Arctic Technology Evaluation 2016

2016 OVERVIEW

RDC Lead: LCDR Samuel Nassar, C4ISR Branch

INSIDE FEATURES:

The Arctic Strategy

In May 2013, the Coast Guard released its Arctic Strategy for how to overcome the region's unique challenges to perform its statutory missions. The document is centered around three strategic objectives:

- Improving Awareness
- Modernizing Governance
- Broadening Partnerships

Each of these objectives requires an element of research and development to ensure it's viability and success.

For inquiries regarding Arctic efforts, including interviews with our science team, contact the RDC Public Affairs Officer:

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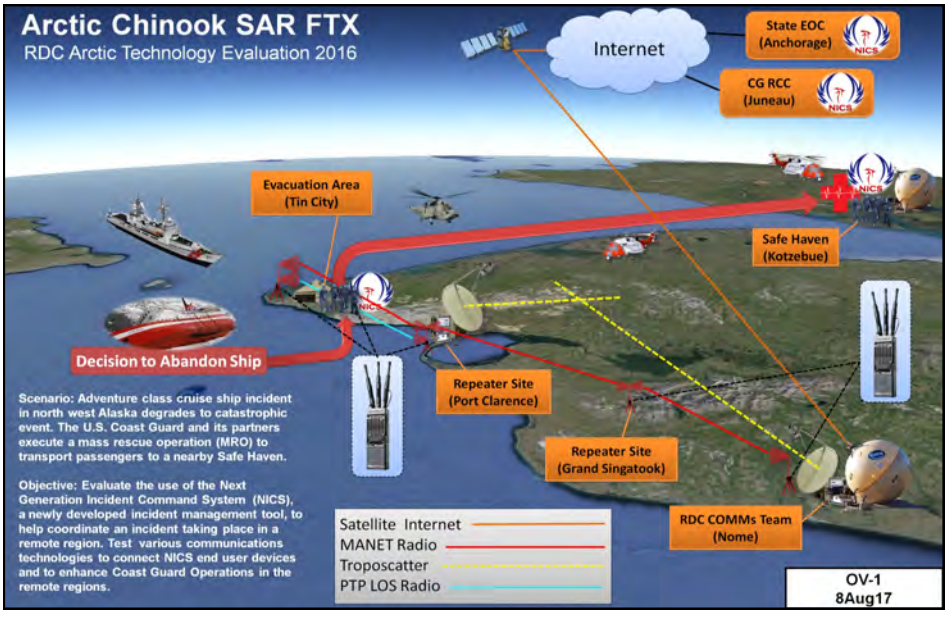
In August 2016, the Research & Development Center (RDC) will travel to Nome, Alaska for new technology evaluations designed to improve Coast Guard communications capabilities in the Arctic. The primary RDC initiative is to establish a terrestrial Arctic Communications link from a remote area (Tin City) to a major internet access point (Nome). Due to the vast distances between populated areas there is insufficient infrastructure capable of handling the volume of communications required in an emergency response effort.

Arctic Chinook. District 17 is sponsoring a mass rescue field exercise that the RDC will work in parallel with. The concept is to simulate a cruise ship fire requiring evacuation in the northern Bering straits. The response effort will involve tracking the rafts as they go ashore at Tin City, mounting a survival gear drop, setting up a triage camp, and evacuating the survivors to the nearest medical facilities which are 250 miles away in Kotzebue and then to a transportation hub or hospital in Anchorage.

As the Arctic warms and the polar ice continues to melt back, commercial, scientific, and tourist vessel traffic is expected to increase. In response to this growing demand and to further coordinate and strengthen Search and Rescue capabilities across the Arctic, an international treaty was signed among Arctic member nations on 12 May, 2011. According to the treaty, each member is committed to respond to an incident within their assigned area. Presently, Coast Guard District 17 is tasked with protecting several thousand miles of Arctic coastline from the tip of the Aleutians to the Canadian border on the North Slope. This area has very sparse infrastructure and very limited communications capabilities. The 2016 Arctic Chinook Search and Rescue exercise provides opportunity to test the DHS S&T developed Next-Generation Incident Command System (NICS) and compare it to the DHS Arctic Domain Awareness Center's testing of the domain awareness application called Field Information Support Tool (FIST). RDC staff will set up two terrestrial communication links from Tin City to Nome to evaluate such things as bandwith, video transmission capability and the practicality of setting up communication relays in remote areas.

