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About N-Wave

N-Wave delivers stable, secure, high-speed network services to enable the vast missions of its stakeholder community within the federal government.

Our national network infrastructure extends across the contiguous U.S., Alaska and Hawaii—reaching remote field sites, major campuses, data centers and supercomputing facilities. Combined with our scalable cloud solutions, robust catalog of enterprise managed services and advanced network operations, N-Wave supports all stakeholder missions with integrity, transparency and flexibility, and employs a unique partnership approach to provide the best customer experience.

The N-Wave Program Office operates under the Office of the Chief Information Officer within the National Oceanic and Atmospheric Administration. N-Wave is NOAA's enterprise network and has expanded to serve other federal government agencies.

From the N-Wave Program Manager



Robert Sears

The N-Wave fall newsletter comes at a time when we have closed out the previous fiscal year on a successful note and are well into advancing our efforts for the new fiscal year. It's an exciting time for N-Wave and its customer community, as NOAA's Office of the Chief Information Officer (OCIO) announced the alignment of the N-Wave Program Office at the division level on September 29, 2021. Since moving from the Office of Oceanic and Atmospheric Research (OAR) into the OCIO beginning fiscal year 2016, N-Wave has experienced incredible growth in terms of network capacity offered, service portfolio scope and the size and breadth of its customer base. It will become apparent as you read through this edition, that 2021 was N-Wave's busiest year to date. N-Wave engineers have traversed the nation building out new infrastructure and capabilities spanning multiple cities in Alaska and provisioning new sites and services in the North East, Florida and the Gulf Coast.

With the expansive growth of new customer sites along with more dense deployments of hardware to provide Managed LAN and wireless services covering campuses and facilities across the nation, there is the need to continually assess and update processes and procedures. Growth, albeit good, can often stress certain areas of operations or outpace current utility functions. The N-Wave team, and partner GlobalNOC, have been examining and formulating new capabilities around the notification process. These new capabilities will improve incident awareness time to customers, allow for more granular notifications where there is shared infrastructure and services and provide a self-subscription portal for customers to sign up directly for notifications on their particular service area of interest.

Another area the N-Wave team has been working on is to validate the resiliency and redundancy across critical service locations. As services expand and grow to accommodate customer needs, add new sites or augment capacity, the action of reviewing, validating and testing infrastructure is key. Over the last fiscal year we have experienced outages at a few critical sites and within our Trusted Internet Connection services. N-Wave will always provide its stakeholders transparency and visibility into any issue that impacts the delivery of high availability services. Sharing information within our community allows us to learn from each other and continue to improve. In the cases noted above, detailed after action reports have been provided along with corrective actions taken to mitigate issues ranging from wide area optical path optimization to new technical processes.

Directly related to N-Wave's core value to provide transparency and visibility across all services is our partnerships within the Science, Research and Education community. N-Wave builds its infrastructure in cooperation with [Regional Optical Networks](#) or [GigaPops](#) and Internet2 based on deep technical and operational collaboration, which yields unique insights, stability, flexibility and security within the N-Wave transport portfolio.

N-Wave Staff Receive NOAA's Bronze Medal Award

The highest honor award granted by the NOAA Administrator, the Department of Commerce Bronze Medal, recognizes federal employees for superior performance and is awarded to individuals, groups (or teams) and organizations.

N-Wave's Robert Sears and Ann Keane received this award under the Leadership category as part of a team of individuals within the Office of the Chief Information Officer. The award was given "for successfully leading the tremendous effort to award the high-priority NOAA Cloud Utility Contract."

Congratulations to Ann Keane and the N-Wave Transport and Cloud engineers who were responsible for the development of unique, enabling cloud transport and associated services supporting NOAA-wide cloud initiatives.



Credit: Crew and Officers of NOAA Ship FAIRWEATHER

N-Wave Engineers in the Field

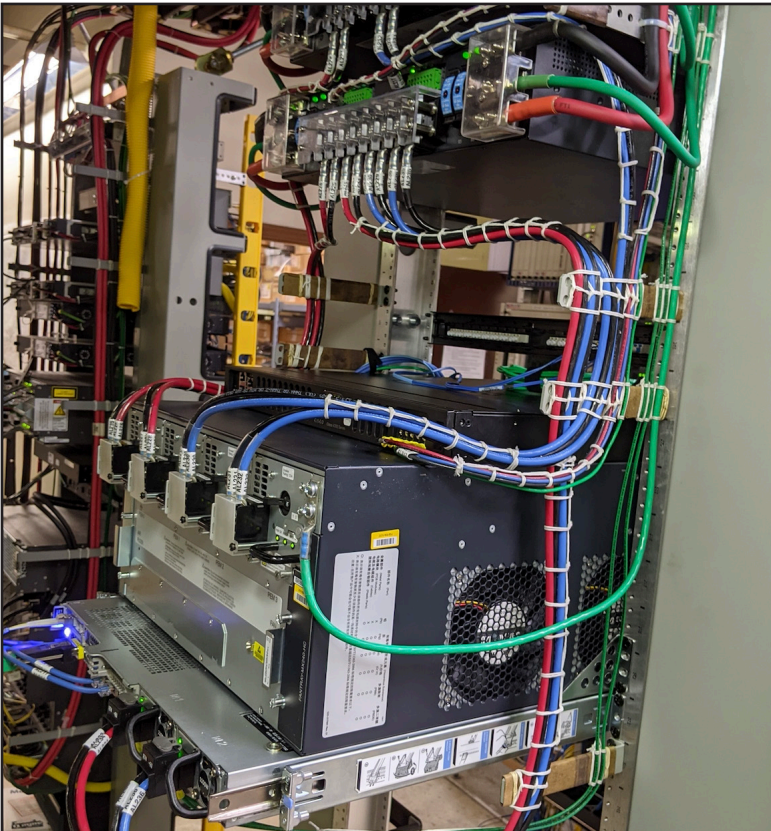
Though travel constraints have been reduced slightly since the spring, N-Wave engineers going onsite to install or upgrade an N-Wave customer continue to adhere to all the needed travel and site access protocols required by COVID-19. Since April, there have been more than 35 N-Wave installs of all types – transport and services - many of which require an N-Wave engineer to travel. These have ranged from locations in Fairbanks, AK, to Lakeland, FL, and many points in between.



We all need some fresh air. N-Wave engineer Josh Brooks takes a breather during an installation in Anchorage, AK. Notice the bald eagle also taking a breather behind him in the water. It is important to take a moment during a site visit to enjoy the natural beauty of places you don't often visit.



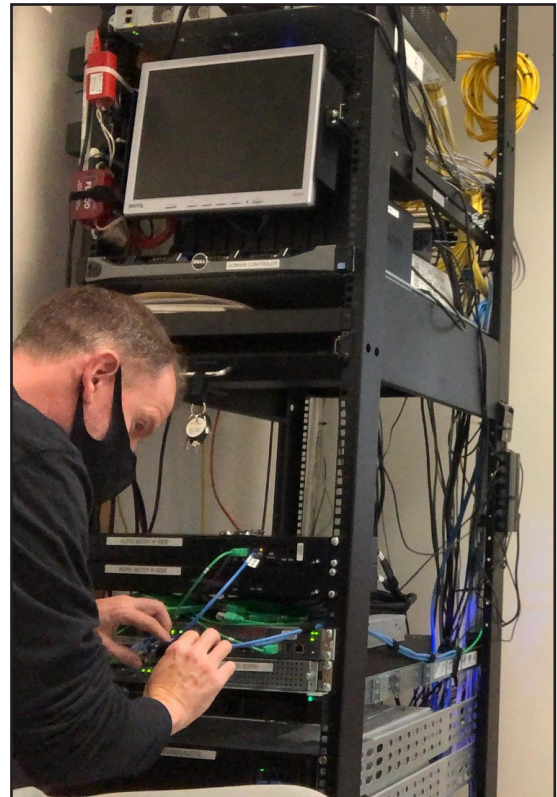
N-Wave engineer Josh Brooks was actively working on installing a new N-Wave aggregation site in Holmdel, NJ. This site supports the National Weather Service (NWS) Advanced Weather Interactive Processing System (AWIPS) mission, serving as the main satellite downlink. During the site visit, Josh connected a PE (Provider Edge) router, an OOB (Out of Band Router) and a pS (perfSONAR) server. He also installed all needed cabling and the cross connects used to connect to the router servicing NOAA's Office of Marine and Aviation Operations (OMAO) ships' satellite downlink.



