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FIRST FLIGHT

The birds were noisier than the Aeryon Scout as the mini quadcopter whirred over the lounging caribou in the field at the Robert G. White Large Animal Research Station.

The Scout climbed to 200 feet, as a crowd of about 50 people silently watched its inaugural flight this gray morning of May 5, 2014, in Fairbanks, Alaska.

It was an historic first for the University of Alaska Fairbanks, the Federal Aviation Administration and unmanned aircraft operations.

That morning Michael Huerta, FAA administrator, announced that the FAA had granted operational status to the Pan-Pacific Unmanned Aircraft Systems Test Range Complex. Minutes after the announcement, Scout operator Mike Cook took the aircraft to the sky on a test site mission, the first flight ever for any of the FAA's six test sites.

"It was picture perfect," said Jay Skaggs, FAA's safety inspector based in Anchorage who witnessed the event. "He made aviation history."

The test range will help FAA develop regulations and certifications for unmanned aircraft operators and equipment. It includes partnerships in Hawaii and Oregon. The range, recently named by FAA as one of six nationally, is part of the Alaska Center for Unmanned Aircraft Systems Integration, one of UAF Geophysical Institute's 15 units.

"The University of Alaska Fairbanks program is important because it includes a diverse set of test site range locations in seven climatic zones, so it will give us a wealth of data to help develop appropriate safety regulations and standards," said Huerta that morning.

UAF's achievement marked years of work with federal, state and private entities, said UAF Chancellor Brian Rogers.

"Our presence here illustrates an important point about unmanned aircraft work," Rogers said. "It's not simply about the technology, but rather about the application of that technology to real-world needs."

An Aeryon Scout quadcopter hovers in the reindeer pen at the Robert G. White Large Animal Research Station, making it the first flight for UAF's Pan-Pacific UAS Test Range Complex. The Scout has a top speed of 30 mph and maximum flight time of 20 minutes and will be used to conduct a series of aerial flights supporting wildlife research. Photo by Todd Paris.

UAF UNIVERSITY OF ALASKA FAIRBANKS

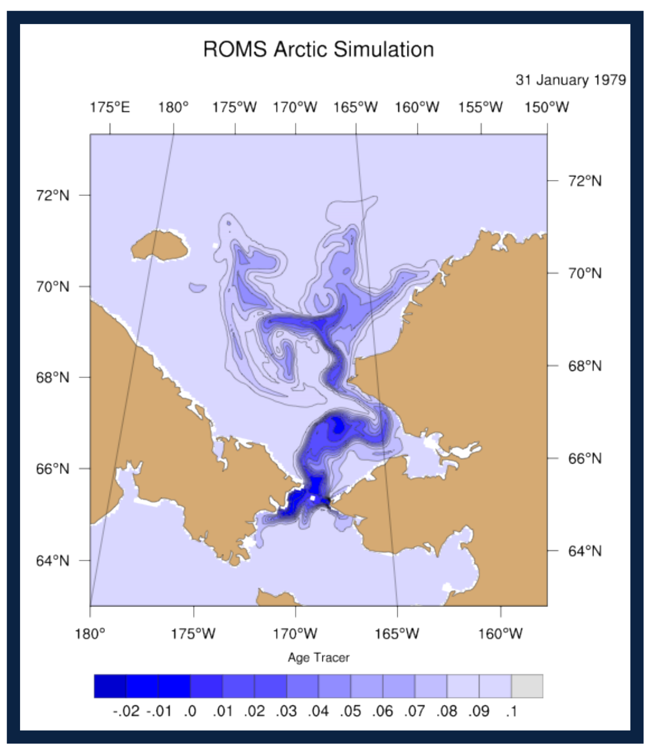
DIGITAL LABORATORIES & VIRTUAL EXPERIMENTS REQUIRE HIGH-PERFORMANCE COMPUTING

Some scientists work in the field and some work in a laboratory, but in order to explore what is otherwise too big, too small, too far away or too expensive, scientists increasingly rely on virtual laboratories.

Thanks to the mathematical capabilities of supercomputers, the complexities of "real world" systems can be represented through scientific computer models. Once these models are created, they act as manipulatable virtual worlds.