This will also provide an opportunity to test the NextGen Incident Command System (NICS) and compare to DHS's FIST.



OV-1 depicting the Chinook field exercise and the RDC terrestrial communications link to Nome

Meet The Science Team

The USCG RDC is leading a science team to establish and test an emergency communications network. The RDC team will consist of staff members from C4ISR, Surface, and Aviation Communications projects. The C4ISR projects include the Arctic Communications Technologies Assessment project funded by DHS and the NICS demonstration project funded by RDC. The Arctic Operations Support project, also funded by RDC, includes the following staff members:

- LCDR Samuel Nassar, C4ISR — Project Lead and Test Director;
- Don Decker, Aviation—Subject Matter Expert—MPU5s;
- Jon Turban, C4ISR—Subject Matter Expert—NICS;
- Scot T. Tripp, Surface— Arctic Logistics Specialist;
- Brian Dolph, Surface—Safety coordinator;
- LT Carlon Brietzke, Surface—Safety and engineer;
- LT Keely Higbie, Surface—Anchorage RCC representative/NICS Demonstrator;
- LT Joe DiRenzo, Surface—Juneau representative/NICS demonstrator;
- ENS Gianfranco Palomba, C4ISR—On Scene Data Capture;
- ENS Hessamoddin Shafeian, C4ISR—On Scene Data Capture; and
- Michele Fitzpatrick, Contractor—Data collection oversight.

The RDC team will be joined in the Arctic by their partners in a Cooperative Research and Development Agreement (CRADA), ComTech. ComTech is providing their Troposcatter systems for evaluation on their performance in the Arctic environment. They are sending two systems and four staff members to operate them. One station will be set up and left to run on automatic. The second will be set up just outside of Nome on Anvil Mountain and will be manned 24/7. They will also bring some of their other communications equipment for potential testing as time permits.

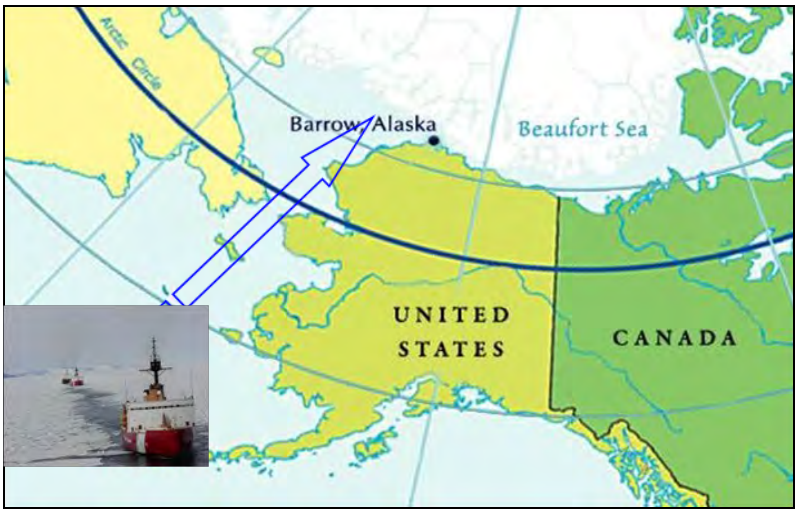
Ground Antenna Transmit and Receive (GATR) will be bringing their inflatable antenna satellite internet relay. They too will be on Anvil Mountain for the exercise.

The Center for Arctic Domain Awareness will be testing their Community Based Observer Network and Systems (CBONs) using the domain awareness app FIST in parallel with our NICS application. And finally, Persistent Systems provided a rush on supplying Man Portable Unit (MPU)-5 wave relay radios and will provide tech support to the actual test.

LCDR Nassar conducting the initial site survey.
Photo by RDC staff.

Arctic Communications

RDC Lead: LCDR Samuel Nassar, C4ISR Branch



With anticipate increases in shipping traffic through the Arctic Region, increased communications to improve mission performance must be assessed. Image from CG RDC.