N-Wave worked with the Arctic Slope Telephone Association Cooperative (ASTAC) as the remote hands and eyes for some of the Alaska installations. N-Wave did three joint installs to ensure ASTAC understood N-Wave standards. Due to the remote nature of Alaska and the current pandemic, N-Wave decided to leverage ASTAC remote services. This install has a pretty impressive cable lacing job!



Daniel Hurley, Jared Brown and Jared Schlemmer (not pictured) work to install new routers and a second core switch in the National Environmental Satellite, Data, and Information Service's (NESDIS) Gilmore Creek, AK, facility in preparation for a new circuit being delivered. This upgrade took a lot of preparation, as all the customer connections needed to move from the existing routers to the newly redundant campus core. Coordination was vital prior to the engineers traveling to the site. During the visit, they also provided local hands and eyes training on N-Wave cabling standards.



N-Wave engineer Jared Brown works to finish the cabling for the Scituate, MA, installation supporting the National Ocean Service's Office of National Marine Sanctuaries (ONMS). Jared installed a PE router, an OOB router, and a pS server. Installations mark the culmination of in-depth and detailed planning and logistics. N-Wave engineers' meticulous planning ensures they are ready to perform a professional installation and work through any unexpected issues while onsite.



Satellite farm in Holmdel, NJ

Introducing N-Wave's New Deputy Director



Adam Nemethy

Silver Springs, MD, and Honolulu, HI. This migration occurred to coordinate, optimize, integrate and consolidate services while supporting the expansion of enterprise network offerings.

The integration of these legacy NOAA network operation centers set the foundation for a new portfolio of N-Wave network services that would rapidly grow across NOAA's major campuses, facilities and field sites. Network services such as wireless, client VPN and Managed LAN bundled well with the already established national, wide area transport and private customer connectivity. It quickly became apparent the N-Wave Services portfolio required federal leadership and Adam Nemethy was well suited to fulfill that role. It also set the stage for N-Wave to have a Deputy Director.

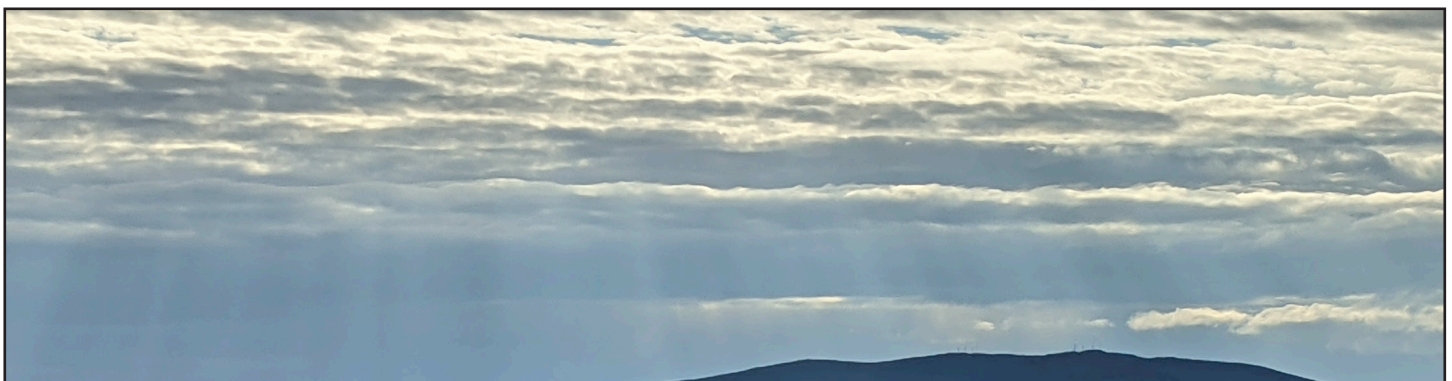
Early on, Adam identified that N-Wave's growing services portfolio incurred new challenges for

More than four years ago, we highlighted the management transfer of NOAA's legacy network operation centers into the N-Wave program. These legacy network operation centers provided NOAA internet services prior to the deployment of the NOAA Trusted Internet Connection Access Points in Seattle, WA, Denver, CO, Dallas, TX,

turning up, monitoring and alerting, which were unique from those of the existing transport service offerings. As new services deployed, communications between N-Wave teams lagged. From wireless installations to new VPN peerings, multiple service areas of N-Wave need to be engaged. For example, there may be a need for a WAN portion, Managed LAN portion or wireless/VPN portion to be working together for a successful and efficient turn up and ongoing operation. These gaps between the transport and services portfolios showcased the need for integrated technical operations oversight.

Common within other NOAA Line Offices, programs and industry, the deputy director or deputy manager role oversees much of the day-to-day technical operations to ensure overall service availability. Adam was in a unique position to fulfill this role due to his cross-portfolio endeavors to optimize both internal operations and customer-facing services. Additionally, working in direct partnership with the GlobalNOC, Adam has developed processes for targeted notifications leveraging the N-Wave GlobalNOC tool sets. This provides greater accuracy and timeliness of notifications across all network service portfolio offerings.

With his exceptional technical expertise and knowledge, we are proud to announce the appointment of Adam Nemethy as N-Wave's first Deputy Director. Congratulations and welcome from the entire N-Wave team!



Fairbanks, AK

Security Update and New Initiatives

For over 20 years, the Center for Internet Security (CIS) has maintained a set of critical security controls which are globally-recognized best practices for securing IT systems and data. Those controls are ranked in order of importance, and the first control in the list is *CIS Control 1: Inventory and Control of Enterprise Assets*. This control maintains the first step in network security is to actively manage (inventory, track and correct) all enterprise IT assets. This ensures only authorized devices are given access, and unauthorized and unmanaged devices are found and prevented from gaining access.

For a large and dynamic environment such as N-Wave, inventory management is no small feat. Devices are constantly coming, going and transitioning between operational states as new customers and sites are added and old customers and sites are decommissioned. Since the last newsletter, the N-Wave security and property teams have worked to get new tools implemented which alert relevant personnel as devices change their operational status. The result is timely notifications of device status changes, which results in tighter control over the inventory and a

more uniform application of security controls. Much like the physical inventory, a network service provider such as N-Wave must also maintain a large inventory of logical network assets (e.g. IP addresses, netblocks, routes and Autonomous System Numbers (ASNs)). In recent months, much effort has been devoted towards adopting a more uniform approach to logical network resource management. This includes registration of logical resources through public-facing entities such as the American Registry for Internet Numbers (ARIN) and Routing Assets Database (RADb) as well as internal tools and processes to streamline and improve IP Address Management (IPAM). All changes to public IP addressing must now come through a standard process and form, thereby ensuring adequate oversight, control and tracking. The result is a more cohesive and central management of NOAA's scarce logical network resources, which translates into increased security and higher availability to serve the NOAA and Department of Commerce (DOC) missions. These changes will also be a great benefit to managing IPv6 addresses as NOAA and DOC implement the Office of Management and Budget (OMB) IPv6-only mandate.



