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NOAA's G-IV Jet Flies Through Pacific Storms

—By Jeanne G. Kouhestani

NOAA's Gulfstream-IV jet is best known for its surveillance flights around Atlantic hurricanes. But a recent mission flying into winter storms over the Pacific Ocean under an often-grueling schedule proved the mettle of the jet and its crew.

"This year's mission was one of our more complex and exhausting winter storm missions because we were working for three clients at one time and had to balance one against the other," said Jack Parrish, G-IV project manager at NOAA's Aircraft Operations Center in Tampa, Fla.

The mission began in late January out of the G-IV's temporary base in Honolulu, Hawaii. The jet then moved to Anchorage, Alaska, at the end of January and returned to Honolulu at the end of February, completing its mission March 15.

The jet's primary project was the Pacific Winter Storm Reconnaissance Program of NOAA's National Centers for Environmental Prediction, now in its fourth year. To collect data to improve forecasts released 24 to 96 hours before a winter storm, the jet flew 23 missions in 149 flight hours and collected atmospheric data with 386 dropwindsondes that were used to profile precursors of what later would become winter storms

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NOAA to Protect Historic Sunken Japanese Mini-Sub

—By Fred Gorell

When representatives of the governments of Japan and the United States met at the Commerce Department in Washington, D.C., Feb. 12 to sign an international agreement, they continued a story that began just off Honolulu, Hawaii, very early on the morning of Dec. 7, 1941.

In an exchange of diplomatic notes, Japan agreed that the United States owns the Japanese mini-

submarine discovered at the entrance to the naval base at Pearl Harbor by the NOAA-cooperative National Undersea Research Program at the University of Hawaii 62 years after it played an historic role in America's entry into World War II.

The agreement also signaled a role for NOAA as the lead agency in an inter-agency effort to protect and manage the historic wreck.

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Terry Kirby/U. Hawaii

The wreck of a Japanese mini-submarine sunk by an American destroyer at the entrance to Pearl Harbor just prior to the air attack on Dec. 7, 1941, is illuminated by the flood light of a manned mini-sub operated by the NOAA-cooperative National Undersea Research Program at the University of Hawaii. Figure-eight-shaped antisubmarine net cutters are visible on the sub's bow, while the lights from a second university sub can be seen as it approaches the stern.

G-IV Jet

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over the Pacific.

The 15 storms targeted by NCEP were all deemed to be threats to the continental United States, Alaska or Hawaii.

During the February flights out of Anchorage, the jet flew in tandem with an Air Force Reserve C-130 aircraft to cover both sides of the jet stream.

The C-130 also deployed dropwindsondes, small disposable instruments that measure temperature, wind speed, humidity and surface pressure. A mainstay of meteorological research, dropwindsondes are released into the atmosphere through a chute in the aircraft, then transmit data back to the aircraft twice each second as they fall toward the ocean.

According to Zoltan Toth, a National Weather Service research meteorologist leading the project, "If you want to really know what the weather will be like two or three days ahead, you must get an

accurate sense of what the weather is doing currently. The increased forecast warning lead time provided by the extra, targeted observations is crucial for residents living in harm's way. Our goal was to collect dropwindsonde observations to improve weather forecasts for 32 preselected forecasts of threatening winter weather events."

Forecasts initialized with and without the winter storm reconnaissance data were verified against surface pressure, winds and temperature observations within the preselected areas of forecast winter storms.

"A preliminary evaluation of the impact of the dropwindsonde data we received this year indicates that the targeted data improved the one- to four-day forecasts for the threatening winter weather events in 66 percent of the cases, while in 34 percent of the cases the data had a neutral or slightly negative effect," Toth said.

Though no scientists from the National Centers for Environmen-
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Japanese Mini-Sub

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Before the air attack on the U.S. naval base at Pearl Harbor began on the morning of Dec. 7, the crew of the U.S. destroyer *Ward* reported that the ship had fired on and hit a surfaced submarine as it approached the harbor entrance. *Ward's* report was largely discounted at the time, and without evidence, the crew's claim remained suspect for more than six decades.