The United States Coast Guard has wide ranging responsibilities in the region, such as defending and protecting U.S. interests, search and rescue, and environmental response. The vast distances, lack of communications infrastructure, harsh weather conditions, and high latitude ionic disturbances combine to make communications in the Arctic difficult. As Coast Guard missions increase in the Arctic the need for reliable communications is required for positive tactical control of all operational units for emergency communications with mariners operating in the area.

The project has several objectives and has been ongoing for a number of years. The current goals are:

- Determine and Model (Coverage Mapping) current HF asset performance (HF & HF ALE) to illustrate Arctic coverage;
- Address lack of documented Arctic HF coverage maps identifying regions of concern; specific concern for the Barrow, Chukchi Sea, and Beaufort Sea operational areas;
- Expand the modeling effort to include VHF distress channel 16 (156.8 MHz) and emergency position beacon frequency (i.e. 406.0 MHz SATCOM);
- Investigate potential antenna types/technology to increase Arctic HF coverage;
- Document HF and Satellite Coverage in the Arctic Region;
- Investigate feasibility of shipboard mobile Automatic Identification System (AIS) transponders on Class A Vessels;
- Configure the Mobile User Objective System (MUOS) for use aboard a Coast Guard Cutter, evaluate MUOS voice/data circuit connectivity during a North Pole transit;
- Test the feasibility of Distributed Tactical Communication System (DTCS) Radios as a First Responder Communication Tool in the Arctic;
- Demonstrate the use of the Next Generation Incident Command System (NICS) in the Arctic;
- Complete survey of all commercial satellite coverage (imagery and communication) in the Arctic; and
- Assess ways to improve Arctic Communications based on Technologies investigated to date.

Currently, the project plans to create a terrestrial communications path to an uplink site that will not be saturated by a forward operating location. District 17 is conducting a mass rescue field exercise between Tin City and Kotzebue Alaska. In parallel with that exercise, the RDC will create the alternative comms path from Tin City to Nome. This will be accomplished in a number of ways and with a variety of partners. The ultimate goal this year is to demonstrate the advantages and value of some of the existing technologies.

The team will set up the communications relay sites and then stream data & live video from Tin City to Juneau and Anchorage response command centers and potentially input to NOAA's ERMA. Staff members will be located in several locations in Alaska with representatives in Juneau, Anchorage, Nome, and Tin City.

Don Decker testing Comms clarity. Photo by RDC staff.

Coast Guard Arctic Strategy, Communications Objectives and Excerpts

The Coast Guard will…

"Optimize communication networks…by expanding and strengthening partnerships… with Federal, state, tribal, local, and territorial governments, as well as with academia, industry, and other non-governmental organizations."

…

"Improved communications… are critical for future success."

Wave Relay with MPU5 Radios

RDC Lead: Don Decker Subject Matter Expert

The team will be setting up a line of sight (LOS) Mobile Ad Hoc Network (MANET) communications system using the Persistent Systems MPU5 radios. The units have integrated GPS and can capture, distribute and view full motion video. This can then be uploaded to the web for decision makers anywhere in the world. They log onto a situational awareness app and can view events live as they are happening.

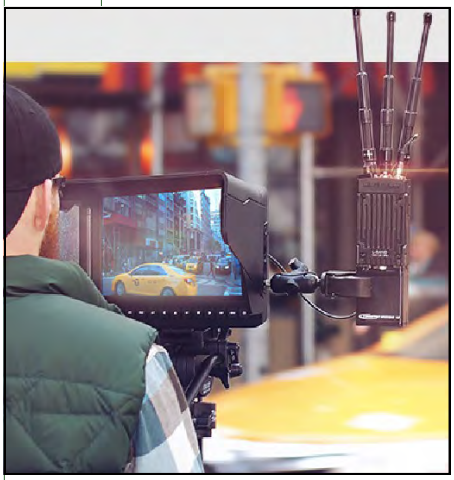
The radios have data, voice, video capability and a fully integrated Android computer system. Two of the radios will be used by CG personnel on scene at Tin City with video, voice, and chat capability in a MANET network. The remaining radios will be set up in line-of-sight relays from the base of operations at Tin City and transport data via Top Camp in Tin City via Port Clarence, via Singatook Mountain and finally to Anvil Mountain and the fire station in Nome where there will be an open connection to the internet. The data forwarded will be used by DHS's Next Generation Incident Command System to provide the Alaskan Rescue Coordination Centers with real time information for the Chinook Field exercise.