Potter's Marsh and the Cook Inlet surrounding Anchorage, AK

Network Changes and New Participants

(April 1 – September 30, 2021)

N-Wave

Aggregation Site - Anchorage, AK:

N-Wave established an aggregation site in Anchorage to support N-Wave customers in the Alaska region. Currently, the National Marine Fisheries Service (NMFS) is being supported through this location and the National Environmental Satellite, Data, and Information Service (NESDIS) will transition to it before the end of the year.

Aggregation Site - Fairbanks, AK:

N-Wave established an aggregation site in Fairbanks to support N-Wave customers in the Alaska region. Currently, the NMFS is being supported through this location and the NESDIS will transition to it before the end of the year.

National Marine Fisheries Service (NMFS)

Southwest Fisheries Science Center - La Jolla, CA:

The NMFS office in La Jolla and N-Wave worked on this project for many years and it is now complete. This office has migrated to a 1 Gbps connection.

Southwest Fisheries Science Center Fisheries Ecology Division - Santa Cruz, CA:

The NMFS office in Santa Cruz has been using N-Wave at 100 Mbps. The site used N-Wave only for internet traffic and had an additional connection for internal NMFS communication. Recently the N-Wave connection was upgraded to 1 Gbps and the internal NMFS connection was migrated to the N-Wave circuit.

Southwest Fisheries Science Center - Monterey, CA:

The NMFS office in Monterey and N-Wave worked on this project for many years and it is now

complete. This office migrated to a 500 Mbps connection. The campus also has a National Ocean Service (NOS) office using an N-Wave 1 Gbps connection. This bandwidth is now shared with the NMFS office.

Hollings Marine Laboratory (HML) - Fort Johnson, SC:

The first NMFS site to use N-Wave's Managed LAN Service was the HML. NMFS joins the National Centers for Coastal Ocean Science (NCCOS) and the National Institute for Standards and Technology (NIST) in utilizing this service at the HML.

Ted Stevens Marine Research Institute (TSMRI) - Juneau, AK:

TSMRI migrated from their existing connectivity in Alaska to an N-Wave 500 Mbps connection. Due to the lack of circuit diversity in the Juneau area, NMFS's office in the Juneau Federal Building connects to TSMRI at 500 Mbps for its N-Wave connectivity. The direct connection between the two sites facilitates an ongoing data replication task between them.

Juneau Federal Building - Juneau, AK:

NMFS migrated its offices in the Juneau Federal Building from their existing connectivity in Alaska to an N-Wave 500 Mbps connection. Due to the lack of circuit diversity in the Juneau area, this site's 500 Mbps connection is to TSMRI for onward connectivity to N-Wave. The direct connection to TSMRI facilitates an ongoing data replication task between the two locations.

Alaska Fisheries Science Center's Kodiak Field Office - Kodiak, AK:

The field office migrated to an N-Wave 10 Mbps connection.

National Ocean Service (NOS)
Office of National Marine Sanctuaries
(ONMS)

Flower Garden Banks - Galveston, TX:

As part of a larger project to move all ONMS sites to N-Wave, Flower Garden Banks migrated to an N-Wave 100 Mbps connection.

Gray's Reef National Marine Sanctuary - Savannah, GA:

The site migrated to 100 Mbps over N-Wave.

Office of Marine and Aviation
Operations (OMAO)

Gulfport Facility - Gulfport, MS:

OMAO recently moved into the Mississippi Power Building in Gulfport, MS. Due to timeline constraints, N-Wave provided initial service over an IPsec tunnel on a commodity circuit. That has now been replaced by a 200 Mbps N-Wave connection.

This site also has N-Wave Managed LAN Service and N-Wave Enterprise Wireless Service.

Department of Commerce (DOC)

International Trade Administration - Washington, D.C.:

This location added redundant and diverse 500 Mbps to reach NOAA's Trusted Internet Connection Access Points.

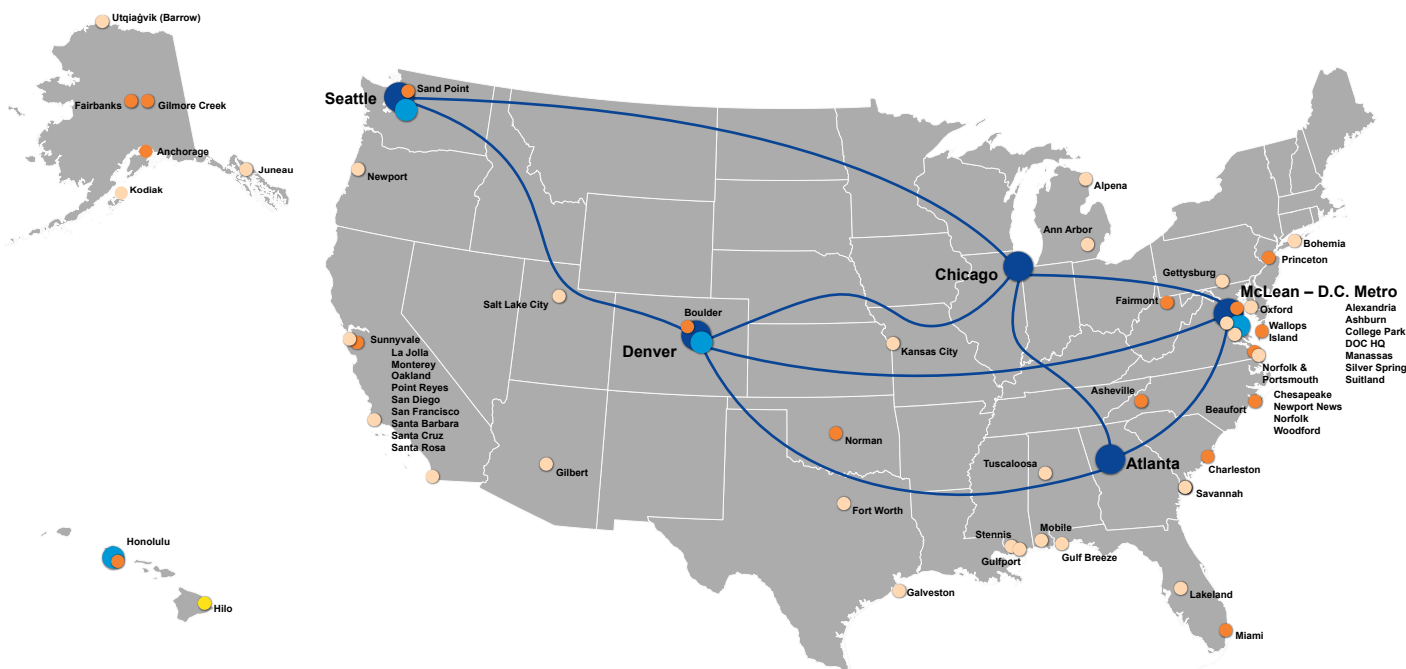
United States Patent and Trade Office - Manassas, VA:

Migrated to a 10 Gbps N-Wave connection to support the office's cloud connectivity needs.

Turned Down Sites

Germantown, MD:

Due to NOAA's Office of the Chief Financial Officer moving out of the location recently, the site was closed and connections were removed.



- Network Core
- TICAP Site
- Aggregation Site
- Participant Site
- VPN Backhaul Site



N-Wave Enterprise Services Updates

(April – October 2021)

Enterprise Firewall Service

N-Wave is laying the foundation for an enterprise firewall solution. N-Wave has traditionally managed firewalls for customers through legacy agreements. These firewalls were single customer and bespoke. Managing many individual firewalls of different vendors along with multiple firewalls at a single site creates an avenue for optimization. By building the Enterprise Firewall Service, N-Wave will reduce overhead, improve security, streamline architectures and offer a standing option for customers who would rather dictate policy and leave the configuration and management to someone else.

