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N-Wave News

NOAA N-Wave

The N-Wave Enterprise Network Services Branch, under the NOAA Office of the Chief Information Officer, Service Delivery Division, supports both operations and research, enabling NOAA's mission of science, service and stewardship through highly available, secure, high-speed network transport and services.

Mission

N-Wave is committed to providing innovative networking capabilities with integrity, transparency, and flexibility, to enable NOAA's missions through the implementation of:

- Quality, advanced high-speed connectivity both internally and externally to NOAA
- Portfolio of secure, flexible, available, high-bandwidth network services
- Retention and recruitment of exceptional operations and engineering staff.

Our Vision

To provide reliable, secure, and sustainable enterprise network services for NOAA, which enables NOAA's mission of science, service, and stewardship.

in this edition:

From the N-Wave Program Manager

Robert Sears

When we become wrapped up in all the day-to-day activities, sometimes clouds can set in and hinder the view of *why* we do what we do. The past six months of fiscal year 2018 have been challenging. The balance of customer needs with finite resources, expansion of the N-Wave service portfolio, continued team integration, optimization of legacy networks and futures planning all feel like they apex in the troposphere.

What recently cleared the cloud cover for me was visiting our existing customer sites, prospective sites and vast new regions where opportunities to enable NOAA's mission exist. This is the "why" of what we do in N-Wave: we connect with colleagues across NOAA to ensure we offer the best possible services in support of their science, service and stewardship missions. One extremely impressionable visit was the NOAA Networking Committee offsite meeting in Anchorage, Alaska, details of which can be read on page 5 of this issue.

This year N-Wave has seen an unprecedented influx of projects spanning multiple NOAA line offices and some sister bureaus in the Department of Commerce. Other projects have been internal to the program and will set the foundation for future enterprise services. The completion of the TICAP inline migration, cloud connectivity endeavors, enterprise wireless, enterprise remote access VPN, newly provisioned sites, FISMA system restructuring and support of campus networks are among this year's successes.

In light of all these major activities – in conjunction with normal operations and management – I must commend the N-Wave team on their steadfast professionalism and dedication to our mission, which is posted on every N-Wave newsletter cover. I cannot speak enough about the pride I have in our N-Wave engineering, business, security and operations teams which span coast to coast and comprise NOAA federal and contractor staff along with our partners at the

GlobalNOC at Indiana University. The integration of these teams has been a great success and reflects well in the services N-Wave delivers.

On this same topic, N-Wave is technically built on partnerships within the scientific, research and education (SR&E) community. Our relationships with Internet2, Indiana University, Corporation for Education Network Initiatives in California (CENIC), Florida LambdaRail (FLR), Front Range GigaPop (FRGP), Lonestar Education and Research Network (LEARN), MCNC and North Carolina Research and Education Network (NCREN), Merit, Mid-Atlantic Crossroads (MAX), Mid-Atlantic GigaPOP (MAGPI), Mississippi State University, OneNet (Oklahoma's R&E network), Pacific Northwest Gigapop (PNWGP), StarLight, Three Rivers Optical Exchange (3ROX), University of Hawaii, University of Miami and Utah Education Network (UEN) are essential for delivering the innovative underpinnings of N-Wave. Ann Keane is the federal technical professional of N-Wave's contractual relationships. She translates into contractual language the technical requirements of delivering N-Wave network services across our portfolio of SR&E contracts. Partnered with Eboni Luck and Ronette Pratt, a stellar duo of contracting specialists within the High Performance Computing and Communications Branch of the Acquisition and Grants Office, they solidify this outstanding team that works daily with our provider partners.

With the contractual tasking mentioned above, N-Wave provides end-to-end service that includes procuring, configuring and deploying all hardware and continuous tracking of all IT assets, including annual maintenance management. This takes great attention to detail and mastery of NOAA's asset management systems. N-Wave team member Sybil Ennis has been the main cog in this wheel since N-Wave's inception more than eight years ago. These business operations, although not directly visible to our customers, are critical in the service delivery process.

Wrapping up, I would like to publicly welcome two new N-Wave team members: Amber Rasche and Adam Nemethy.

Amber is N-Wave's first technical writer, and she is jumping into N-Wave with a focus on documenting the restructuring of N-Wave's FISMA systems. She has a master's in mass communication (which gained her a seat on our newsletter editing team) and has experience with the volunteer group that designs and builds SCinet, the SC Conference's dedicated high-capacity network.

Adam is an N-Wave network engineer based out of Jacksonville, North Carolina. He currently is playing a lead role in the enterprise wireless project, supports the Boulder NOC wireless network and supports the networks of the National Centers for Coastal Ocean Science. He has a bachelor's in information technology and served in the Marine Corps for over 12 years, stationed in Japan, Maryland and North Carolina and deployed to Iraq and Afghanistan.

We graciously welcome these new team members who have already begun to make their marks in the program!

Network Monitoring at Sea

Okeanos Explorer adds perfSONAR

To better monitor network performance on the NOAA Ship ***Okeanos Explorer***, N-Wave recently added perfSONAR technology to the vessel's on board network and teleport site that links its satellite communications with N-Wave's core network.

perfSONAR is a network performance measurement tool capable of testing data throughput, latency and loss. It was developed through an international collaboration lead by Internet2, ESnet, Indiana University and GÉANT.

N-Wave engineers placed three new perfSONAR servers – one on the ***Okeanos Explorer*** visitors' local area network, one at the ship's satellite transceiver, and one at the onshore satellite teleport – to extend testing capabilities to and from existing perfSONAR equipment at N-Wave's node in Silver Spring, Maryland.

They then set up the throughput, latency and loss tests among the sites and created a web-based dashboard to display the results. The throughput test produces bursts of traffic at scheduled intervals to verify the bandwidth between two perfSONAR servers. The latency and loss tests send out one packet per second with time information so the time it takes for the packet to travel between the two perfSONAR servers can be measured. If an expected packet does not arrive, it is marked as lost.

Photo Credit: National Oceanic and Atmospheric Administration

perfSONAR servers typically are attached to high-speed interfaces at core network nodes capable of transporting 10 Gbps or more; however, in this case, N-Wave aimed to gather performance metrics on a satellite link with a maximum bandwidth of 15 Mbps.

For the connection between the onshore teleport and the node at Silver Spring, they set up all three tests. However, because throughput testing on a limited-bandwidth satellite link was unnecessary, they set up only latency and loss tests between the teleport and ship.

In light of the lower bandwidth and a vision to deploy perfSONAR on other NOAA ships in the future, the engineering team chose a lower cost, lower speed perfSONAR platform. The ZOTAC ZBOX CI325 nano costs less than $300 and offers 8 MB memory, 32 GB disk storage and both Ethernet and WiFi network connectivity. In initial testing in N-Wave's lab, the team was able to generate throughput traffic up to 950 Mbps, indicating the CI325 would be sufficient for any basic perfSONAR application, not just the ship's.