Some of the radios will be set up in remote locations and left to operate independently. They are rugged and made for extreme conditions. This makes Alaska an excellent spot to test them. For this demonstration we will have the potential for varying temperatures, rain, fog, salt, immersion, and animal interference.

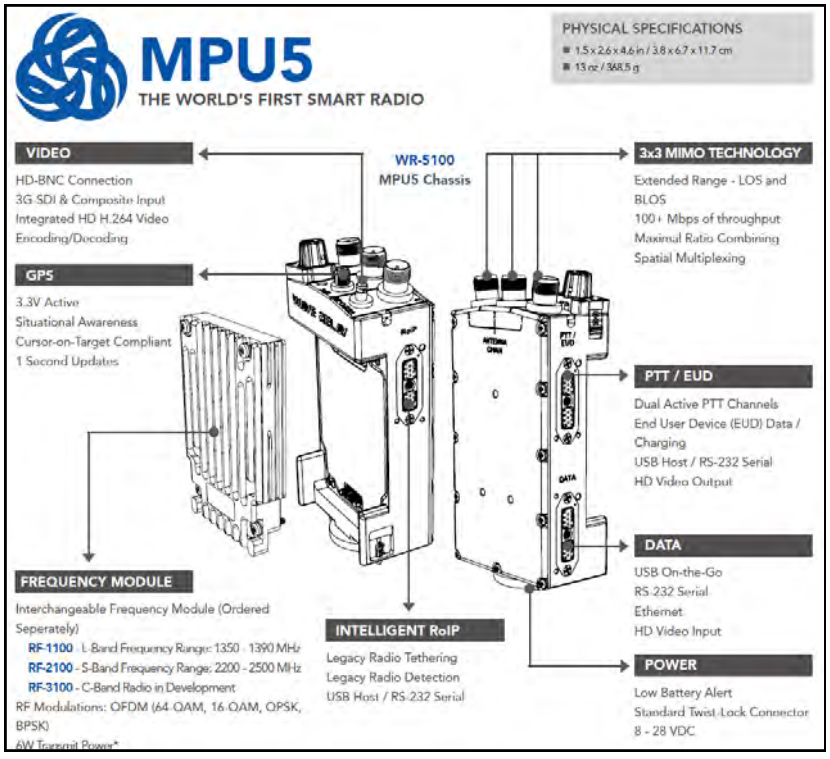
MPU5 Radio

Coast Guard Arctic Strategy, Communication Gaps and Innovation

Improved communications, charting, domain awareness, infrastructure investments, and training and exercise opportunities are critical enablers for future success. Long-term commitment and innovation are necessary to address gaps as efficiently as possible.



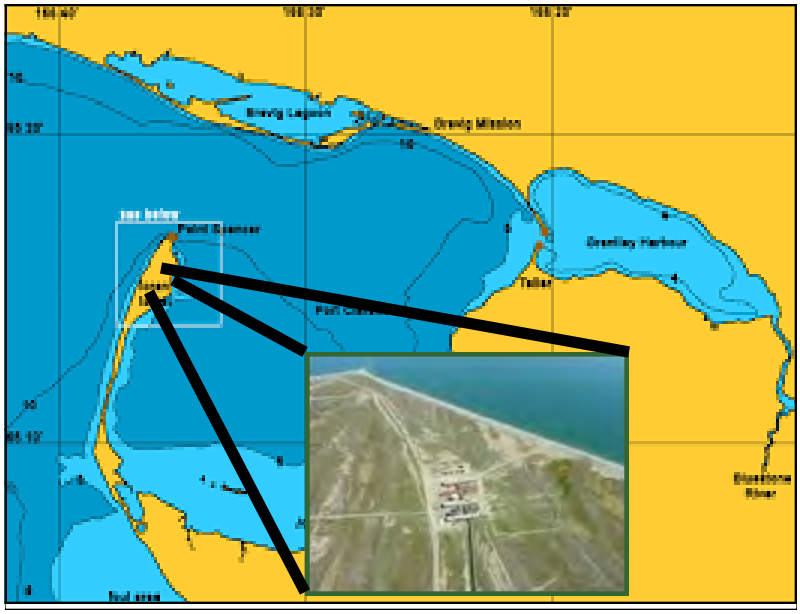
MPU5 attached to a video recorder and broadcasting live video. Picture from Persistent Systems web page.