All suspicion ended when the National Undersea Research Program at the University of Hawaii discovered the 78-foot-long submarine during a training dive on Aug. 28, 2002, not far from where *USS Ward* claimed it was sunk in America's first military action of World War II.

About an hour before the air attack on Pearl Harbor, *Ward's* crew reported by radio that they fired their four-inch gun at the starboard side of a submarine trying to enter the harbor behind a cargo ship, then dropped depth charges on the sub. When the submarine was found, a four-inch hole was observed in the starboard side of its conning tower.

The mini-submarine lies upright, 1,200 feet deep off the entrance to Pearl Harbor, with its two torpedoes still in place. Because the hatch at the top of the conning tower is closed, it is presumed that two Japanese sailors who operated the vessel are entombed inside.

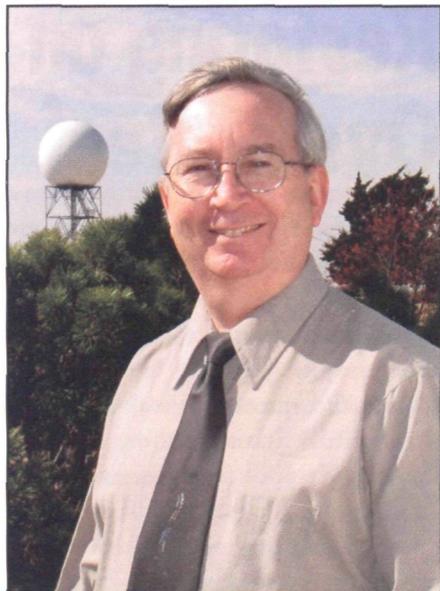
In a partnership with other federal agencies, NOAA is playing a key role in the protection and management of the mini-sub under the provisions of U.S. policy on sunken vessels and historic preservation laws and policies.

"NOAA continues to work closely with the National Park Service, the Navy, the Department
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Jack Parrish/NOAA

In Honolulu, Hawaii, the NOAA Gulfstream IV jet prepares to launch into a squall to study a winter storm.



Dan Purcell/NOAA

Richard Ice.

Richard Ice Is the April Team Member of the Month

—By Keli Tarp

Richard Ice, a senior radar systems engineer with RSIS, Inc., working at NOAA's Radar Operations Center in Norman, Okla., is the April Team Member of the Month, recognized for his role in evaluating a new component that will be added to NEXRAD weather radars.

But Ice said his initial interest in radar was a complete accident. He enlisted in the Air Force as a radar technician in 1971, he said, because it was what the recruiter had on his list to fill that day.

In the Air Force, Ice worked as a radar technician in electronic warfare, got a bachelor and master's degree in electrical engineering, taught for three years at West Point, then was one of the first 25 employees to join the Radar Operations Center in 1990.

Ice retired from the Air Force in 1992, but stayed on as a civilian employee of the Radar Operations Center for another six and a half years. At that point, he resigned to

do more hands-on engineering work and became a contractor. He was hired by RSIS when the company won a radar-support contract at the center four years ago, and now works as part of a team evaluating the components of a major upgrade to the NEXRAD signal processing system.

"Richard Ice is a proven technical leader with an unrelenting drive and exceptional analytical mind," said Lt. Ron Fehlen, NEXRAD hardware engineering team lead with the Radar Operations Center. "His evaluation and refinement of a new NEXRAD clutter filter design resulted in a major advance in the NEXRAD radar's ability to provide accurate weather data."

NEXRAD radar is the primary severe weather forecasting tool for meteorologists. Unfortunately, the radar also detects buildings, cars, power lines and other things generally referred to as "clutter." This can corrupt the radar data and can confuse computer algorithms designed to detect tornadoes, heavy rain leading to flash floods and other life threatening conditions. Filters are used to separate clutter from weather.

As part of a major upgrade of the NEXRAD signal processing system, a new, frequency-based clutter filter was proposed. The Office of Science and Technology of NOAA's National Weather Service requested the Radar Operations Center evaluate the new clutter filter against stringent NEXRAD requirements within a short, three-month deadline.