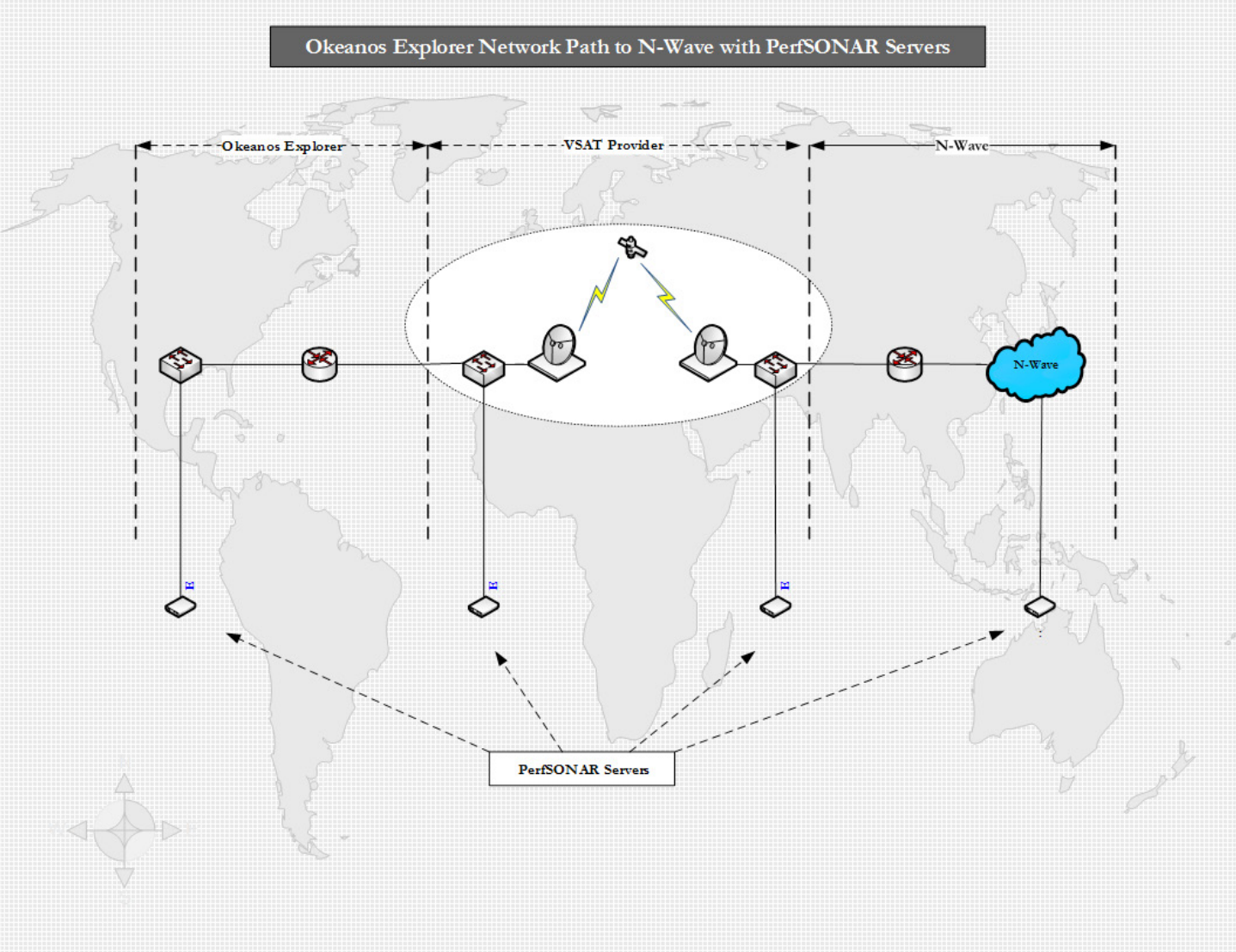
After deploying and tuning the equipment, engineers observed the following in their initial perfSONAR monitoring of the ***Okeanos Explorer***:

- For a packet to travel from the shore to the ship took nearly twice as long as from the ship to the shore,

indicating that traffic in the former direction went through two satellites whereas in the latter direction it went through only one.

- The ship's satellite uses a polarized beam system, so as the ship moves it transfers from one beam to another. Engineers measured an increase in packet loss as the ship neared the edge of a beam. Following that discovery, the satellite provider adjusted the sensitivity on the ship's receiver to reduce loss at the beam's edge.
- Due to high jitter in the Network Time Protocol (NTP) traffic over the satellite link, using shore-based NTP servers was not precise enough to get proper latency measurements. Engineers resolved this by using the NTP server on the ship's GPS instead of the onshore servers.

Based on initial experiences with perfSONAR on the ***Okeanos Explorer***, N-Wave engineers are now looking at deploying perfSONAR on all NOAA Office of Marine & Aviation Operations ships. The ZOTAC CI325 has proven to work well in this case, and it may have other applications for perfSONAR monitoring in the 1 Gbps or less range.

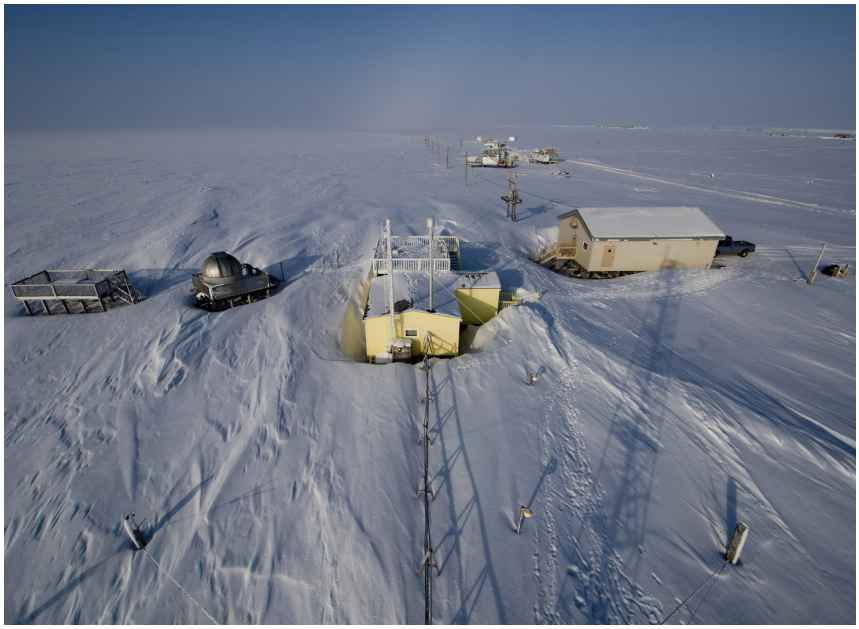


NOAA Networking Committee Gathers in Alaska to review challenges, opportunities

The NOAA Networking Committee (NNC) held its semiannual off-site meeting in Anchorage, Alaska, on February 28 – March 2 to discuss telecommunication challenges in the Alaska region. Discussions centered on the unique missions line offices perform in Alaska and the telecommunications infrastructure needed to support those activities.