Excerpt from the Persistent Systems specifications pdf on their web site

TROPOSCATTER

RDC LEAD: LCDR SAM NASSAR



Port Clarence—an abandoned Coast Guard LORAN station will be one side of the troposcatter link. Photo by RDC staff.

COAST GUARD ARCTIC STRATEGY, COMMUNICATION EXCERPTS

"Arctic operations require reliable command, control, communications, computers, and information technology (C4IT) capabilities. The Arctic region is known for poor propagation of radio signals, geomagnetic interference, and limited satellite coverage and bandwidth.

"Proceed with a risk-based, phased approach to resourcing to address the highest operational needs, including the establishment of infrastructure and communications systems to support operations."

Troposphere scatter (aka troposcatter) is a method of communication up to 186 miles over-the-horizon without the need for telecommunication satellites or multiple repeaters. As the radio waves pass through the upper layers of the troposphere, some of the randomly scattered beams find their way to the receivers. The receiver (which also acts as a transmitter), uses this portion of original signal to construct a reliable and secure data link.

The previous generation of gigantic troposcatter systems which were built primarily for the cold war era are now obsolete and have been replaced by more modern and smaller systems that are manufactured by companies such as ComTech. ComTech will provide the RDC with a 67 mile communication link from Anvil Mountain to Port Clarence, with a rate comparable to or exceeding that of satellites. Compared to satellites, troposcatters are much easier to assemble and disassemble, cheaper, more secure and require minimal maintenance for continuous operation.

The RDC has entered into a Cooperative Research and Development Agreement (CRADA) with ComTech Systems.

The old Cold War Troposcatter antennas still stand at the White Alice facility right outside of Nome.

Photo by RDC staff

The new Troposcatter equipment is provided through a CRADA with ComTech Systems.

Image courtesy of ComTech Systems®.

Setting up Terrrestrial Nodes

Lead: LCDR Sam Nassar

The project required the use of a helicopter to reach the remote locations needed to establish the communications relays. When the nodes are actually set up, the staff will be ferrying equipment and generators to the sites selected. Tin City is the start point for the network and is an Air Force base manned by support contractors. There is one gravel landing strip and they maintain a radar at the top of a mountain called Top Camp. The next node is at Port Clarence which was formerly a manned Coast Guard LORAN Station. From there the network goes to Nome at the White Alice site that still has two 1950s troposcatter dishes that are over 30 feet tall.

Coast Guard Arctic Strategy, Exerpts supporting testing of terrestrial nodes

"…scarcity of physical infrastructure present(s) logistical challenges."

"Due to undeveloped shore-based infrastructure, much of the increased tourism is expected to involve transportation via passenger vessel…"

"The Coast Guard will… set requirements and seek an adaptable mix of…boats… and shore infrastructure to enable effective seasonal operations."

Chartered helo for accessing remote sites to establish comms relays. Photo by RDC staff.

Top Camp comms relay point at Tin City. Photo by RDC staff.

Typical mountain top landing site for the Helo. Photo by RDC staff.

Port Clarence—Formerly manned CG LORAN station—one of our relay stations to be installed by the old transformer room. Operational concerns include interference from moose, muskox and bears. Photo by RDC Staff.

Native Alaskan Outreach

Lead: Sudie Hargis—D-17 tribal liaison

One of the important things that is done when working in the Arctic is to consult with the local natives. They were briefed on the project and had a chance to voice any concerns. It is also a chance to learn if the project will be interfering with any of the tribal activities such as subsistence hunting.

The town of Teller was visited during the communications survey trip

Teller, AK is a local village that is close along the communications paths being set up by the project team. They have hunters and fisherman who needed to be consulted before the relays could be established. This served two functions, first they were informed so that they did not disturb the equipment in the remote locations and second they let us know where we should restrict activities so as not to interfere with their hunting.

The team met with the Mayor and the tribal elders in the village common room. The village is located at the end of the Nome-Teller Highway approximately 70 miles north of Nome.

One concern they had about the RDC setting up a communications relay point on Port Clarence was that when it was an operational LORAN station, they found that the whales and the walrus stopped coming into the bay.