The firewall service is operated with centralized and decentralized firewalls. The two functional types of firewalls complement each other and simplify the architecture. Most user networks need no traffic sourced from outside their network and require protection and Network Address Translation (NAT) to the internet. Centralized firewalls protect those users. Some server and scientific equipment require access from flows originating from the internet. Decentralized firewalls protect those subset of networks.

Centralized firewalls:

- Designed for routing instances where flows don't need to originate from outside.
- Performs NAT for traffic destined to the internet.
- Traffic sourced from, and destined for, the same routing instance will not transverse the firewall.
- Centralization reduces the number of firewalls since they are able to aggregate traffic for many nodes across many sites.

Decentralized firewalls:

- Designed for routing instances where flows need to originate from outside.
- Local traffic to subnets is supported.



55+ VPN groups

All **6** NOAA Line Offices and **1** other federal entity use ERAV

7,000+ registered users

- The firewall is the gateway to the subnets for which it is providing security.
- Performs NAT as needed.
- Provides rulesets for flows between subnets in the same routing instance.

The Enterprise Firewall Service will continue to grow as new customers in locations old or new move to it. The service as designed is highly scalable and versatile. Utilizing firewall management and analyzer tools, N-Wave can greatly reduce the overhead and complexity of managing many firewalls. Look for an update on the operational sites in the next newsletter.

Wireless

The core wireless architecture is changing this year. With newer code available, a change in how controllers operate is needed. Traditional master controllers are where all the configuration magic happens. The master controllers push the configuration down to the local controllers. Due to the new architecture, master controllers are being replaced with mobility conductors. The purpose is similar but there are many enhancements to capabilities. The newer code also has better performance and support for IPv6. N-Wave is currently testing these features in the lab to prepare for roll out to production. N-Wave is also updating the policy managers controlling login



25+ service locations spanning the U.S.
15 states with service locations
1,000+ wireless access points

for the wireless service. While users should have a relatively seamless experience, there will be maintenance windows announced as the new code is implemented.

As wireless continues to grow and customers continue to re-imagine the office environment, N-Wave users are moving more of their staff to wireless. The minimal architecture needed for backend systems will remain on wired connections. Some benefits of wireless include:

- A reduced need for managing a user LAN.
- Improved security by both using VPN for access and not having wired ports left unattended at a site, giving users the same experience whether working remotely or on site.
- Ability for users to connect automatically in their office and while roaming in the building.
- Less use of new cabling for an office remodel.
- Increased flexibility.

This consistency for users reduces the stress of working while traveling or at home, and allows supporting tools to work the same regardless of a user's location. It will also reduce service desk workload.

Managed LAN

Vendor equipment delays, due to global supply chain disruptions, have presented unique challenges this year and this circumstance continues. Some equipment is taking over 10 months to ship. We are diligently working with

these timelines and our customers to ensure we are ready to hit the ground running when equipment arrives. We continue to adapt processes so these extended gaps - from planning to implementation - don't result in data being out of date. A few of these process improvements include:

- Bringing engineers into the process earlier allows for the project to proceed as soon as equipment arrives.
- Enhanced project documentation means any engineer can pick up the project for implementation even though they weren't involved in the design.
- Grouping installations across teams reduces the number of engineers who have to travel and keeps continuity between teams.

As a result of the unfortunate events surrounding water damage in Silver Spring, MD, earlier this year, we are seeing more equipment moving to the Enterprise Data Center (EDC) in Ashburn, VA. Multiple groups have contacted N-Wave for managed services in EDC-Ashburn and N-Wave has been able to provide solutions. These services range from Managed LAN to Enterprise Firewall Services and from rack to rack cabling requests to demarc extensions.

Managed LAN continues to grow with optimizations and improvements still in the works. As the "new normal" continues, N-Wave is working to ensure its processes and procedures reflect the changing environment.



20+ Managed LAN deployments
15+ additional sites use a form of the Managed LAN service in support of NOAA Enterprise Wireless
255+ switches deployed

Added Value of N-Wave Services

Recently, the National Marine Fisheries Service (NMFS) relocated some of its network infrastructure to Ashburn, VA, and made it a core site. In this transition, the Silver Spring Metro Center (SSMC) was moved to a spoke site. This relocation leveraged engineers from many N-Wave teams including those associated with the data center, telcom, transport, service desk, business operations, Silver Spring engineering and project management. From assistance with coordinating the project, running cabling in Ashburn between NMFS's racks (and extending the Verizon demarcs), to configuring a private VRF across the backbone and peering on the data center core switches

to many other important functions, all of these N-Wave teams contributed to the success of this relocation.

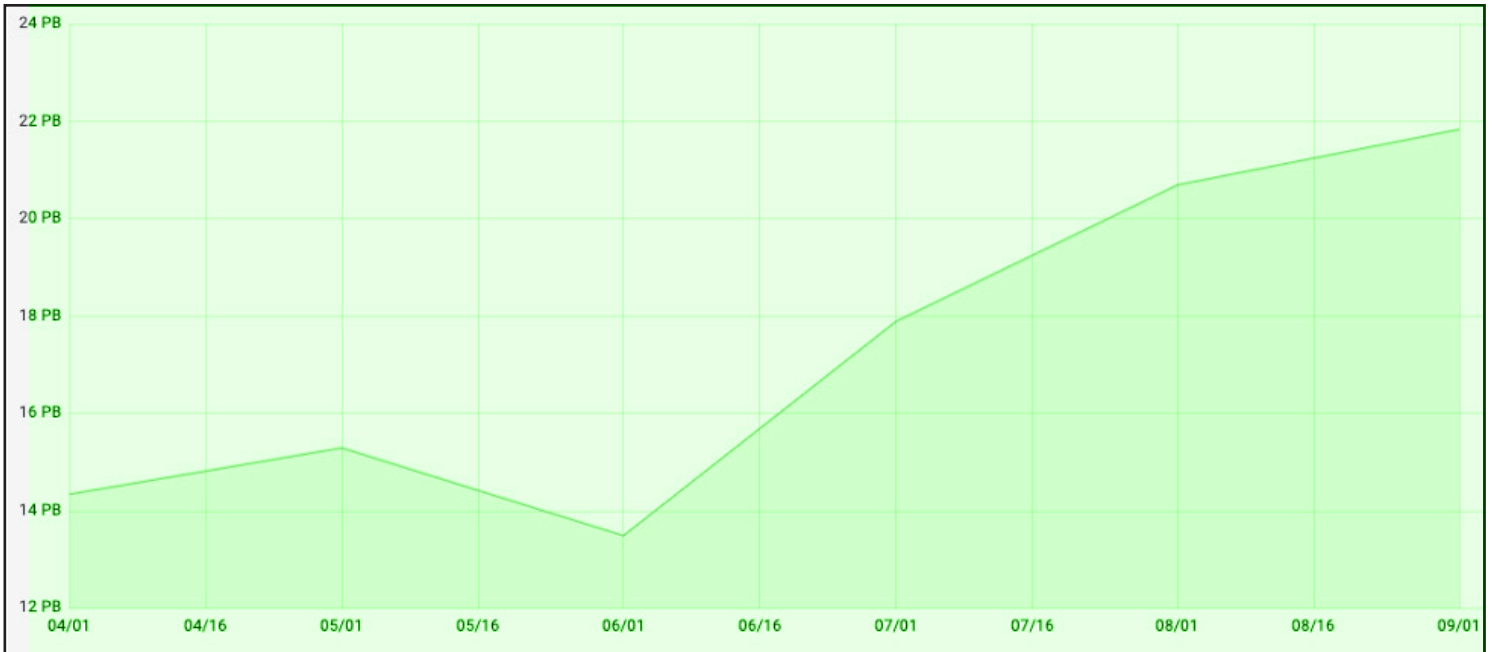
NMFS's relocation is not the only time where multiple services from N-Wave were needed. Projects are now streamlined and no longer delayed when waiting on multiple organizations or contracts to finish different pieces of work. N-Wave's internal coordination reduces the customer's workload and the number of items they need to track. N-Wave's single point of entry for tickets and communication flows enhances this process and reduces the chance of lost communications.