Several NOAA line offices participated, including the National Marine Fisheries Service (NMFS), National Weather Service (NWS), National Environmental Satellite, Data, and Information Service (NESDIS), Oceanic and Atmospheric Research/Earth System Research Laboratory (OAR/ESRL), Office of Marine and Aviation Operations (OAMO), National Ocean Service (NOS), and the Office of the CIO (OCIO), along with other stakeholders from the region. NNC chair Robert Sears opened the conference with an overview of NOAA network activity in the Alaska region. He introduced the broad outline of N-Wave's history and development, and led a brief discussion on possible areas where N-Wave could assist in Alaska.

Several of the line office presentations focused on remote activities in Alaska. ESRL's Global Monitoring Division conducts research in Utqiagvik (previously known as Barrow) because of unique features of the geography and atmospheric conditions. The prevailing winds, combined with the stable siteing allow repeatable, high-quality sampling of arctic atmosphere not feasible elsewhere in the world. ESRL coordinates operations in Utqiagvik with NWS, NESDIS and the Department of Energy Office of Science's Atmospheric Radiation Measurement Climate Research Facility. Even basic communications are challenged by the environment: local wireless receivers and transmitters are frequently snow and rime encrusted, requiring manual maintenance. Bryan Thomas, station chief at the Barrow Observatory, shared images of this equipment before and after the maintenance.



The Barrow Observatory is located at the northernmost point of the United States. It is staffed year-round by two engineers/scientists who perform routine maintenance of equipment and instruments in sometimes extreme weather conditions.

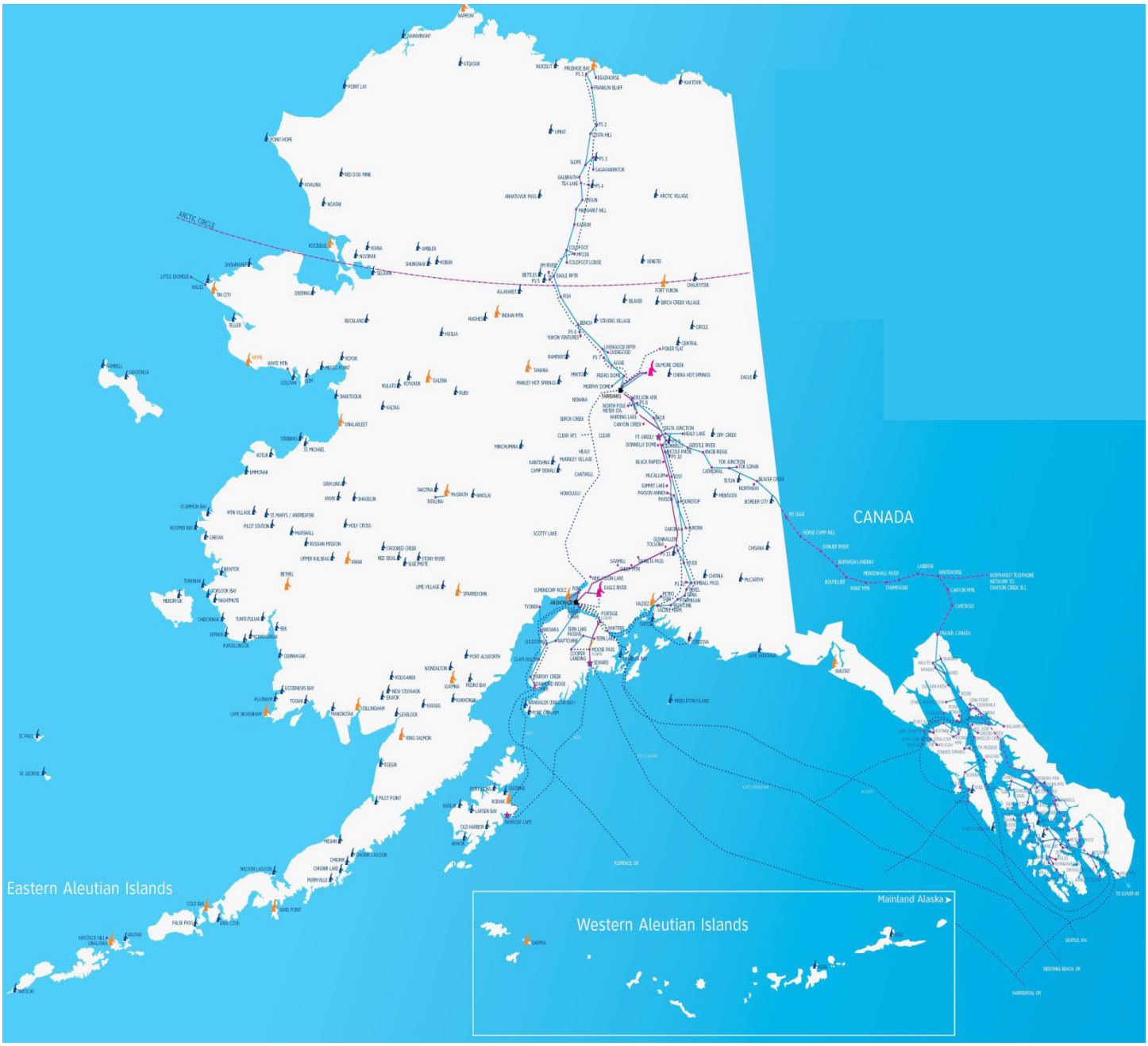
OAMO Captain David Zezula shared similar challenges with his office's research vessels and the volume of science and mission data they collect. Docks and piers in Alaska are subject to harsh conditions and are frequently in need of maintenance and repair. Several ports such as Dutch Harbor and Kodiak have limited bandwidth, and all Alaska ports have challenges delivering available bandwidth to docked vessels.

Walt Schleicher and Tom Heinrichs provided an overview of NESDIS operations in the region, including the tremendous benefits of collecting data from polar-orbiting satellites allowed by Alaska's high latitudes. Much of the office's operations in Alaska are focused on Fairbanks, but new data capacity to Alaska's North Slope, including Utqiagvik, is spurring plans for a downlink station to take advantage of the even higher latitudes. NESDIS also shared some of the challenges they experience with time-division multiplexing circuit synchronous

protocols routing to international locations and coordinating transit for those circuits through security points in Seattle, Denver and the Washington, D.C., area.