The project team assured them that our particular set up in no way would be transmitting the level of energy that the 1000 ft LORAN tower did. The locals were also informed that this would be a temporary installation lasting less than two weeks.

Staff talking with local fisherman.
Photo by RDC staff.

When all the questions and concerns were covered, the mayor took the staff on a walking tour of the town where they got to meet some of the residents.

The city of Teller from the Nome Teller Highway. Photo by RDC staff.

Teller is a community that lives off subsistence hunting. There are mostly public service jobs in the town. The community has limited infrastructure, such as the school and the town municipal building.

The locals were friendly and told stories of the towns history. There are no roads that connect to the rest of Alaska, so everything they have is either barged or flown in. Needless to say, things like a car costs as much to have shipped in as it does to buy it. It also costs to have it shipped out when no longer serviceable.

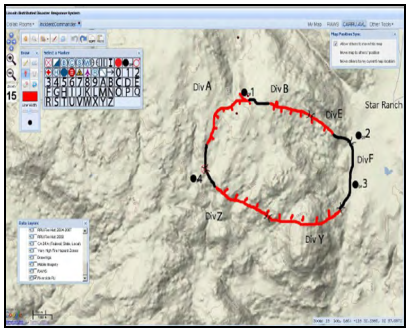
They also asked us not to fly near certain mountains as they would be hunting in those areas and did not want the game to be frightened out of the hunting grounds.

Moose and bear are some of the more dangerous animals in the areas.
Photo by RDC staff.

Next Generation Incident Command System

Lead: LT Joseph DiRenzo

NICS symbol taken from the MIT Lincoln Labs Help website.

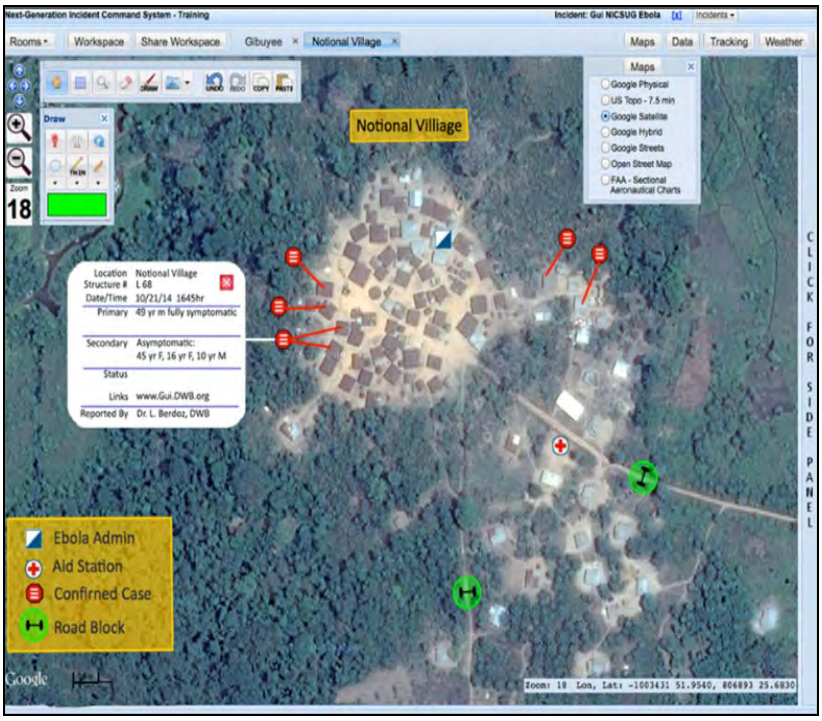


NICS web-based user interface from MIT "Tech Notes".

In addition to testing state-of-the-art line of sight and beyond line of sight communications capabilities, the RDC team will be inputting information into the Next Generation Incident Command System (NICS) during the Arctic Chinook exercise. NICS is a web-based command and control tool with scalability ranging from smaller localized incidents to larger national level incidents. The program enables collaboration across a wide range of stakeholders including Federal, Tribal, Military, State and Local / Municipal level responders. NICS allows all levels of the Incident Command System to maintain situational awareness throughout an incident.