Gilmore Creek, AK

N-Wave Network Performance Metrics

Network Traffic (April 1 - September 30, 2021)



As mentioned in the last newsletter, N-Wave has been working on a new way to collect total traffic statistics. Previously, the collection and processing of data used in the newsletter was cumbersome and time consuming. Going forward, N-Wave will be using an automated tool to generate informational graphs for the newsletter resulting in saved time and giving us the ability to easily access current charts.

In the chart above, you will notice an uptick in traffic beginning with June. As part of the changes in how this data is collected, N-Wave performed an audit of all devices' netflow configurations. N-Wave engineers also worked to ensure all interfaces expected to send flow data were configured to

work properly. N-Wave has also turned up over a dozen new sites this spring and summer further pushing the traffic carried. All were contributors in the uptick.

N-Wave will continue to track the cumulative monthly traffic volume in each issue of the newsletter. From this issue forward, the start date will be April 2021. For reference, the cumulative total from N-Wave's inception through March 2021, can be found on page 15 of the [spring 2021 newsletter](#).

For the Spring 2022 issue, N-Wave is working to add the total IPv4 and IPv6 addresses.



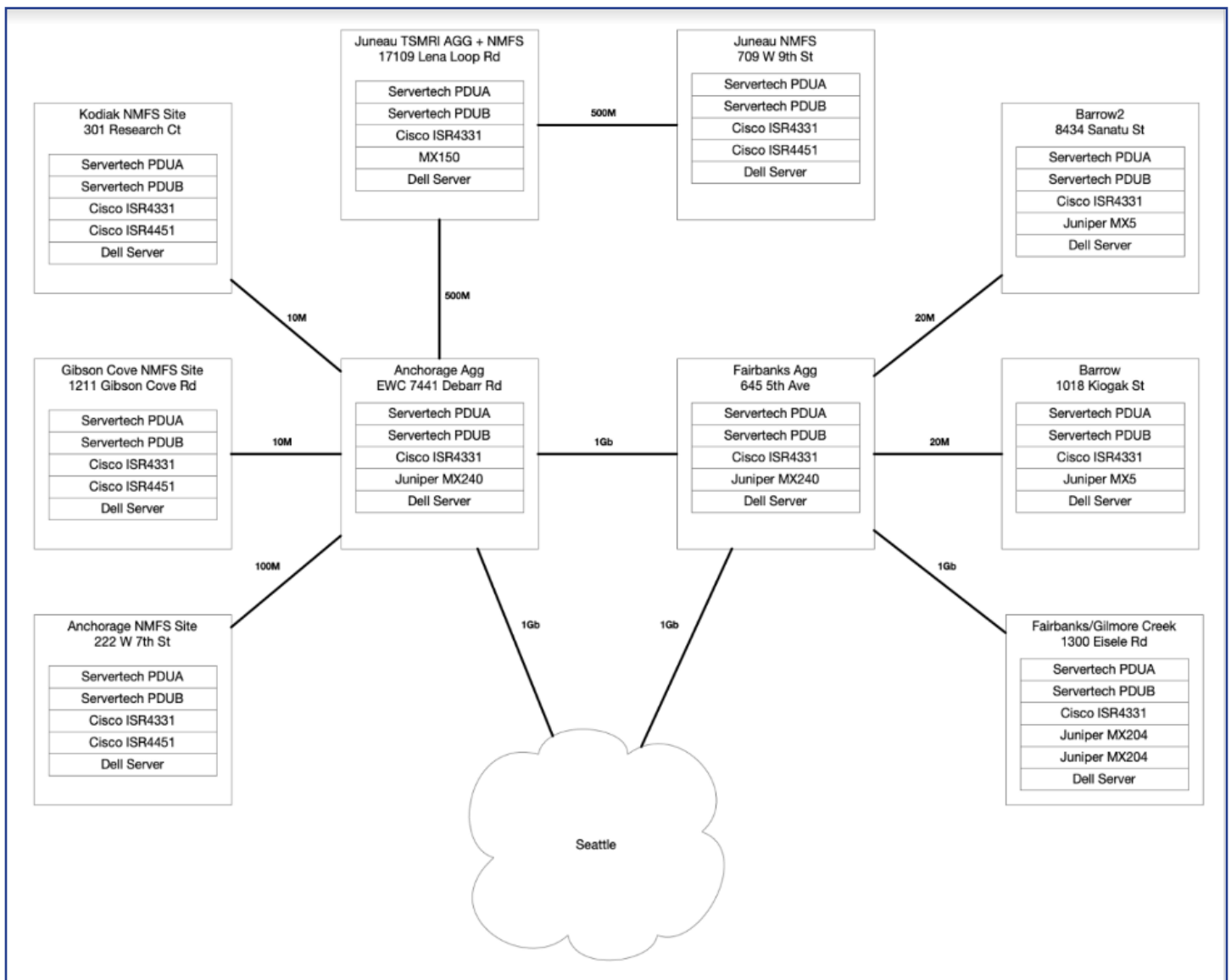
Credit: NOAA Climate Program Office

Alaska Progress Update

The N-Wave Alaska project is well underway. The partnership with Internet2 continues to yield great value to the N-Wave program. Arctic Slope Telephone Association Cooperative (ASTAC) and Alaska Communications (ACS) are great additions to the list of N-Wave's partners. The National Marine Fisheries Service (NMFS), the first customer on N-Wave's new, shared Alaska infrastructure, finished migrating its initial set of Alaskan sites to N-Wave in October.

The relationships with Internet2, ASTAC, and ACS were crucial to the N-Wave network development

in the Alaska region. N-Wave has partnered with Internet2 since its inception and the results of this partnership can be seen across the N-Wave network. With their local knowledge, establishing the relationship with ASTAC and ACS through Internet2 was critical in planning and executing the N-Wave Alaskan network, and remains so with respect to its operation. This group was involved in researching the path diversity options for the core, the circuit options for each customer site and establishing quotes in the early stages of the discovery phase.



This diagram shows the current architecture for the Alaska Shared Network Infrastructure project.

During the execution phase, ASTAC and ACS worked closely to bring up the circuit connectivity to each site. ASTAC helped with intrastate shipping and with the installation of N-Wave's gear at all locations. N-Wave and ASTAC engineers worked collaboratively on the installation of the N-Wave Alaskan aggregation sites (Anchorage and Fairbanks) and NMFS's Anchorage Federal Building site. By establishing Methods of Procedures and through the shared experience of working together at the three initial locations, ASTAC handled all the remaining N-Wave installations and circuit turn ups. The only thing remaining on the initial installation list is to migrate circuit handoffs between N-Wave and the provider from 1 gbps to 10 gbps to provide for future growth at the two Alaskan aggregation sites and N-Wave's core node in Seattle, WA. This is still outstanding because of supply chain issues.

NMFS was the initial customer to migrate to N-Wave's shared Alaska infrastructure. Its first site to migrate was the Alaska Fisheries Science Center's Ted Stevens Marine Research Institute (TSMRI) in Juneau. This site migrated from 30 mbps to 500 mbps. The next site was the NMFS office in Kodiak, which migrated from 6 mbps to 10 mbps. The NMFS office in the Juneau Federal Center has also migrated to N-Wave. This was a migration from 30 mbps to 500 mbps and supports the Office of Law Enforcement as well as the headquarters of the Alaska Regional Office (AKRO) and its customers. The last two NMFS sites, Anchorage Federal Building office and Gibson Cove, migrated in October. The Anchorage office

increased its bandwidth from 90 mbps to 100 mbps. The Gibson Cove location moved from 4 mbps to 10 mbps.