Steven Deputy and Mike Wallette presented an overview of the extensive NWS operations in Alaska, including over 15 offices in even the remotest reaches of Alaska. Many of the remote offices are on very thin feeds – sub-T1 connections. However, major NWS forecasting offices use multiple media (including fiber-based MPLS and broadcast satellite) to manage the high volumes of data required by their mission. In contrast, NMFS has lower data volume, but greater challenges with data routing, as much of its traffic is with local Alaskan users; however, Trusted Internet Connection (TIC) mandates establish the ingress and egress routing at the Seattle TIC access point. NMFS supports both a science mission, as well as providing data services to in-region fishermen and other stakeholders.

Network transport for many line offices in Alaska share similar underpinnings. As an example, the map shows AT&T's network infrastructure in Alaska.



Satellite communications play specialized roles. As an example, NWS uses satellite broadcast for some bulk download applications – remote offices are sometimes patched back to hubs in Juneau, Fairbanks and Anchorage.

On the second day of the NNC meeting, several telecommunications vendors briefed their capabilities in the region. Local carriers Alaska Communications System (ACS) and Glacier Communications Inc. (GCI) presented on the connectivity they deliver to the lower 48 and to remote and inaccessible regions of Alaska. GCI shared about recent expansions in undersea fiber capability and highlighted their presence in the contiguous United States. Many NOAA line offices in Alaska use ACS and GCI, particularly (but not exclusively) for intra-region connectivity. AT&T presented their Alaska region connectivity, and they also took the opportunity to discuss their national network and their positioning in the FirstNet project.
The Arctic Slope Regional Corporation (ASRC) – one of thirteen Alaska Native Regional Corporations – discussed their work in support of the federal government and the University of Alaska. ASRC is involved with Quintillion, a major new arctic undersea fiber that extends over the North Slope of Alaska, including Utqiagvik and Nome, and inland to Fairbanks.

In addition to the commercial network provider presentations, the University of Alaska provided an update regarding its presence across Alaska. The university operates an extensive network, including significant MPLS capacity in a ring between Anchorage, Fairbanks and Juneau. It also reaches very remote regions of Alaska by diverse and creative means. Representatives from the Marine Exchange of Alaska also presented at the meeting. The exchange is a non-profit organization promoting safe maritime operations, including buoy services, vessel position tracking and other services. They are heavily dependent on data services for high volume sensor data, real time tracking services and data distribution to customers.

Quintillion is a 1,400-mile subsea and terrestrial fiber optic network that extends over Alaska's North Slope and inland to Fairbanks.
Photo Credit: Quintillion

As a result of the conference, both the NOAA OCIO/NCC leadership and the line offices attained a greater understanding of the missions, challenges and network infrastructures of other NOAA field offices in the Alaska region. One of the takeaway actions is to organize regular regional coordination calls, with an early goal to identify proposals for N-Wave projects in the region.

The meeting also provided an opportunity for the regional line offices to share some genuine Alaska culture, as it overlapped with what's known as "Fur Rondy" week in Anchorage. Fur Rondy is a 10-day winter festival that historically coincided with the time when fur trappers rendezvoused with fur traders in the city to strike deals. One Fur Rondy activity that a number of conference attendees observed was the ice sculpture contest. A pop-up amusement park with a very large ferris wheel was nearby, along with some Iditarod sled teams exercising on local tracks before the March 3 start of the race.

N-Wave Provides Advanced Networking for New GOES-R Through U Series Satellites

In 2013, N-Wave conducted a network assessment for the National Environmental Satellite, Data, and Information Service (NESDIS) that eventually led to the implementation of an advanced, high-speed and high-availability wide area network (WAN) infrastructure for NOAA's new GOES ground system.

The Geostationary Operational Environmental Satellites (GOES) system provides continuous weather imagery and monitoring of meteorological and space environment data in support of NOAA's mission to protect lives and property. N-Wave completed the WAN implementation for GOES in advance of the GOES-R launch in November 2016. It is designed to deliver connectivity for GOES-R through GOES-U, the fourth and final satellite in the GOES series expected to launch in 2024.

In its initial form, the WAN was a multi-1 Gbps network with multiple virtually segmented networks (achieved through virtual routing and forwarding, or VRF). It connects three major GOES-R ground segment sites:

- NOAA Satellite Operations Facility (NSOF) at Suitland, Maryland
- Wallops Command and Data Acquisition System (WCDAS) at Wallops Island, Virginia
- Consolidated Backup Unit (CBU) at Fairmont, West Virginia

N-Wave also provides essential GOES-R mission connectivity to the National Weather Service's Advanced Weather Interactive Processing System (AWIPS) in Silver Spring, Maryland, and Fairmont, West Virginia, and to the operational support locations at the Harris Corporate Headquarters in Melbourne, Florida, and the NOAA Center for Weather and Climate Prediction (NCWCP) in College Park, Maryland.

N-Wave engineers recently upgraded the edge interfaces at each of the ground segment sites from 1 to 10 Gbps. The upgrade provides the high bandwidth required to transport GOES-R Level 0 raw satellite data for retrieval by NOAA, NASA and other external partners who are interested in the data.

The primary instrument on the new GOES-R series satellites collects three times more data, provides four times higher resolution images and facilitates more than five times faster coverage than current satellites. As a result, N-Wave's high bandwidth connectivity on the ground is essential.

Because GOES-R data is much sought after for weather prediction and modeling, disseminating that data to the public requires significant bandwidth. As part of the GOES-R Phase 2 N-Wave deployment, engineers implemented a 100 Gbps Dense Wavelength Division Multiplexing (DWDM) optical ring to support multiple 10 Gbps waves in the Washington, D.C., area. The 100 Gbps metro ring not only supports inter-NOAA communications, but also provides connectivity for the NOAA TICAP in the Eastern region in preparation for the ever-growing bandwidth required to deliver new generation weather satellite data to the public.

The most recent GOES series satellite, GOES-S (which became GOES-17 when it reached its final orbit), launched March 1, 2018. Read more about the launch and about how the satellite will be a game-changer for weather forecasting:

- NOAA's GOES-S satellite roars into orbit – http://www.noaa.gov/media-release/noaa-s-goes-s-satellite-roars-into-orbit

- Five Reasons GOES-S will be a Game-Changer for Weather Forecasts in the Western U.S. – https://www.nesdis.noaa.gov/content/five-reasons-goes-s-will-be-game-changer-weather-forecasts-western-us

GOES-R lifted off at 6:42 p.m. EST on November 19, 2016 from Cape Canaveral Air Force Station's Space Launch Complex 41, aboard a United Launch Alliance Atlas V 541 rocket. Credit: United Launch Alliance.