Ice was selected for this daunting task because of his reputation for technical excellence and mission focus, Fehlen said. "He was immediately put to the test when we realized the NEXRAD requirements for the current filter did not apply directly to evaluating the new filter. Rich rapidly assessed the

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Allison Soussi-Tanani/NOAA

Tracey McCray.

Tracey McCray Is April's Employee of the Month

—By Jana Goldman

In less than a year, Tracey McCray has had seven different bosses. It's not because she's tough on them and they leave in despair. Rather, it's because of a novel solution during a time of transition for NOAA's Office of Oceanic and Atmospheric Research.

During the summer of 2003, while then-Acting Assistant Administrator Louisa Koch was on maternity leave, directors from five of NOAA's environmental laboratories came to Silver Spring, Md., on a rotating basis to provide leadership to NOAA Research.

It is because of her poise and professionalism handling the schedules and personalities of those six people, plus Richard Rosen, who was selected to be the new assistant administrator in October, that McCray, a senior secretary, was nominated for the NOAA Employee of the Month award.

The transition really began in the fall of 2002, when the assistant

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Focus On...

Restoring an Oyster Reef

—By Stephanie L. Hunt

Anyone who has visited Georgia's coast remembers the jagged, oyster-lined shorelines. But old-timers say it's nothing like it used to be. And numbers speak louder than words. Statistics show a downward spiral for Georgia oyster landings from nearly seven million pounds a century ago to just over seven thousand pounds today.

To respond to declining oyster populations, NOAA Fisheries supports citizen groups and local organizations in restoring these vital reef habitats.

On March 20, a NOAA-funded project called Generating Enhanced Oyster Reefs in Georgia's Inshore Areas, or GEORGIA for short, completed its first oyster planting, dumping 150 bags of shells into Skidway River on the outskirts of Savannah.

"Oysters are a great source of protein for humans and other animals and they also provide ecological benefits," said Kay McGraw, a fisheries biologist at the NOAA Community-based Restoration Center in Silver Spring, Md. "They filter algae and particulate matter from the water and form a unique three-dimensional ecosystem that provides habitat for a variety of organisms, including barnacles, crabs, worms, fish and small shrimp. In addition, they can prevent erosion and destruction of sea grass beds by serving as wave and storm surge barriers."

Over-harvesting, pollution and disease all contribute to declining oyster populations. But exacerbating these factors is the practice of not returning shells to the water after harvest.

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Alan Powell/U.Ga.

Volunteers supported by the NOAA Community-based Restoration Center load oyster shells collected from oyster roasts, restaurants and other sources into bags that will be transported to the Skidway River on the outskirts of Savannah, Ga.



Ellie Covington/U.Ga.

At low tide, the volunteers form a human chain to move the bags of oyster shells across environmentally sensitive ground to the banks of the Skidway River.

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“In Georgia, the majority of oysters are consumed at outdoor parties called oyster roasts, and most of the shells from these events end up going on driveways or in dumpsters,” said Alan Powers, GEORGIA’s project manager from the University of Georgia’s Shellfish Research Laboratory.

Using the NOAA grant and matching funds from the Ocean Trust organization, the GEORGIA group set-up shell recycling centers, conducted a massive public education campaign and will build a total of five reefs in the greater Savannah area.

“We built on-site collection facilities where the public can drop off oyster shells. And if people can’t bring the shells to us, we go to the parties and pick up the shell,” Powers said.

The GEORGIA group has attended 40 roasts to date, collecting nearly 400 bushels of shells to return to the water. Along with private citizens, three local restaurants save and donate shells on a



Dodi Sanders/U.Ga.

The bags of oyster shells are assembled in a marsh that will later be flooded by the river’s tidal flow.

weekly basis.

Once shells are collected, they are dried in the sun for several months to eliminate bacteria and disease. Volunteers then pack the shells into plastic mesh bags, which

are used to build a new oyster reef.

When all five reefs have been constructed, local groups such as the 4-H Club and local restaurants will adopt the sites and conduct monthly monitoring to determine success rates.

