CHALLENGE
HURL needed to protect and manage terabytes of irreplaceable video data, gathered during 30 years of deep-sea exploration, as well as simplify the process of making clips available to researchers worldwide.

SOLUTION
HURL installed an HP X5520 Enterprise Storage System and two HP Z1 Workstations, all based on Intel Xeon processors. The system provides secure, centralized data storage, helps reclaim floor space, and reduces the time HURL staff spends retrieving requested clips by 75 percent.

Intel® Xeon® Processor-based Storage Helps HURL Increase Staff Efficiency by 75 Percent

To protect irreplaceable deep-sea video footage, Hawai'i Undersea Research Laboratory is transferring terabytes of data to an HP X5220 Network-attached Storage* system based on Intel® Xeon® processors. The solution accelerates data retrieval, increasing staff efficiency by 75 percent and helping HURL optimize resources while reducing IT costs.[1]

The system helps us give everyone the ability to see what lives beneath the ocean in a way that very few people have actually observed.

—Rachael Orange
Data Manager
Hawai'i Undersea Research Laboratory

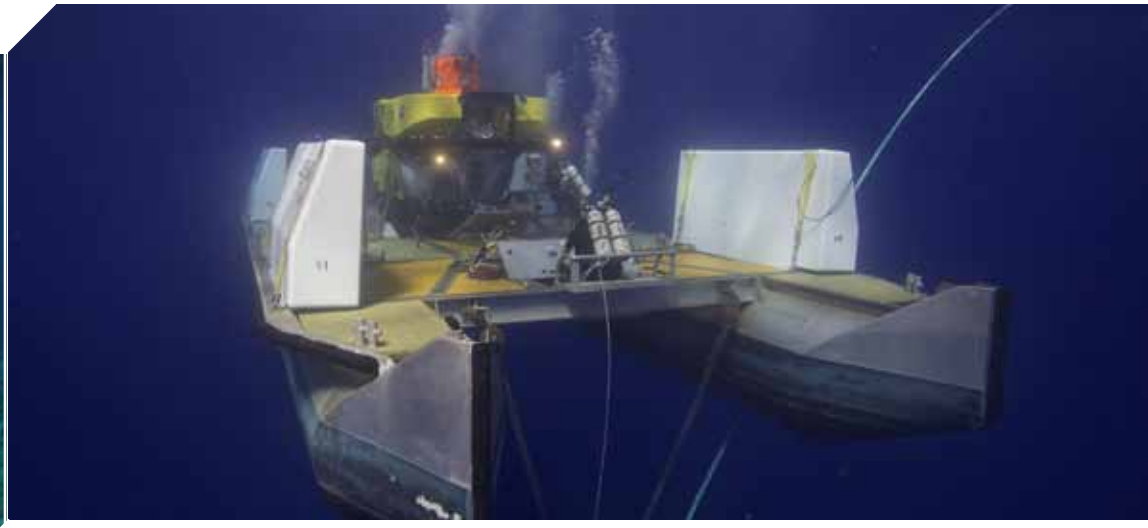
Hawai'i Undersea Research Laboratory (HURL) plays a key role in enabling deep-sea research exploration in the Pacific Ocean. Established through a cooperative agreement between the University of Hawai'i and the National Oceanic and Atmospheric Administration (NOAA), HURL supports NOAA's mission by providing scientists with the tools and expertise they need to investigate the undersea environment, including manned and remotely operated deep-sea submersible vessels.

During deep-sea dives, high-definition video cameras on the submersibles continuously capture images of marine organisms and ecosystems. These unique videos contain information that is of great interest to marine researchers, educators, and filmmakers worldwide. Accordingly, HURL responds to many requests for video footage each year.

Until recently, the videos were scattered across an eclectic collection of external hard drives, DVDs, and four types of tape, and housed in cabinets that consumed valuable floor space—a veritable museum of storage media over the past 30 years. As the accumulated volume of data grew to 30 terabytes, it became increasingly challenging to secure, search, and retrieve specific video data.