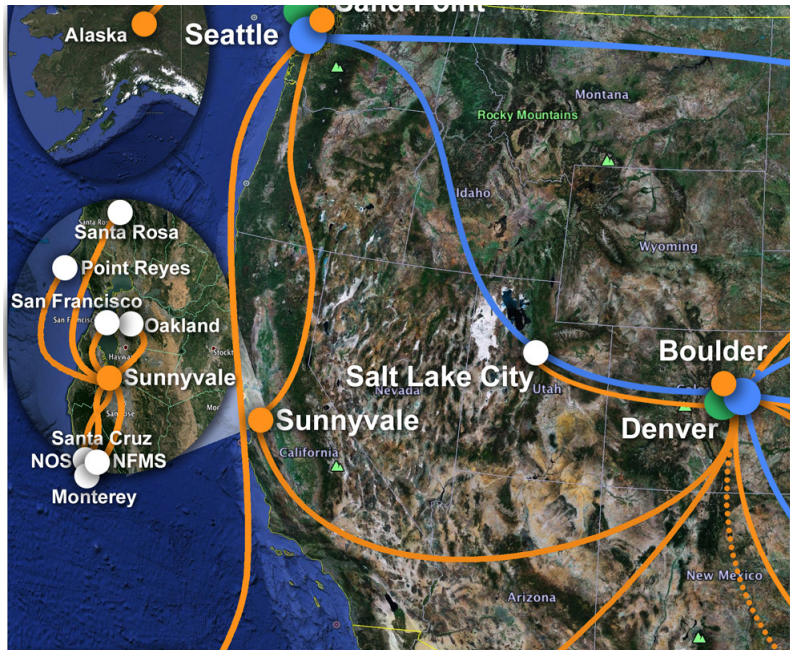
GOES-R on its way to orbit. Credit: United Launch Alliance.

California Aggregation Site is a Model Worth Repeating

Two years following its deployment, N-Wave's customer aggregation site at Sunnyvale, California, is setting the stage for future expansion of the network. Sunnyvale is the first model of an N-Wave aggregation site that delivers cost-efficient wide area network (WAN) services to multiple small- and medium-bandwidth customers within defined geographical areas. In California, that encompasses most of the state with customer sites currently in Monterey, Oakland, Point Reyes, San Francisco, Santa Cruz and Santa Rosa, and with Santa Barbara and San Diego to be added soon. Following success in California, N-Wave plans to replicate this model to bring new connectivity elsewhere.

The challenge of deploying the aggregation model is that it requires a greater investment of time and resources up front. The model relies on first discovering all prospective customers in a geographical area who could potentially benefit from N-Wave services. Once prospective customers are known, research is required to identify networking partners in the area and develop the cost model for delivering those services.

While that process can be complicated and time-consuming, the benefits are plenty once the aggregation site is in place. Determining how to deliver services to meet customer needs at multiple sites within a defined geographical area can provide a better return on investment for NOAA than attempting to answer that question on a one-by-one basis.



N-Wave's aggregation site in Sunnyvale, California, currently provides connectivity to participant sites at Monterey, Oakland, Point Reyes, San Francisco, Santa Cruz and Santa Rosa.

As a result, N-Wave customers can obtain cost effective services that may otherwise be cost prohibitive. The model reduces hardware costs by using less expensive and sometimes already installed hardware at customer sites to connect to a single aggregation site, which in turn provides diverse high-bandwidth links back to the N-Wave core nodes. The more customer sites that connect to the shared aggregation devices, the lower the costs for each customer. Because the aggregation site is closer in geographical fiber distance than the nearest N-Wave core nodes, the WAN connectivity cost also is significantly cheaper.

Growth at Sunnyvale

The benefits of the aggregation site model make it a competitive option for meeting N-Wave customers' needs, as evidenced by new and higher-bandwidth connections to the Sunnyvale site. The National Ocean Service (NOS) and Office of National Marine Sanctuaries (ONMS) at Monterey are the most recent participants to route through the aggregation site—with a connection of 1 Gbps. That is a significant increase over the 100 Mbps links established for the six participant sites routed through Sunnyvale when it first launched.

Sunnyvale's aggregation site also is providing new connectivity opportunities within the University of California (UC) system. A project is underway to provide connectivity to the NOAA office on the UC Santa Barbara campus. This path relies on the use of CENIC's High Performance Research network to provide a Layer 2 path from the NOAA site in Santa Barbara back to the N-Wave aggregation site in Sunnyvale. The CENIC HPR network is a 100 Gbps network with connectivity to most UC campuses. This opens new doors for other NOAA sites that are near or collocated with UC campuses to connect to N-Wave via the HPR network.

Next on the horizon for site aggregation

In light of successes in California, a new project is underway to implement a similar aggregation site in Norfolk, Virginia, with Internet2 and a new N-Wave partner: Old Dominion University (ODU). NOAA sites in Norfolk, Newport News, Woodford and Chesapeake will be the first to transition to the service. For this Tidewater aggregation project (named for the geographic area in which these sites are located) N-Wave will leverage ODU, Mid-Atlantic Research Infrastructure Alliance (MARIA), E-Lite metropolitan network and Internet2 to provide customer connections ranging from 50 Mbps to 1 Gbps. Similar to California, the aggregation site in Norfolk will have diverse 10 Gbps connectivity to N-Wave core nodes, in this case in McLean, Virginia, and Atlanta, Georgia.

N-Wave also is exploring use of the aggregation site model to improve connectivity in Alaska. The Office of Atmospheric Research (OAR), National Marine Fisheries Service (NMFS), National Weather Service (NWS) and National Environmental Satellite, Data, and Information Service (NESDIS) are among those NOAA offices in the state that currently facilitate their own connectivity back to the contiguous United States. The aggregation site model could prove an effective alternative for delivering more cost efficient and reliable services to NOAA sites in the state.

Scenes captured by Dune Rothman of NMFS at the Fur Rendezvous Alaska State Snow Sculpting Championships at Anchorage's Ship Creek.

TICAP Collaboration Leads to DOC Bronze Medal for NOAA OCIO's Cyber Security Division and N-Wave Staff

A team of four that included staff from the NOAA OCIO's Cyber Security Division and N-Wave were recognized for improving NOAA's Trusted Internet Connection Access Points (TICAP) security posture.

Chi Kang, Cyber Security Division acting deputy director for operations, Robert Sears, N-Wave program manager, John V. Parker, N-Wave information system security officer, and Rose Bernaldo, Department of Commerce IT manager, received Department of Commerce Bronze Medal Awards for their efforts to implement multi-agency TICAP security controls.