"That's the only way we can experiment," said Nicole Mölders, a professor of atmospheric sciences at the University of Alaska Fairbanks.

As an atmospheric scientist, Mölders focuses on a dynamic system in which creating the same environment twice is impossible. Using mathematical models of such a complex system requires massive computational power.



Visualization of Arctic Ocean circulation using ROMS. Courtesy of Kate Hedstrom, School of Fisheries and Ocean Sciences.

"We have very complex physical equations," Mölders said. "What a supercomputer does best is math."

"Using supercomputers is a valuable tool for any researcher, undergraduate or graduate student," said Liam Forbes, interim director at the Geophysical Institute's Arctic Region Supercomputing Center (ARSC). "More and more high-power computation and modeling are being used in science," explained Forbes. "It's not just field work and observation anymore."

Mölders agrees and makes sure all of her graduate students are trained on a supercomputer. "They learn how to analyze large, complex sets of data," she said. "It makes them employable."

For instance, Huy Tran, a 2013 UAF PhD recipient, developed a model that explored how air pollution would impact unmonitored Fairbanks, Alaska, neighborhoods. Fairbanks air quality is poor during the winter due to temperature inversions in the Tanana Valley.

Mölders' current students are looking at wildfire emissions, pollution impacts on Glacier Bay, Alaska, and the use of reduced-sulfur fuels in Fairbanks.

ARSC is currently serving the modeling and other computational needs of 115 active projects. These projects cover a wide range of research, including sea ice and ice sheet studies, oceanography, and mapping projects.

Two high-powered resources are available to all University of Alaska affiliates. The first is named Pacman. Pacman is a Penguin Computing cluster composed of processors clustered together to allow for communication and coop- eration across "nodes." Nodes are basic units that make up a larger network. The other HPC system is the Cray XK6-m 200 known as Fish. Fish's graphics processing units simultaneously handle multiple streams of incoming data allowing for significantly faster results.

The distinguishing feature of the Cray system known as Fish is its graphics processing units that simultaneously handle multiple streams of incoming data, allowing for significantly faster results.

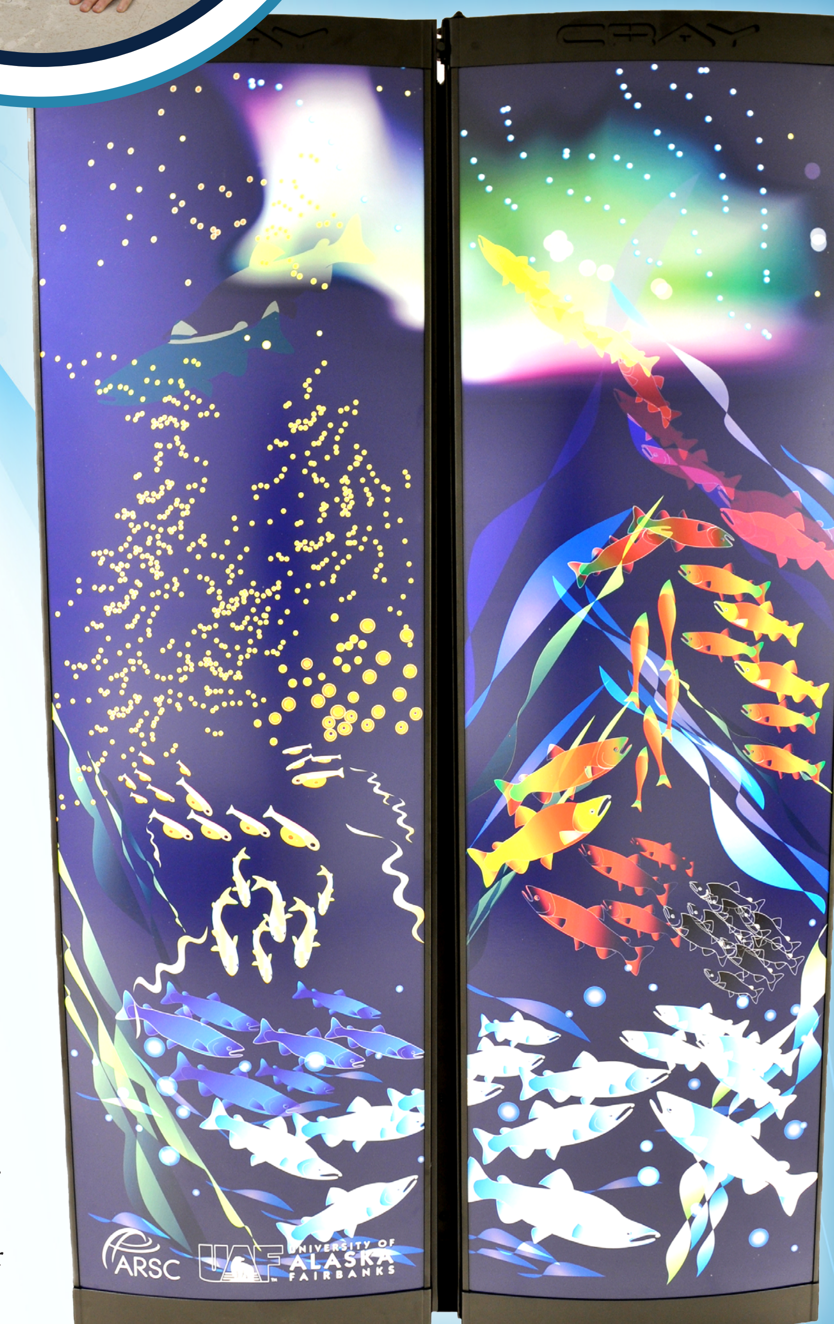
Not only do these systems have the ability to process large problems, they can turn that data into something visual. "The supercomputers can expand a researcher's view of their work," Forbes said.