If scientists wanted information about a specific marine organism, they sent HURL a request for video records showing the species. It might take HURL staff half a day to find and compile video segments because they first needed to identify the specific dives on which the species had been recorded, find the videos among the disparate storage media, and compile video clips that were finally placed on an FTP server for download. "There was quite a hurdle for someone to access our data because they had ask for something very specific and find one of us to help them satisfy the request," says Rachel Orange, HURL's data manager.

Data security was another concern, highlighted by an incident during a winter holiday when an emergency chemical-wash shower located in a University laboratory flooded a storage cabinet containing HURL tapes and drives on the floor below. Luckily, no data was lost because the drives were stored in zip-sealed plastic bags.



Business, academic, and scientific research organizations need better ways to organize, store, and manage growing volumes of irreplaceable data. HURL is a great example of how a storage solution based on Intel® Xeon® processors can significantly increase the velocity of an organization's mission in the face of ongoing budget constraints.

—Dave Boehmer
Director, Platform Applications Engineering
Intel Corporation

It became obvious that HURL needed a better data-storage system, says John R. Smith, PhD, science director at HURL. "Our vision was to move the data into a storage system that's more secure and makes the data much more accessible—without tying up our resources searching for information that's hard to find or may not exist."

New Solution Unifies Disparate Storage Media

HURL installed a centralized HP X5520 Network-attached Storage* (NAS) system, based on two Intel® Xeon® processors E5620. They scaled the system to manage 48 additional drives on four drive enclosures, for a total of 147 TB of usable storage. The NAS is linked to an HP 2100 Switch* using 10-gigabit Ethernet networking.

The system provides fast data access and multiple levels of data protection, including up to RAID 6, automatic failover, multipath I/O, and redundant power supplies and cooling. HURL simultaneously deployed two HP Z1 Workstations*, each based on Intel® Xeon® processor E3-1245.

HURL has begun transferring their video library to the storage system and uses the powerful workstations to view, edit, and catalog footage using Video Annotation and Reference System (VARS) software, developed at the Monterey Bay Aquarium Research Institute.

Digital Video Enables Rich Environmental Metadata

Using VARS, HURL program biologist Christopher Kelley, PhD, is able to merge video with comprehensive environmental data collected by the submersible's sensors into a single file based on time codes. "More people are interested in information such as the depth, location, temperature, and salinity at which each species was observed, especially in relation to climate change. Researchers look at minute changes in the temperature or oxygen content over time or at different depths" says Kelley. "A lot of these animals, especially in the deeper areas, live in a delicate balance with their environment."

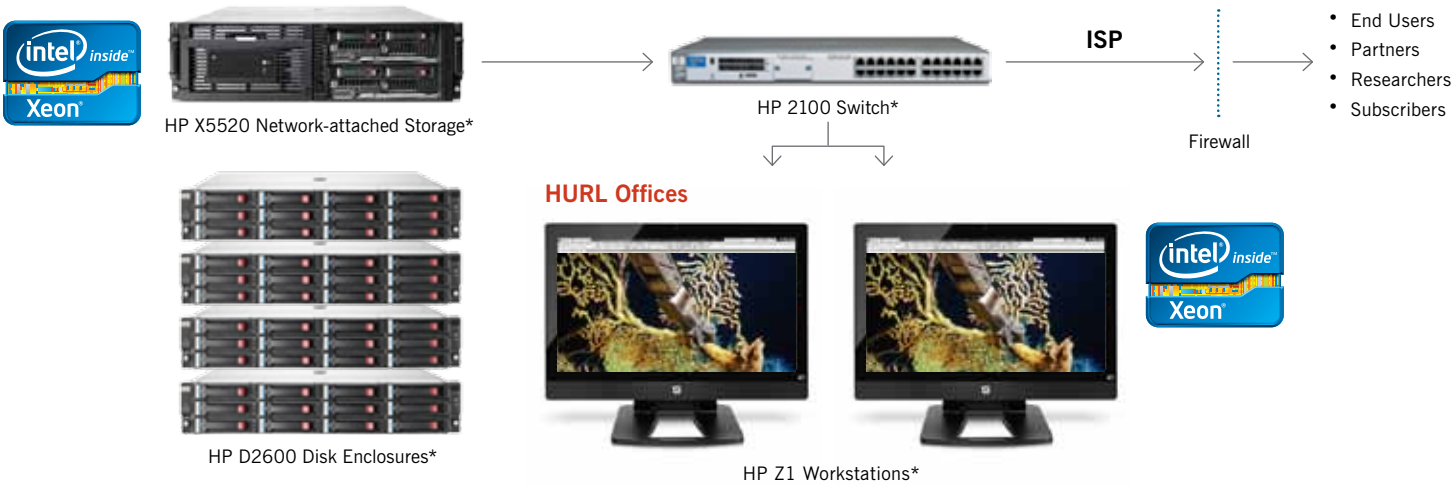
The annotated metadata is automatically added to the catalog and becomes searchable using the workstations. This is particularly beneficial for researchers looking at underwater changes over time. "You can have a video from 30 years ago, but if you don't know what it contains it's of very little use," Orange explains. "When you have it annotated in this way, people can search the database and go straight to the things they're interested in."