Originally sponsored by the Department of Homeland Security Science and Technology Directorate and developed by the Massachusetts Institute of Technology Lincoln Laboratory, NICS has already been utilized by a wide range of emergency operators including the California First Responder Community. The RDC will be using NICS during Operation Arctic Chinook to track the progression of Search and Rescue efforts during the course of a mass rescue exercise. Members of the RDC will be entering information from remote Alaskan areas including: Tin City, Kotzebue, Nome, Juneau, and Anchorage.

Using NICS, participants in the exercise will be able to closely track and manage the location data for resources, assets, and personnel. Users will also be able to receive real-time weather, critical infrastructure, and terrain information. NICS uses a web-based, open standards platform, meaning that it can be downloaded by any first responder on a mobile phone or smart device. The program includes graphical tools, including geo-referenced virtual whiteboards, which allows first responders to send messages to one another during an incident. Designed for the "Tired-Dirty-Hungry" first responders, NICS is easy to learn and use making it a promising solution for incident management.



NICS user-interface. Photo taken from OpenIdeo in an article written about NICS by Dr. Jack Thrope

Partnering with Academia

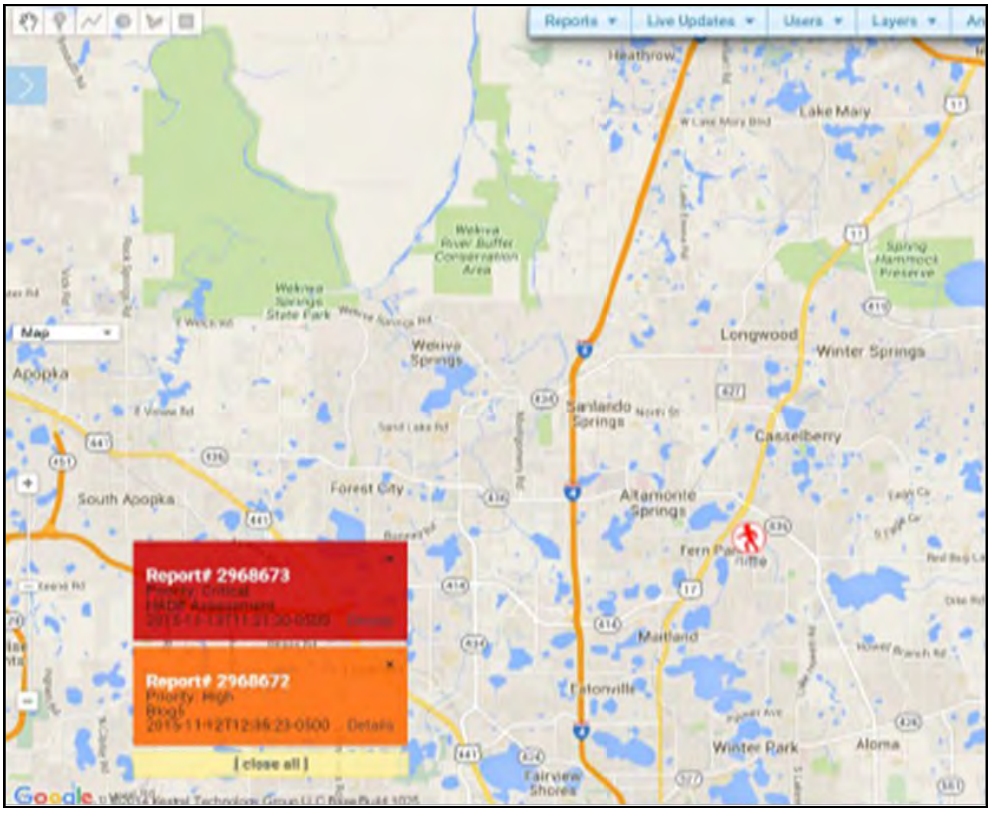
Lead: LT Joseph DiRenzo

During the course of the Arctic Chinook tests, the RDC partnered with several different Academic and Department of Defense organizations for the purpose of increasing domain awareness in the arctic. One of the additional domain awareness tools being field tested in the Arctic is the Field Information Support Tool (FIST) which is being assessed by the Arctic Domain Awareness Center (ADAC) in conjunction with the Nova Corporation and the Kestrel Technology Group. FIST offers a number of different features including: multi-mission Common Operating Picture, Sensor and Partner System Integration, Data Visualization, Data Fusion, and Data Analysis.