Elena Suleimani, Amy Macpherson, Dmitry Nicolsky and other GI researchers have been using ARSC services to simulate multiple hypothetical tsunamis for 76 Alaska coastal communities, based on a variety of earthquakes and landslide scenarios. The simulations give community emergency managers an idea of dangers and thus help with tsunami hazard mitigation and response efforts. "It's the best tool we have," Nicolsky stated.

This project's complex modeling reflects the complexity of reality, so it must take into consideration historical and current data, earthquakes, geography, ocean dynamics and hydrology, among other things. The group has been working on the project for multiple years and delivered a set of maps to about a dozen coastal Alaska communities. The most recent set of maps was delivered to Cordova and Tatitlek.

"You have to think about how waves propagate across the ocean, impact the coast and make their way through fjords and around islands," Nicolsky said. "If you model each scenario, it could take up a lot of time using a desktop computer. The supercomputer is equivalent to 100 to 200 desktops on this project and drastically reduces the time to deliver critical results to Alaskans."

Tim Slauson, ARSC research project assistant, runs cables under the Butrovich Machine Room floors. Photo by Azara Mohammadi.



The doors of Fish feature artwork representing the life cycle of salmon by UAF art student Yumi Kawaguchi. Photo by Azara Mohammadi.

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Fountains of Lava at Pavlof Volcano

Rising surface temperatures at the summit of Pavlof Volcano, seen in satellite imagery, prompted Alaska Volcano Observatory scientists to raise the aviation color code level of concern to orange on May 31.

Within days, reports arrived of incandescent glowing at the northern vent of the summit, indicating lava fountaining. Lava fountains form when lava is forcefully but not explosively expelled from a volcanic vent.

"Lava fountaining is not the most common mode of eruption in Alaska," said Jeff Freymueller, AVO coordinating scientist and professor of geophysics at UAF. "Alaska volcanoes tend to be more explosive, but we have a wide variety of eruptive types, and this seems to be what Pavlof does."

Freymueller said data suggests that this eruption is similar to the eruption in May–June 2013. Reports of lava fountaining and spatter cones, formed by blob-like piles of ejected lava, as well as melted snow and ice forming lahars on the northern flank, are consistent with the observations from the 2013 eruption.

For current information on Alaska's active volcanoes, visit avo.alaska.edu.

Incandescence from lava fountaining at the summit on Pavlof, with the spatter-fed lava flow down the north flank. Image courtesy of Rachel Kremer.