“Oyster restoration is a high priority for the Community-based Restoration Program,” said Robin Bruckner, a fisheries biologist with the NOAA restoration center. “We fund projects in the Pacific Northwest, the Chesapeake Bay, on the Gulf coast and in New England. In fact the GEORGIA program is modeled after a highly successful program that we funded in South Carolina.”

“The public has embraced the project and they are actually getting excited about shellfish restoration,” Powers said. “It’s amazing to see the change in people’s faces as you explain the different functions of oysters—water filtration, shoreline erosion control, habitat for fish. They are usually astounded and even more eager to become involved.”



Dodi Sanders/U.Ga.

The team puts the finishing touches on the rebuilt oyster shell reef, which will provide the substrate necessary for colonization by living oysters.

Japanese Mini-Sub

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of State and others to ensure that our management plans focus on the submarine as both an historic vessel and a war grave," said Richard Spinrad, assistant administrator for NOAA's National Ocean Service. "Through our National Marine Sanctuary Program we will continue our efforts to preserve this important piece of our nation's marine heritage."

Following the exchange of diplomatic notes, NOAA and National Park Service representatives assured the representative of Japan that the wreck will be managed with the utmost respect for the vessel as a war grave and that the procedures followed will be the same as those used at U.S. war graves.

"Cooperative efforts are already underway, including marine archaeologists from NOAA working with counterparts in the National Park Service's Submerged Resources Center," said Capt. Craig McLean, director of NOAA's Office of Ocean Exploration. "Their objective is to learn more about the condition of the submarine's hull and how best to protect the vessel and its environment."

Scientists have already placed unobtrusive environmental monitoring devices on and near the hull structure of the midget submarine to obtain baseline data on the condition of the hull and its rate of corrosion to better understand whether the submarine is well preserved as it sits, or is deteriorating rapidly.

The resulting data will be used to determine the preferred alterna-

tive for long-term management and protection.

"The Navy obviously has an interest in the submarine and its role in the opening history of the attack on Pearl Harbor," said marine sanctuary program director Dan Basta. "In addition to their interest in the Japanese mini-submarine and the wrecks of *USS Arizona* and *Utah*, Navy researchers and historians are interested in a survey and inventory of other submerged wreck sites in and around Pearl Harbor."

As evidence of the start of World War II in the Pacific, the wreck of the mini-submarine is a significant

As evidence of the start of World War II in the Pacific, the wreck of the mini-submarine is a significant historic resource that is likely eligible for the National Register and perhaps even National Landmark status.

historic resource that is likely eligible for the National Register and perhaps even National Landmark status. The National Park Service has agreed to take the lead in the nomination

process under the National Historic Preservation Act.

There are no plans to salvage the mini-sub. The preferred U.S. policy for such an intact, well-preserved historic shipwreck is for preservation in place. The United States Policy for the Protection of Sunken Warships provides authority to protect and preserve this sunken craft, including preventing any unauthorized salvage.

The approach to protecting and managing the mini-submarine is also an example of federal agencies working together to further President Bush's March 3, 2003, executive order entitled "Preserve America." The order emphasizes the protection, enhancement and contemporary use of the historic properties owned by the federal government through intergovernmental cooperation. ☺

G-IV Jet

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tal Prediction were on board the jet during the project, Parrish received daily instructions from the senior duty meteorologist at NCEP's central operations.

NCEP ran anywhere from two to three dozen test computer simulation experiments every day to identify weak spots over the Pacific in storm-sensitive areas where data were sparse. Weak spots were "bull's-eyes" for flights; the G-IV crew would be tasked to fly a specific eight-and-one-half-hour flight pattern around that region along the jet stream on the following day.

Flight patterns were predetermined and numbered. NCEP then provided the flight path number to the G-IV crew, creating "hybrid" flight patterns when conditions warranted. The G-IV pilots would run the new path through flight navigation software to determine if it was within the jet's fuel reserves under expected atmospheric conditions. If not, the flight director would negotiate the points that could be cut from the flight path.