ADAC will be using their Community Based Observing Networks and Systems (CBONS) during the Arctic Chinook exercise to provide inputs into the FIST system. CBONS uses trusted, local "high fidelity observers" to submit geo-referenced observations which are combined with data from other systems (including NOAA buoy data, weather information, data layers, etc.). FIST is available for both smart phone and web based applications.

FIST mobile interface, image taken from the March 2016 ADAC presentation on FIST.

In addition to field testing FIST, the Department of Defense participants in the exercise will be field testing the Surveillance Intelligence Reconnaissance Information System (SIRIS). According to the SIRIS fact sheet, "SIRIS provides automation of mission data integration to present users a common and intuitive user interface that is tailored to the mission and provides shared situational understanding and real-time collaboration between distributed mission partners on multiple networks".



FIST web-based interface. Image taken from the March 2016 ADAC presentation on FIST.

The RDC In The Arctic

The Arctic has been a significant focal point of Coast Guard operations over the last several years. "The RDC plays a key role in charting the Service's future efforts in the Arctic by evaluating new and emerging technologies for the applicability to Coast Guard operations in the harsh and remote environment.," said RDC Commanding Officer, Capt. Dennis Evans.

The RDC first began research in the Arctic in the 1970's, assessing the burning of oil spilled on the ice. More recently, due to receding ice and increased vessel traffic and human activity, the RDC committed more of its project work to Arctic issues.

The RDC has commissioned studies to improve knowledge on Arctic issues, conducted oil in ice and Arctic craft testing in the Chukchi and Beaufort Seas, participated in multiple oil-in-ice response workshops and conferences, and have continuously conducted market research to identify the latest Arctic-capable technologies.

The RDC survey team attended a Coast Guard sponsored oil boom deployment exercise. Photo by RDC staff.

RDC Arctic Technology Evaluation Team Members

Rich Hansen, Arctic Coordinator
LCDR Samuel Nassar, Lead Scientist
Jon Turban, Subject Matter Expert
Don Decker, Arctic Comms Lead
Scot T. Tripp, Logistics

Project Staff

LT Keely Higbie
LT Carlon Brietzke
LT Joe DiRenzo
ENS Hessamoddin Shafeian
ENS Gianfranco Palomba
Brian Dolph
Michele Fitzpatrick

The Research, Development, Test & Evaluation Program (RDT&E)

At any given time, the Coast Guard's RDT&E program is working on projects that support Coast Guard requirements across all mission areas. The RDT&E program is comprised of the Office of RDT&E at Coast Guard Headquarters in Washington, DC, and the Research & Development Center (RDC) at New London, CT. The RDC is the Coast Guard's sole facility performing applied RDT&E experimentation and demonstrations.

The RDT&E program enhances acquisition and mission execution by helping transition new technologies into the service's operational forces. The program also provides Coast Guard leadership with knowledge necessary for making strategic decisions. Test and evaluation activities support the entire Coast Guard in requirements verification planning, including mission-specific test preparation and deck-plate procedure execution.

The RDT&E program pursues technologies that provide incremental improvements as well as those with the greatest potential to strategically transform the way the Coast Guard does business. The program leverages partnerships with academia, other government agencies and private industry to anticipate and research solutions to future technological challenges.

The RDT&E program is dedicated to maintaining a balanced portfolio of projects that supports the Coast Guard's short, medium, and long range requirements across all mission areas. Projects fall under seven main program areas including Surface, Aviation, C4ISR, Acquisition Support & Analysis, Environment & Waterways, Modeling & Simulation Center of Excellence, and Test & Evaluation.

RDC Websites

The RDC's public facing website is:

http://www.uscg.mil/acquisition/rdc/

The RDC has also set up a Coast Guard–internal site to help provide RDC staff, project sponsors and stakeholders, and other members of the organization with visibility on the field activities, projects, and products being produced at the RDC. We invite you to visit the site regularly to stay up to date on the Arctic Technology Evaluation and other RDC activities. The Internal CG blog is located at:

https://cgportal2.uscg.mil/units/cg9/2/6/rdc/rdcblog/default.aspx

DHS partners can access the RDC Blog through the DHS HSIN network.