With N-Wave now having a shared infrastructure in Alaska, other NOAA Line Offices and agencies are investigating ways they can utilize the connectivity in the area. N-Wave is actively working on migrating the National Environmental Satellite, Data, and Information Service (NESDIS) and Earth System Research Laboratories (ESRL) connectivity in Utqiagvik (Barrow), AK, along with NESDIS and its partners in Gilmore Creek, AK (GC). New hardware has been installed at GC and all NESDIS and partner connections migrated onto it. It is anticipated that the remaining step of migrating the service for GC and Utqiagvik onto the shared infrastructure will be completed before the end of the year. N-Wave is working on providing options for multiple National Weather Service (NWS) Alaskan sites. NWS will compare the N-Wave offerings in Alaska to the options Enterprise Infrastructure Solutions (EIS) has provided. N-Wave continues to work with NOAA Cybersecurity to have a Trusted Internet Connection Access Provider (TICAP) installed in Alaska. More to come on this in the next newsletter.

The progress in Alaska has been very positive thanks to the support of the partnerships with Internet2, ASTAC and ACS as well as the help from the staff of NMFS and NESDIS. N-Wave is working toward continued growth in the area, which will help the missions of NOAA and other departments.



Credit: NOAA/OAR/OER

Network Operations Center Metrics and Updates

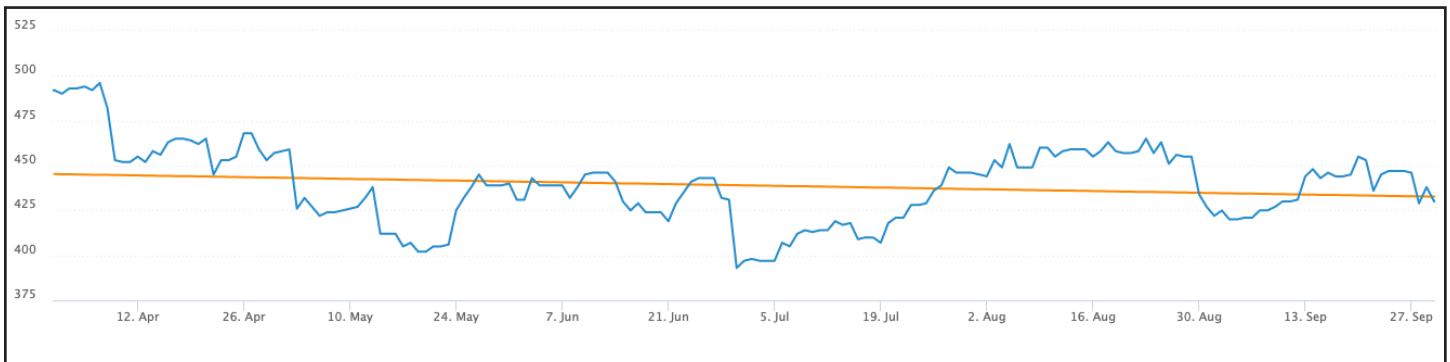
(April – September 2021)

N-Wave partners with the GlobalNOC at Indiana University to provide advanced network operations, offering support 24 hours a day, 365 days a year and is integrated within the N-Wave Federal Information Security Modernization Act (FISMA) High system controls. N-Wave NOC support includes tier I, II and III engineering, along with monitoring, measurement and analysis.

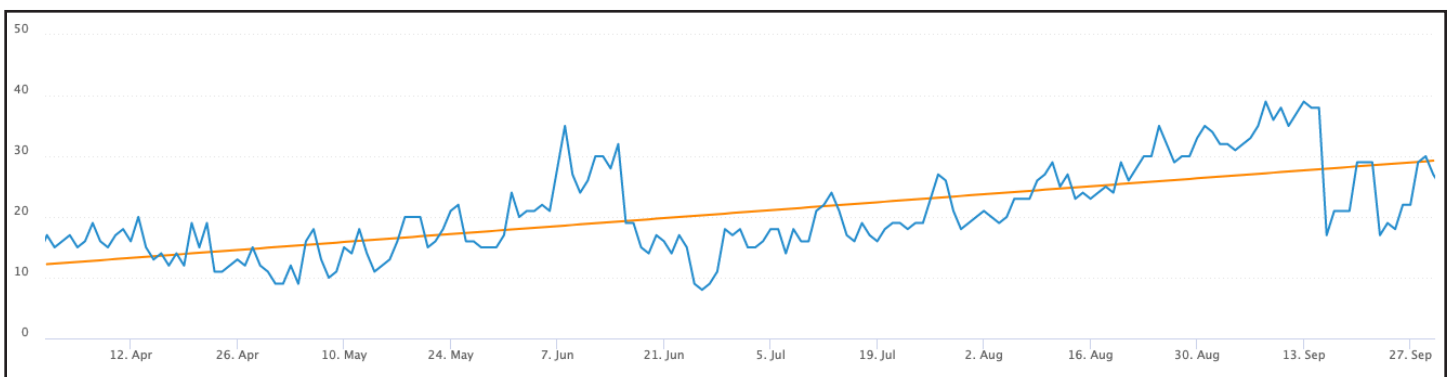
Support metrics gathered from April through September 2021 indicate the N-Wave NOC opened 11,093 tickets. These tickets encompass all incidents, service requests, change and maintenance events, and customer communication records, such as individual phone calls and incoming and outgoing email correspondence of the NOC. Service requests (19%) and communication records (64%) make up the bulk of those tickets, while incidents and changes together account for only 17% of tickets.

Trends in Requests and Incidents

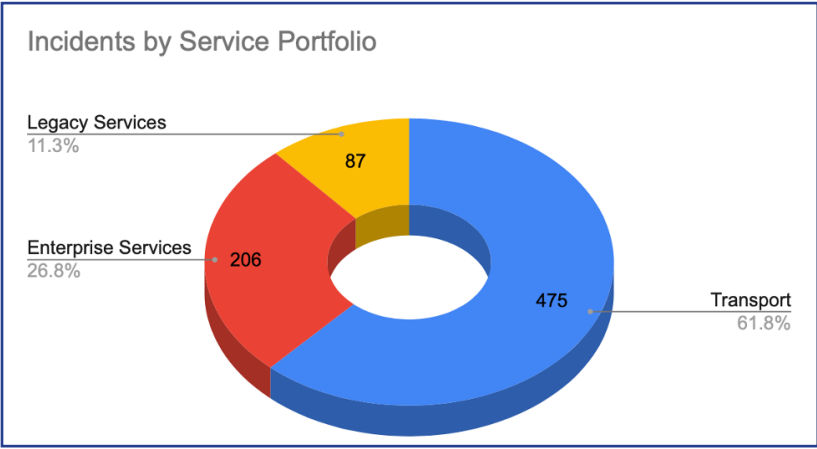
The trend line for customer requests is slightly decreasing, indicative of increased efficiency in processing customer requests. The trend line for incidents is increasing, reflecting the growth of the network.



The Active Requests metric shows the trend of all catalog tasks active on any given day.