When the G-IV was not called on for NCEP's winter storm study, the G-IV team made itself available to researchers David Parrish and Adrian Tuck of NOAA's Aeronomy Laboratory in Boulder, Colo., for its Pacific Sub-tropical Jet Study, which is investigating the transport of ozone in the vicinity of the Pacific jet stream.

Ozone is a gas that occurs both in the troposphere, where it affects climate and is a pollutant at the Earth's surface, and the stratosphere, where it is naturally more abundant and absorbs much of the sun's harmful ultraviolet radiation.

The G-IV flew seven missions, about 50 flight hours, for the *continued on page 7*

G-IV Jet

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Aeronomy Lab. Data were collected by ozone measuring instruments in combination with 12 dropwindsondes during flights that explored tropospheric folds and cutoff lows, regions of suspected high transport of strato-

spheric ozone into the lower troposphere.

"We got exactly what we planned," David Parrish

said. "We were able to fly through the jet stream and measure ozone both at its entrance and exit regions. This information had been missing from our previous analyses, and fulfilled our first goal.

"Our second goal was to follow tendrils of stratospheric ozone that break off from the jet stream and travel to the mid- and lower troposphere and mix with it. My co-workers Owen Cooper and Andreas Stohl planned two successful flights where we followed tendrils down to near the marine boundary level [the lower part of the troposphere that is directly influenced by the sea surface]."

"We had a good surprise in how lucky we were to have stratospheric tendrils so close to Hawaii," he added. "The Aircraft Operations Center was able to work closely with the Honolulu air traffic controllers so we could study these in much greater detail than would have been possible outside the control area."

Tuck was particularly intrigued by the variations in ozone concentration, from which he and co-workers Karen Rosenlof and Eric Ray will be able to glean information about ozone sources and sinks and the mixing process both within the troposphere and between the stratosphere and troposphere.

Analyses of all the ozone data obtained from the seven flights combined with the humidity and stability information from the dropwindsondes should provide enough raw material for at least three significant papers, publishable in internationally recognized journals.

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During three Aeronomy Lab flights, the G-IV also conducted piggyback experiments for its third client, the Defense Department, deploying 44 dropwindsondes to measure temperature and humidity in the atmosphere and sea surface temperatures. These measurements will be used to groundtruth the same measurements made by a Defense satellite that passed over the same area of ocean at the same time as the G-IV.

To make sure all systems are running properly and to troubleshoot when they aren't, the G-IV carries its own maintenance guru along on every flight.

In plane years, the G-IV is approaching middle age.

"This jet is nearly 10 years old, so more maintenance problems are happening," said G-IV pilot NOAA Cdr. Garner Yates. "In addition to that, the tempo we flew was not something we have done with this plane routinely."

"It can be a challenge," G-IV flight engineer and crew chief Kevin Rotteveel said. "It's a big electric airplane and all the electronic boxes have got to talk to each other. There are certain things I can do on the road, and some I say we've got to go into the Gulfstream service center to get done right."

Rotteveel spends about half his time doing pre- and post-flight inspections, and the other half monitoring two computer screens and the electric power distribution panel during flights.

The job isn't as glamorous as the pilot's, but the flight engineer's ability to fix things can save the day.

As the jet was preparing to leave Anchorage, the toilet broke. Despite their mad scramble to find "his and her

jars" and avoid delaying the scheduled flight, the crew was no doubt relieved when Rotteveel found and fixed the problem.

The next challenge presented a bigger threat than discomfort.

On the way from Anchorage to Honolulu, the G-IV sprang a fuel leak and had to stop at a Gulfstream facility in Long Beach, Calif., for a repair.

During its mission flights, the G-IV went searching for bad weather, and found it. Oddly enough, the worst weather encountered during the mission was not in Alaska, but in Hawaii.

"We were landing in a crosswind of 29 knots, right on the safety threshold," Jack Parrish said. "We had two days of work ahead of us, and it was questionable whether we could land. I'll be darned if Garner didn't put it down and put it down sweetly. It was wild, the most exciting G-IV landing I've been involved in. We were always worried about coming into Anchorage, and here we had the worst landing coming into Honolulu.