The TICAP project launched as part of the 2013-2018 OCIO Strategic Plan for Network and Transport Services. It involved collaboration among multiple partners including engineers from the Global Research Network Operations Center (GlobalNOC) at Indiana University, N-Wave, Boulder Network Operations Center and NOAA Cyber Security Division, along with infrastructure and service provider partners Internet2, Mid Atlantic Crossroads (MAX), Lonestar Education and Research Network (LEARN), Front Range GigaPop (FRGP) and Pacific Northwest GigaPop (PNWGP). N-Wave and Cyber Security Division engineers completed the final step of this multi-year project in early April through the inlining of network traffic at the Denver TICAP.

Rod Turk, acting CIO for the Department of Commerce (DOC), Rose Bernaldo, DOC IT manager, John V. Parker, N-Wave information system security officer, and Zachary Goldstein, CIO for NOAA, at the 2018 DOC OCIO Bronze Awards ceremony. Photo Credit: Mike Maraya

The project earned NOAA an above 96% security rating in the Department of Homeland Security evaluation that is required to become a certified TICAP installation. Following completion of the project, NOAA will be able to extend the N-Wave TICAP service offering to other bureaus in the DOC, including the department's headquarters at the Herbert C. Hoover Building in Washington, D.C.

The Bronze Medal recognizes outstanding or significant contributions that have increased the efficiency and effectiveness of the operating unit or office in the Department of Commerce.

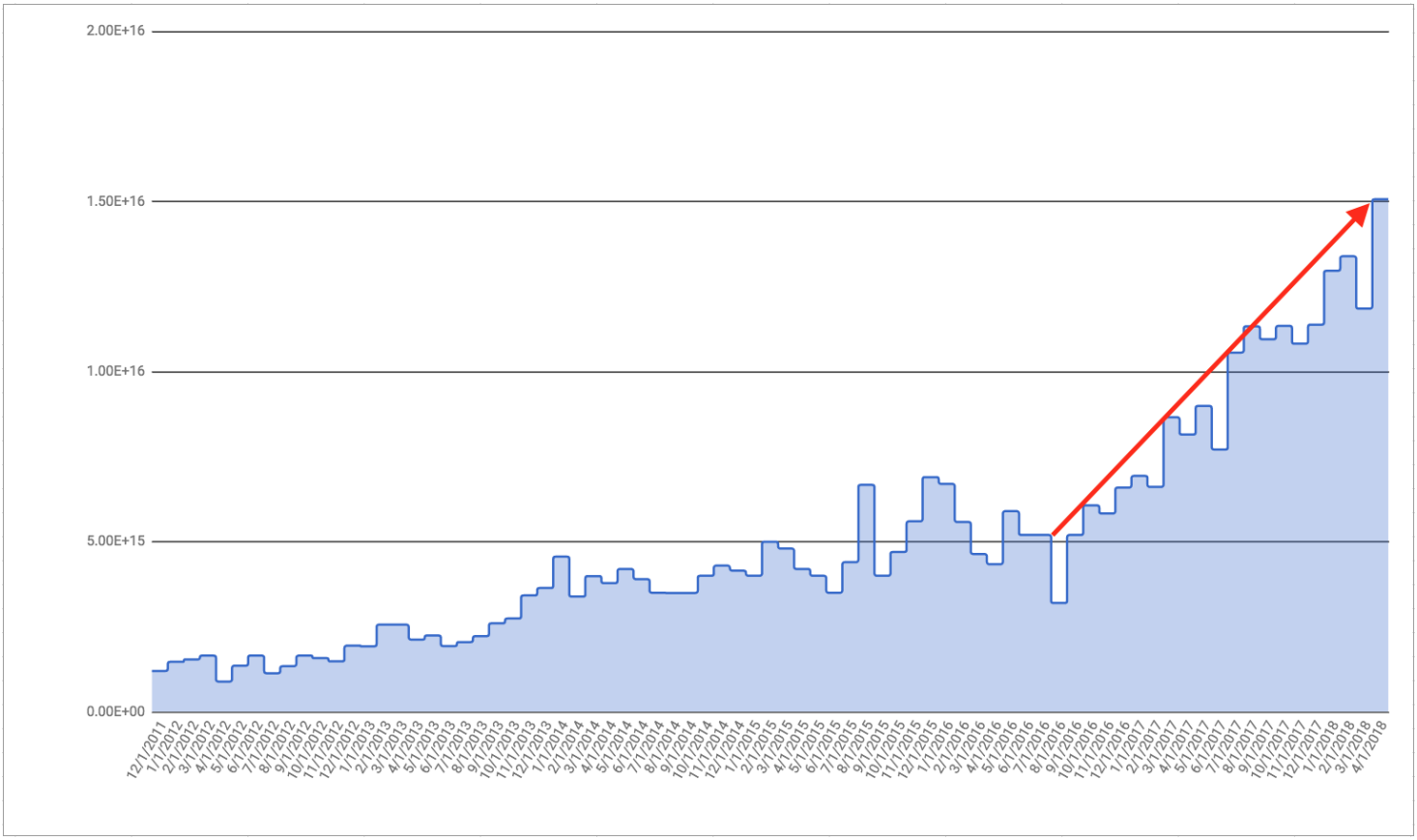
The recognition ceremony took place January 30 in the Herbert C. Hoover Building auditorium.

N-Wave Network Performance Metrics

Following several years of incremental growth, N-Wave traffic during the past year was marked by a noticeably steep rise. From 2014 through 2016, the average yearly traffic rates across N-Wave increased by approximately 25% per year. Since spring 2017, total traffic carried by N-Wave has increased by 85%. The chart below illustrates the sharp increase in traffic rates that has occurred since N-Wave transitioned network transport for all of NOAA's internet traffic to the OMB mandated Trusted Internet Connection Access Points (TICAP) in Honolulu, Seattle, Denver, Dallas and McLean. With the inlining of network traffic at the final TICAP location in Denver in April 2018, all traffic between NOAA and the internet now transits N-Wave. As public dissemination of weather and satellite data is a major aspect of NOAA's mission, consolidating this traffic to the TICAPs has given N-Wave an accurate picture of NOAA's total network utilization.

With the launch of new satellites and development of more accurate weather models, the demand for additional bandwidth across N-Wave and out to the internet will continue to increase. N-Wave's current challenge is the limitation of the original 10 Gbps backbone, which through the years has been augmented in a few select locations to meet demand. The recent increases in NOAA traffic over the network evidence the need for NOAA line offices and programs to continue partnering with the NOAA Networking Committee and N-Wave in capacity planning sessions to forecast network and funding resources needed to support NOAA's mission now and in the future.