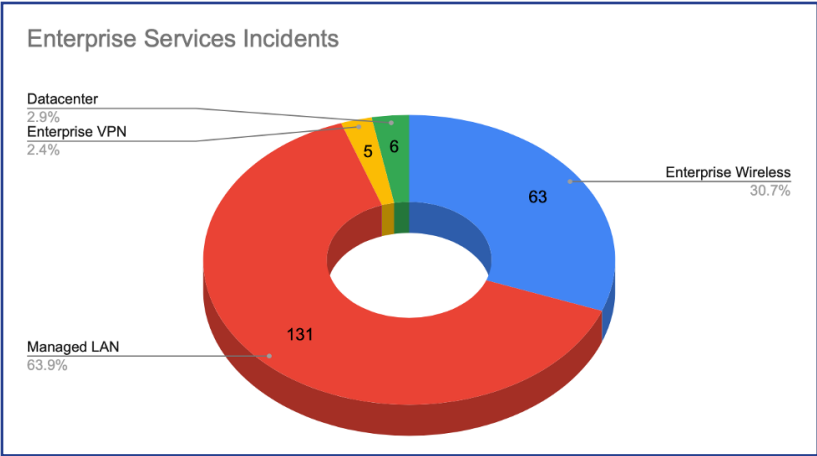
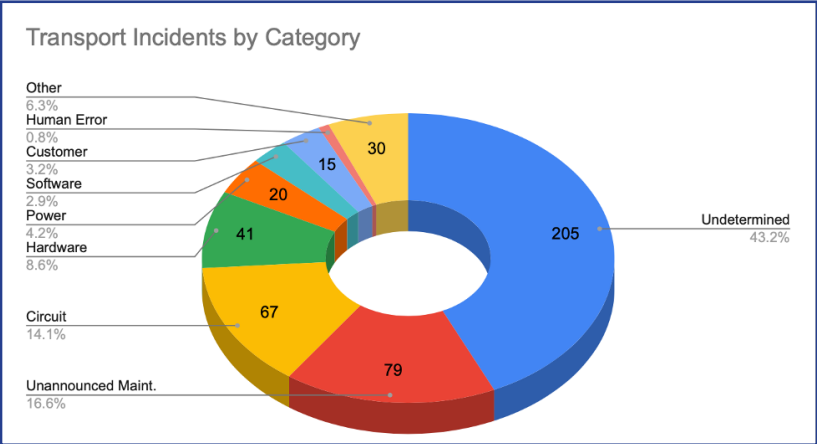


The Active Incidents metric shows the trend of all incidents active on a given day.



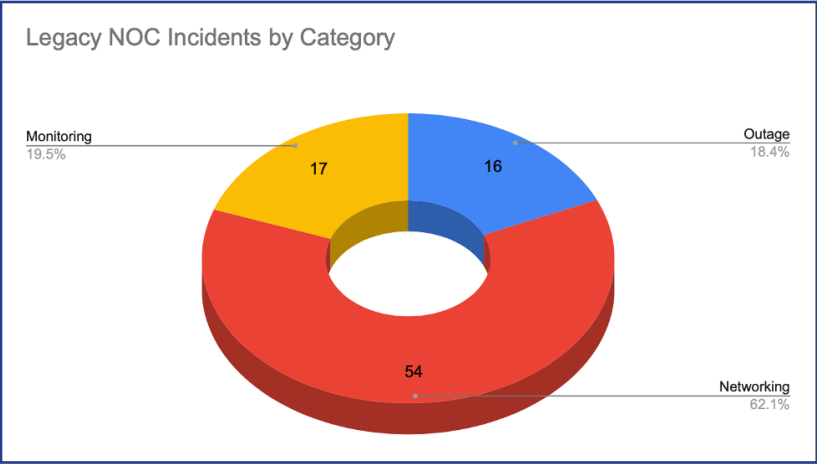
This represents 768 total incidents, broken down by service portfolio: N-Wave Transport, N-Wave Enterprise Services and NOAA Silver Spring Legacy Services.

This shows the 475 total Transport incidents, broken down by category. Undetermined incidents mostly comprise very brief, mainly non-customer-impacting observed outages for which a vendor is not able to determine the cause. Unannounced maintenance events typically occur when customers or providers do not announce the maintenance to N-Wave. Circuit incidents are outages caused by fiber damage, bumped fiber, vandalism or cut fiber.



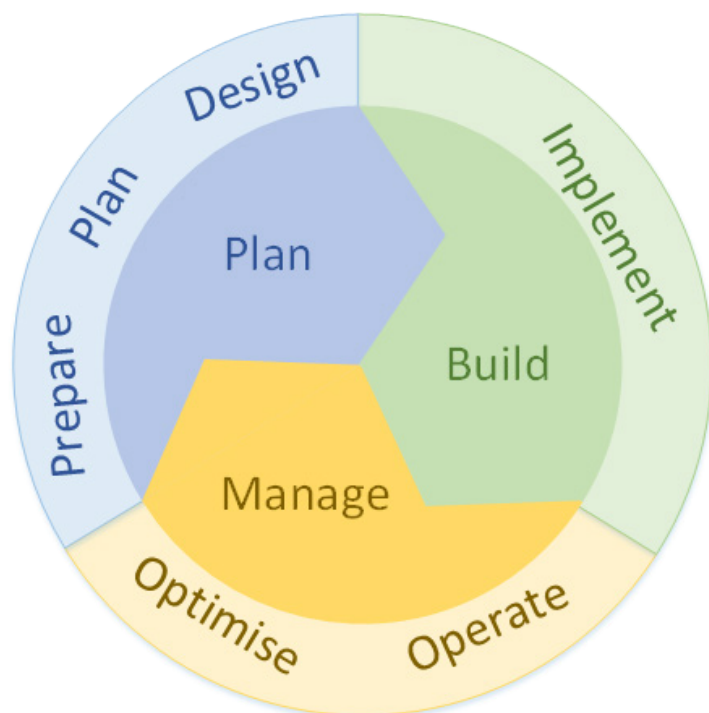
This shows the 206 total incidents related to N-Wave Enterprise Services, broken down by specific service: Datacenter, Enterprise Remote Access VPN (ERAV), Enterprise Wireless and Managed LAN.

This shows the 87 total incidents related to NOAA Silver Spring Legacy NOC, broken down by category: Outage, Networking and Monitoring.



N-Wave Lab Update

As covered in the [May 2020 N-Wave newsletter](#) (see p. 8), the N-Wave lab plays an important role in assisting with the Plan, Build and Manage lifecycle of the network.



The following are some highlights of the various tests accomplished in the lab:

Plan phase

- Next Generation Trusted Internet Connections (TIC) Architecture (described in more detail on next page)
- New Platforms
 - MX10003 to support higher port density and higher bandwidth aggregation
 - PTX10001 to support new 400 Gbps backbone links with high port density
 - EX4400 to replace EX4300 and provide VXLAN capability
 - MX150 to support smaller customers
 - QFX10002 to support the Enterprise Data Center in Ashburn, VA
- IPv6
 - First IPv6 only network in NOAA
 - Proving out DNS64 and NAT64
 - Plan to migrate lab infrastructure to IPv6 only

- XaaS
 - Test possible scenarios for N-Wave providing X-Wave as a Service (XaaS) networking to interconnect the X-Wave routers (X-Wave is the network that currently interconnects the external border routers for Trusted Internet Connection Access Points (TICAP) in the contiguous 48 states
- Future
 - SR-TE and SRv6 to improve future capabilities of N-Wave

Build phase

- IPv6 only Service Set Identifier (SSID) for N-Wave Enterprise Wireless Service to be deployed in production
- Cisco ISR policing to provide customers with sub-rate connectivity allowing for rapid upgrades of future bandwidth needs
- SRX Features: Static Network Address Translation (NAT) and route propagation
- Unicast Reverse Path Forwarding (uRPF) for anti-spoofing

Manage phase

- Code upgrades: SRX firewalls, EX switches and ArubaOS for WiFi
- Automation for configuration consistency and code upgrades: EX switches and SRX firewalls
- Troubleshooting: replicating issues seen in production to test fixes and provide regression testing
- GlobalNOC tools access to validate new hardware capabilities and configuration

One of the more important roles of the lab is to maintain a simulation of the current N-Wave production network. The simulation was expanded beyond the transport network, which encompasses the N-Wave and X-Wave networks, to include additional components from the services group: N-Wave's Enterprise Wireless Service, campus backbone and Managed LAN services.