"From Feb. 27, the weather stayed bad in Hawaii for the next two weeks. We didn't care, as long as it was good enough to get off the ground and back." Parrish said. "But we saw a lot of disappointed tourists." ☺

Ice

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NEXRAD requirements and determined scientifically how they could be accurately applied, an exercise that would tax even the most seasoned radar engineer.”

Ice's work to translate the requirements provided the foundation by which the new clutter filters would be evaluated. Performance data for the new clutter filter were non-existent and there were no methods of direct measurement. Ice truly started from “ground zero” in designing a process to collect and analyze data to determine the new filter's performance.

The method he established and orchestrated was so efficient it allowed his team to use simulations of all types of weather to collect and analyze over 10 million data points that covered over 80 percent of the meteorological scenarios, Fehlen said.

Ice's work has proven that the new clutter filter design allows the Weather Service and Federal Aviation Administration to avoid a planned \$5-million communications infrastructure upgrade, including an associated \$250,000 annual increase in circuit costs, without degrading radar data quality.

“When the new filter is deployed, the impact of Rich's exceptional technical evaluation will be felt at every level of the NEXRAD program, from the front-line meteorologists and air traffic controllers to program management leadership,” Fehlen said.

The teamwork required to accomplish this project is what he enjoys the most, Ice said. “I do best when I have a small group so that we can all support each other and coordinate things. I didn't do this by myself.”

McCray

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administrator and chief financial officer left NOAA. The secretaries for those individuals also changed jobs, so much of the work fell to McCray. She saw it as an opportunity to improve the service provided by the support staff and began to build a team.

In her role as senior secretary, McCray encourages team behavior and provides guidance to the other NOAA Research support staff. She also ensures that there is common knowledge among her team so they can step in and help their colleagues.

“We now all have the same knowledge, even though we bring different skills and talents to our jobs,” she said. “My goal is to share, encourage and motivate the other support staff,” she said.

While working with the support staff, McCray also adroitly handled the incoming temporary leadership. She deftly adjusted to each new individual as they came for their turn as acting assistant administrator or acting deputy assistant administrator. She helped them understand NOAA and Office of Oceanic and Atmospheric Research policies and procedures, while ensuring they had the necessary support from NOAA and Oceanic and Atmospheric Research staffs.

Balancing calendars, tracking action items and arranging meetings for the visiting lab directors were just some of McCray's many tasks. Her graciousness and professionalism helped the newcomers quickly settle into their new roles.

“During my time there, she was of tremendous help. She also has a tremendous ‘NOAA’ attitude,” said Stephen Brandt, director of NOAA's Great Lakes Environmental Research Laboratory in Ann Arbor, Mich., and one of the five visiting directors.

McCray's efforts were also noticed and appreciated by the key staff in the laboratories.

Jeanne Waters, secretary to Aeronomy Laboratory director Dan Albritton, said, “Tracey kept in touch with me so that we could coordinate Dan's increasingly complex schedule. It was very reassuring to me to know that Tracey was on the job and that Dan was well-supported at headquarters. She always went the extra mile to be sure that the visiting leadership had the information and material they needed. When she had questions she went ahead and called; but it is a mark of her excellence that she didn't have too many questions.”

Always looking to learn, McCray saw the transition as an opportunity.

“I learned a lot from working with the visiting directors,” she said. “That experience also allowed me the opportunity to grow,” said McCray, who came to the Office of Oceanic and Atmospheric Research in August 2000 from the International Trade Commission.

“I do love NOAA,” she said. “I wasn't familiar with NOAA before I started to work here, but I love to tell my friends and family about not only the science but that it's a good agency for which to work.”

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Address comments to:

Editor, NOAA Report
1315 East-West Highway
SSMC3, room 10853
Silver Spring, MD 20910
 301-713-9042

Email: dane.konop@noaa.gov

NOAA Report Online: <http://www.publicaffairs.noaa.gov/nr>
 Jordan St. John, director, OPCIA
 Dane Konop, editor

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