather Service, NOAA
501 West Ocean Blvd.
Room 4480
Long Beach, CA 90802-4213
310-980-4090 FAX: 310-980-4089
TELEX: 7402731/BOBW UC

Robert Novak, PMO
National Weather Service, NOAA
1301 Clay St. Suite 1190N
Oakland, CA 94612-5217
510-637-2960 FAX 510-637-2961
TELEX: 7402795/WPMO UC

Patrick Brandow, PMO
National Weather Service, NOAA
7600 Sand Point Way, N.E.
Seattle, WA 98115-0070
206-526-6100 FAX: 206-526-6094

Bob McArter, PMO
Environment Canada
700-1200 W. 73rd Av.
Vancouver, British Columbia
V69 6H9
604-664-9136

Duane Carpenter OIC
National Weather Service, NOAA
600 Sandy Hook St., Suite 1
Kodiak, AK 99615
907-487-2102 FAX: 907-487-9730

Lynn Chrystal, OIC
National Weather Service, NOAA
Box 427, Valdez, AK 99686
907-835-4505

Greg Matzen, Marine Program Mgr.
W/AR1x2 Alaska Region
National Weather Service
222 West 7th Avenue #23
Anchorage, AK 99513-7575
907-271-3507

Great Lakes Ports

Amy Gustafson, PMO
National Weather Service, NOAA
333 West University Dr.
Romeoville, IL 60441
815-834-0600 xtn 525
FAX: 815-834-0645

George Smith, PMO
National Weather Service, NOAA
Hopkins International Airport
Federal Facilities Bldg.
Cleveland, OH 44135
216-265-2374

Ron Fordyce, Supt. Marine Data Unit
Rick Shukster, PMO
Keith Clifford, PMO
Environment Canada
Port Meteorological Office
100 East Port Blvd.
Hamilton, Ontario L8H 7S4
905-312-0900
Fax: 905-312-0730

U.S. Headquarters

Vincent Zegowitz
Marine Obs. Program Leader
National Weather Service, NOAA
Room 14112
1325 East West Highway
Silver Spring, MD 20910
301-713-1677, ext 129
FAX: 301-713-1598

Murtin Baron
VOS Program Manager
National Weather Service, NOAA
Room 14470
1325 East West Highway
Silver Spring, MD 20910
301-713-1677, ext. 134
FAX: 301-713-1598

Mariners Weather Log
National Weather Service
SSMC2, 14th Floor
1315 East-West Highway
Silver Spring, MD 20910
301-713-1677, ext. 129
FAX: 301-713-1598

Great Britain Headquarters

Captain Gordon V. Mackie,
Marine Superintendent, BD (OM)
Meteorological Office, Met O (OM)
Scott Building, Eastern Road
Bracknell, Berks RG12 2PW England
Tel: +44-1344 855654
Fax: +44-1344 855921
Telex: 849801 WEABKA G

Australia Headquarters

A.D. (Tony) Baxter, Headquarters
Bureau of Meteorology
Regional Office for Victoria, 26 floor
150 Lonsdale Street
Melbourne, Vic 3001`
Tel: +613 6694000 FAX: +613 6632059

Japan Headquarters

Marine Met. Div., Marine Dept.
Japan Meteorological Agency
1-3-4 Otemachi, Chiyoda-ku
Tokyo, 100 Japan
FAX: 03-3211-6908

This discarded line is done fishing. But it's not done killing.

Carelessly discarded plastic fishing line can keep working long after you're done with it– entangling birds, seals, sea turtles, and other animals.

And because plastic line is strong and durable, it's nearly impossible for these animals to break free. They strangle, drown, or starve. That's not sporting.

Some birds even use old fishing line in their nests, creating death traps for their young.

Other plastic debris can be dangerous, too. Fish, birds, and seals become entangled in six-pack rings. Sea turtles eat plastic bags– which they mistake for jellyfish– and suffer internal injury, intestinal blockage, or death by starvation. Birds are known to ingest everything from small plastic pieces to plastic cigarette lighters and bottle caps.

Plastic debris also can foul boat propellers and block cooling intakes, causing annoying– sometimes dangerous– delays and causing costly repairs.

So please, save your old fishing line and other plastic trash for proper disposal.

That's not all you'll be saving.

To learn more about how you can help, write: Center for Environmental Education, 1725 DeSales Street, N.W., Suite 500, Washington, D.C. 20036.