The Next Generation TIC testing included coordination with the NOAA Cybersecurity team to test a new layer 2 architecture for the security components (bump-in-the-wire) through the use of a packet broker that also facilitates a more scalable and agile TIC. This will help avoid forklift upgrades and provide the ability to more easily incorporate new security technologies. The testing included evaluation of various high availability architectures and provided invaluable information

about failure recovery that will be used to tune the new fail to bypass service allowing TIC traffic to flow around a failed TICAP in a particular region to minimize interruptions to service. This work with the NOAA Cybersecurity team has led to discussions for a possible coordinated test lab where the TIC components can be more accurately simulated. This would benefit both N-Wave and the Cybersecurity team with increased awareness of each other's future plans.



Scituate, MA

Recap: Second N-Wave JETI Meeting



More than 100 registrants participated in the second N-Wave Joint Engineering and Technical Interchange (JETI), marking a successful and collaborative continuation of this technical community event. JETI is planned to become semi-annual in 2022. Due to COVID-19, the meeting was held virtually August 3-6, 2021. JETI was conceived as a new workshop held for network engineers and technical staff who operate and design NOAA and Department of Commerce (DOC) networks. It is intended to serve as a forum for the exchange of technical updates across NOAA Line and Staff Offices, DOC Bureaus and N-Wave's network partners and provide a much deeper technical focus than what is discussed at the N-Wave Stakeholders Summits.

With 16 unique sessions and two training classes spanning four days, and a 7 a.m. HST to 5 p.m. ET window to accommodate time zones in which DOC Bureaus operate across the United States, the JETI agenda yielded a fast-paced meeting. The speakers included representatives from NOAA Line and Staff Offices, DOC Bureaus, as well as the Engagement and Performance Operations Center (EPOC), a joint program of the Department of Energy's (DOE) ESnet and Indiana University. In light of the recent Office of Management and Budget (OMB) memo directing all networks to become IPv6-only, IPv6 continued to be one of the focus areas of the meeting. A report on the progress of the IPv6 mandate was given and more details about this effort can be found in the N-Wave Lab Update article (see page 17). The meeting also included additional, lengthier sessions focused on fostering greater technical interchange with one Birds of a Feather session giving JETI members the ability to discuss their journey into network automation and another allowing open discussion among members regarding any issues they might be encountering. Other program highlights are provided in the sidebars and below.

Engagement and Performance Operations Center (EPOC) Application Deep Dive

N-Wave is continuing to look for NOAA programs to engage in an Application Deep Dive. Anyone looking to help their scientists conduct their research easier, faster and safer should contact nwave-jeti@noaa.gov so an Application Deep Dive can be initiated.

More information from the 2021 JETI and upcoming events is available online:

- **Public access:** <https://www.noaa.gov/n-wave-jeti>
- **Internal event site** (registration or NOAA Google account required): <https://sites.google.com/noaa.gov/nwave-jeti/>

Basic and Advanced IPv6 Training

Over 60 JETI members registered for the Basic or Advanced IPv6 training held in conjunction with the second JETI meeting. The syllabus ranged from the structure of an IPv6 address to more advanced topics such as IPv6 Security and Threats including demos of attacks on new IPv6 technology like Neighbor Discovery Protocol (NDP). The training was well received with feedback such as *"Working on a certification right now, and I just covered IPv6, the instructor elaborated more on the topic which helped me really get a grasp of it,"* and *"Rick [Graziani] was a great instructor, really provided a great baseline knowledge for someone very unfamiliar with IPv6."* Additional IPv6 training is available on the resources section of the [Internal N-Wave Event Site](#) ([registration](#) or NOAA Google account required).

N-Wave Welcomes Three New Staff

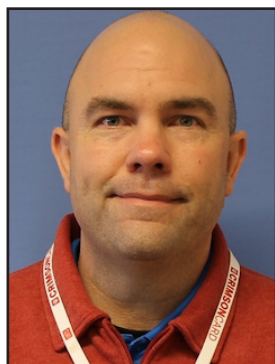


Amy Bogner

Amy Bogner has been hired as N-Wave's Communications and Outreach Specialist. She provides support as a subject matter expert on content creation, development and strategy for the newsletter, workshops/events and with other communication needs. Amy joined N-Wave in October 2021 and is based in Boulder, CO. Her career spans more than 20 years of working with governmental entities, public-private organizations and trade associations, specializing in media and legislative relations, communications, marketing, advertising and outreach. Amy received her Bachelor of Science degree in Business Administration from the University of Central Florida.

Jason Lomonaco

Jason Lomonaco joined the GlobalNOC's N-Wave team as a senior network engineer in September 2021, with a focus on supporting the N-Wave transport network. He's based in Grand Rapids, MI. Before joining N-Wave, he was most recently a senior network engineer with the GlobalNOC supporting Internet2's network and held a variety of other positions in his career acquiring technical skills in Dense Wavelength Division Multiplexing network planning, IPv6 and out-of-band network design among others. Jason has a Bachelor of Science degree in Information Technology from Central Michigan University.



Anthony "Tony" Winkler

Tony Winkler joined N-Wave as a network engineer with the NOAA team, providing support for Network Transport in October 2021. He is based in Indianapolis, IN, and his career background includes extensive experience in network engineering gained primarily while working for a national cellular carrier and smaller regional transport carriers. Before joining the NOAA team, Tony was part of the GlobalNOC's regionals team based at Indiana University. He graduated from Purdue University with a Bachelor of Science degree in Electrical Engineering Technology, focusing on electronics design, power distribution and networking. In his spare time, Tony enjoys playing tennis, woodworking and home improvement projects.

N-Wave Outreach Events

This fall, N-Wave is launching a new series of technical one-day workshops entitled JETI Path, as it's designed to guide the same audience who participate in the JETI meetings.

The inaugural JETI Path workshop will be fully virtual, focused on IPv6 and IPv6-only networking and held on Wednesday, December 8, 2021. Tentative time is 12:00 - 5:15 p.m. ET.



N-Wave Stakeholders Summit

The N-Wave Stakeholders and Science Engagement Summit is a yearly gathering of NOAA's leaders, campus technology coordinators, data producers, data managers, information security officers, network engineers, researchers, scientists and system administrators. N-Wave's partners from the scientific, research and education networking community also participate. Those who attend – in person or virtually – have an opportunity to learn about:

- Current and future uses of NOAA's networks where increased data flows will drive capacity planning for network backbones and the Trusted Internet Connection Access Points (TICAPs)

- Expansion of current programs or new initiatives from:
 - Department of Commerce Branches and NOAA Line and Staff Offices
 - Other federal government agencies
 - International partnerships
- N-Wave's new services and future plans
- New networking technologies and their possible application to better support NOAA's mission

The next Stakeholders Summit is scheduled for the week of February 28, 2022. Tentatively, the sessions will be held on Tuesday, March 1 - Thursday, March 3. This meeting will be held virtually starting at 12:00 p.m. and ending around 5:00 p.m. ET.

For more Information on N-Wave Outreach Events, see the [N-Wave outreach events webpage](#)

N-Wave News

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For more information:
NOAA N-Wave Program
<http://noc.nwave.noaa.gov>
Office of the Chief Information Officer
<https://www.noaa.gov/information-technology>

Robert Sears, Director, N-Wave
Paul Love, Newsletter Coordinator
Holly Palm, Design and Layout
Amy Bogner, Editor



U. S. Department of Commerce
National Oceanic and Atmospheric Administration
N-Wave
325 Broadway
Boulder, CO 80305-3337