Network Traffic (December 2011 – March 2018)

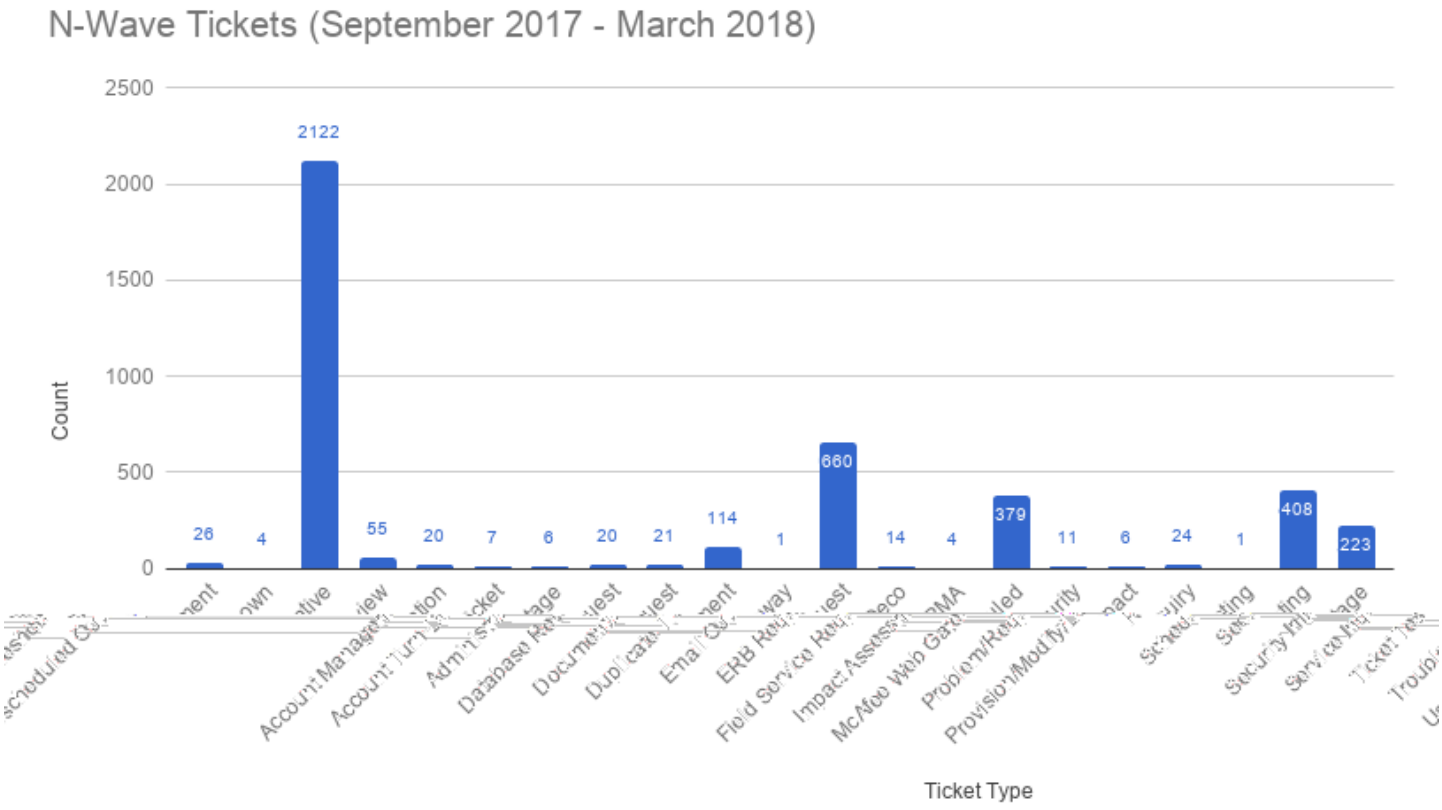


N-Wave traffic per month from December 2011 through March 2018 shown in petabytes.

N-Wave Network Operations Center Metrics and Updates

N-Wave NOC Tickets - September 2017 to March 2018

The N-Wave Network Operations Center (NOC) provides support 24 hours per day, 365 days per year. Support metrics gathered from September 2017 through March 2018 included more than 4,100 tickets, over half of which were categorized into the Administrative category. About 70% of the Administrative tickets fell into three subcategories: VPN, Impact Assessment and Configuration/Change Management. The VPN subcategory is reserved for any request to add or remove a user from a VPN group. The NOC generates an Impact Assessment ticket to prompt further investigation when notified of upcoming maintenance that could impact the N-Wave network. Lastly, the Configuration/Change Management subcategory is used for requests to change the configuration of a network device. The N-Wave Tickets chart provides additional detail regarding the number of each ticket type.



NOAA's Western Regional Center Transitions to N-Wave NOC Support

NOAA's Western Regional Center (WRC) currently is transitioning tier 1 services to the N-Wave NOC. When the transition is complete, the N-Wave NOC will monitor campus services and will serve as the first point of contact for any network-related concerns at the WRC. In the event of a service outage or service degradation, customers should notify the N-Wave NOC via phone (812-856-7477) or email (nwave-noc@noaa.gov).

Network Changes and New Participants

Stennis Space Center, Mississippi

N-Wave has deployed a point of presence (PoP) at the Stennis Space Center in Mississippi, which is slated to become an aggregation site. The site connects to the N-Wave core in Washington, D.C., and Denver, Colorado, via 10 Gbps layer 2 circuits across the Mississippi State University network, University of Southern Mississippi network, Mississippi Optical Network (MissION) and Internet2's Advanced Layer 2 Services. The National Centers for Environmental Information – Mississippi and National Environmental Satellite, Data, and Information Service administrative local area network were migrated from the legacy site-to-site virtual private network onto the new N-Wave PoP router at Stennis.

Legacy GOES Ground System Migration to N-Wave

N-Wave and Office of Satellite and Product Operations (OSPO) engineers migrated the GOES ground system from OSPO-managed T1 circuits to N-Wave 1 Gbps private virtual routing and forwarding, or VRF, connectivity between three major sites: Suitland, Maryland, Wallops Island, Virginia, and Fairbanks, Alaska. This change allows the National Environmental Satellite, Data, and Information Service to free up and decommission legacy (and expensive) commercial T1 circuits. GOES now can take advantage of increased bandwidth (1.5 Mbps to 1 Gbps), increased stability and reduced latency (approximately one third of the latency experienced over the legacy T1s).

Wallops Island 10 Gbps Southern Path to Atlanta

N-Wave installed a redundant 10 Gbps circuit out of Wallops Island, Virginia, via a southern path to the N-Wave core at Atlanta, Georgia. The 10 Gbps northern path extends from Wallops Island to the N-Wave core in Washington, D.C. The southern path now provides this critical satellite downlink site with a diverse path out of Wallops Island in case of a network failure in the Washington, D.C., area.

Trusted Internet Connection (TIC) Update

NOAA completed the migration of all internet traffic to the new Trusted Internet Connection Access Points (TICAP) infrastructure. The security infrastructure at the five locations in Honolulu, Seattle, Dallas, Denver and the Washington, D.C., metro area are now inspecting traffic to and from the internet, ensuring NOAA's compliance with the Office of Management and Budget TIC 2.0 mandate.