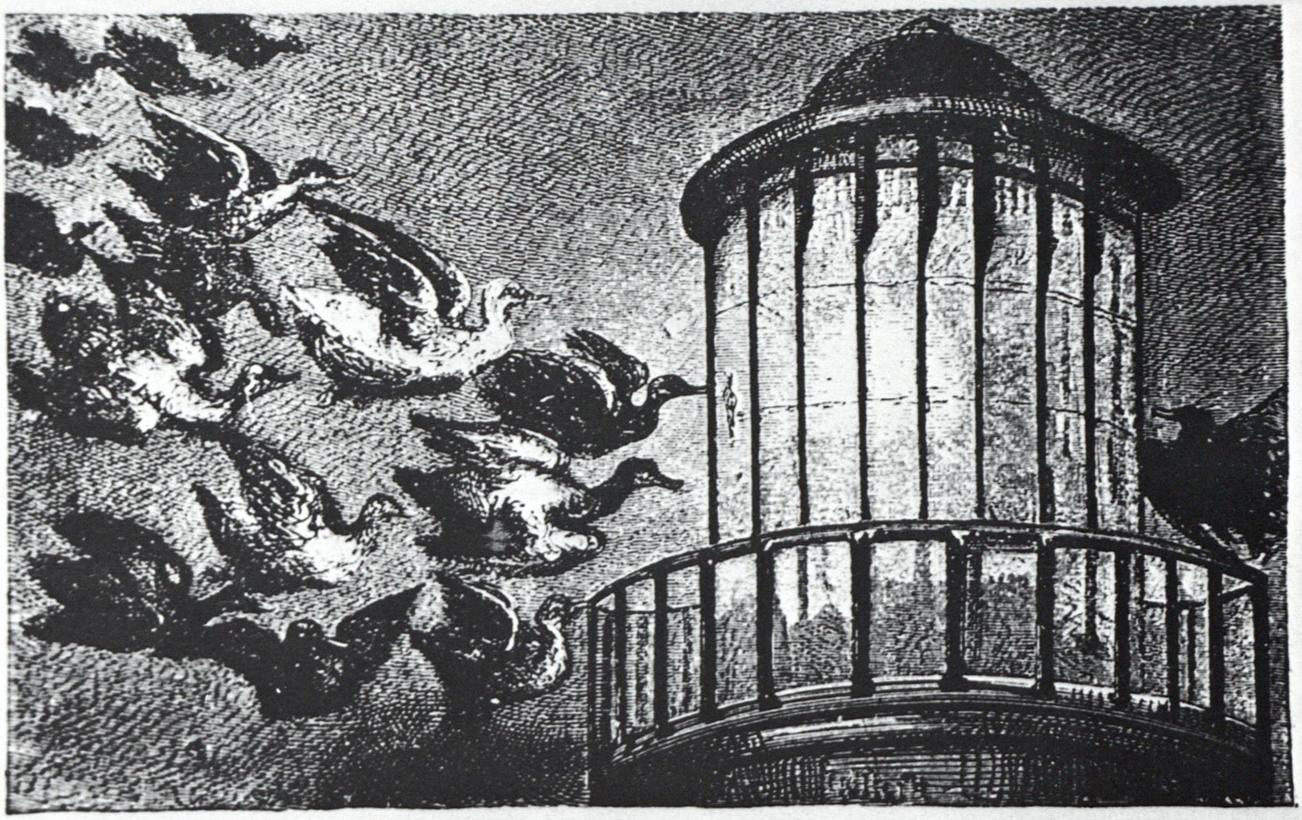
A public service message from:
The Center for Environmental Education
The National Oceanic and Atmospheric Administration
The Society of the Plastics Industry

AGGIES

At Attention

Photo courtesy of Mark Zegowitz

night had flown violently against the panes of the lantern, and



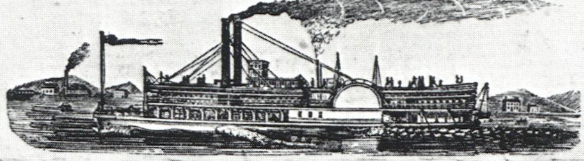
ALLURED BY THE LIGHT WITHIN.

being stunned, had fallen far down upon the cruel rocks, which

Photo courtesy of Elinor DeWire

In accordance with the Act of Congress, approved Aug. 30, 1852.

The *Original* ~~Renewal.~~



No. *596*

PILOT'S CERTIFICATE.

The undersigned, Inspectors for the District of St. Louis, Certify that [redacted] having been by them this day duly examined, touching his qualifications as a **Pilot** of a Steam Boat, is a suitable and safe person to be intrusted with the power and duties of Pilot of Steam Boats, and do license him to act as such for one year from this date, on the following rivers, to wit: *On the Mississippi River to and from St Louis And New Orleans*

Given under our hands, this *9th* day of *April* 185*9*

James H McCord

Ne Templeton

I, *James H McCord* Inspector for the District of St. Louis, certify that the above named *Saml Clemens* this day, before me, solemnly swore that he would faithfully and honestly, according to his best skill and judgment, without concealment or reservation, perform all the duties required of him as a Pilot, by the Act of Congress, approved August 30, 1852, entitled "An act to amend an act entitled 'An act to provide for the better security of the lives of passengers on board of vessels propelled in whole or in part by steam,' and for other purposes."

Given under my hand, this *9th* day of *April* 185*9*

James H McCord

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National Oceanic and Atmospheric Administration
1315 East West Highway
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