Information Technology Center (ITC) at Largo, Maryland

N-Wave installed two aggregation routers at the NOAA ITC data center in Largo, Maryland, along with a new dark fiber path. Once the provisioning and migration work is complete, this PoP will provide diverse 10 Gbps connectivity and support expanded access to the Fairmont, West Virginia, data center for the Commerce Business Systems and internet connectivity for the NOAA Web Operations Center.

National Ocean Service (NOS) – Charleston Backbone Upgrade

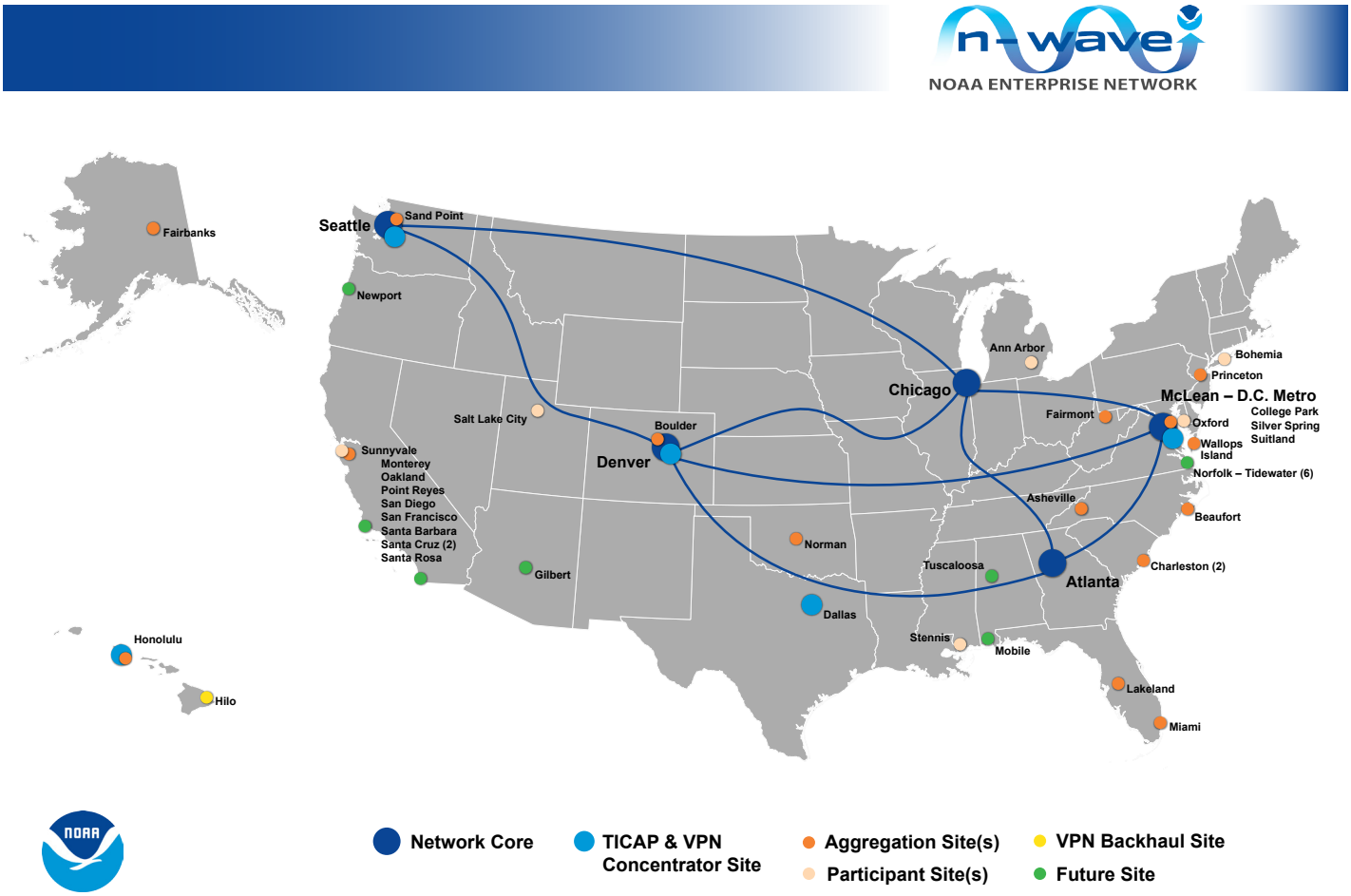
Through partnerships with Internet2 and Spirit Telecom, N-Wave upgraded the backbone circuits for two NOS sites in Charleston, South Carolina: the Office for Coastal Management and the National Centers for Coastal Ocean Science office on the Fort Johnson campus. This upgrade provides both sites with redundant connectivity via the N-Wave core in Atlanta, Georgia, and the aggregation site in Asheville, North Carolina.

Sand Point Campus Core Upgrade

N-Wave upgraded and expanded the NOAA Western Regional Center campus core network in Seattle, Washington. This new infrastructure will allow N-Wave to aggregate all of the campus networks, while providing improved local network services.

Enterprise Wireless

While N-Wave engineers continue to work towards implementing a NOAA enterprise wireless infrastructure, several NOAA locations have been brought online in a temporary configuration. The Western Region Center campus at Sand Point, NOAA Environmental Security Computing Center data center at Fairmont and Aircraft Operations Center in Lakeland, Florida, have wireless access via an extension of the Boulder, Colorado, campus wireless system.



Scenes captured by Steven Deputy of NWS at the Fur Rendezvous Alaska State Snow Sculpting Championships at Anchorage's Ship Creek.

2018 Internet2 Global Summit

Internet2 will host the annual meeting of its members, the Global Summit, May 6–9 in San Diego, California. Nearly 1,000 of Internet2's university members, regional optical networks and other affiliated groups (including NOAA), along with international universities and RONs, will attend the event, which is co-hosted by CENIC (the California RON), UC San Diego and San Diego State University.

The Global Summit includes several workshops on topics of interest to higher education and high performance networks, with program tracks on Trust, Identity, and Security; Advanced Networking; Solutions for Research and Education – Global and National; and an Executive Track. Presentation areas include security, clouds, evolving advanced network designs, international connectivity for R&E networks, and bringing R&E networking to developing areas of the world.

Of great value to all who attend are the opportunities for informal discussions one-on-one or in a group. As with any physical meeting where this can happen, these conversations often lead to new insights, projects and collaborations.

NOAA N-Wave attendees: Dave Mauro, Paul Love, Mark Mutz, Michael Mankarious and Robert Sears
NOAA N-Wave speakers: Robert Sears, Dave Mauro and Mark Mutz: Side meeting of the NCO/NITRD Joint Engineering Team

n-wave
NOAA ENTERPRISE NETWORK

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