Scientists and Educators See the Benefits

In addition to helping scientists identify the video data they need, the solution also enables HURL to respond to requests for data much faster. Orange can immediately view the requested videos on one of the workstations instead of hunting through multiple external drives or enduring painfully slow loading from tapes or optical discs. She can then quickly extract relevant video clips and make them available on an FTP server to the person requesting the data. "A job that previously took half a day now may take only an hour," says Orange.

HURL's Storage System

Rack System in University of Hawai'i Data Center



System Specifications

MODEL	HP X5520 Network-attached Storage* (NAS)	HP D2600 Disk Enclosures* (4)	HP Z1 Workstations* (2)	HP 2100 Switch*
DESCRIPTION	• Intel® Xeon® processor E5620 + Intel® 5520 chipset per X5460sb server blade • Two-node Microsoft Windows* cluster • Microsoft Windows Storage Server 2008R2* • Run virtual machines (VMs) to host archive/search apps and Windows Media Services* for transcoding, on-demand video/live camera feed • 2x 10-GB ports per blade + 1-GB ports can isolate internal/external domains	• 12 drives per enclosure for 147 TB of usable storage • Scalable • Provisioned with 900-GB enterprise SAS drives or 3-TB nearline drives	• Intel® Xeon® processor E3-1245 (3.30 Ghz, 8 MB cache, 4 cores); Intel® C206 chipset • User-oriented searches • Video editing • Cataloging, transcoding management • Backup software: HP Data Protector Express* • Blu-ray* attached for backup	• 10-gigabit Ethernet networking

HURL's Deep Sea Explorations

HURL's submersibles include the three-person vessels Pisces IV and Pisces V, which can explore the ocean at depths up to 2,000 meters, and a new unmanned remotely operated vehicle that can dive to 6,000 meters. Over the past 30 years, HURL's vessels have conducted more than 1,900 dives representing 9,300 hours under water. Highlights include:

- Facilitating 25 years of interdisciplinary study of Lo'ihi submarine volcano by documenting the growth of this new Hawaiian island—including its explosive history, collapse events, tsunami risk, and unique and extreme ecosystems.
- Helping researchers study Hawaiian Monk Seal habitat and discover an estimated 80 new species of corals and sponges in Papahanaumokuakea Marine National Monument in the Northwestern Hawaiian Islands.
- Supporting the research of scientists who found that deep-sea corals are some of the oldest living organisms on Earth. Their innovative approach has shown some gold corals to be more than 2,700 years old, while the ages of some deep-water black corals were found to exceed 4,200 years.
- Discovering the Japanese midget submarine that was identified, fired upon, and sunk by the destroyer USS Ward while it was trying to enter Pearl Harbor just prior to the aerial attack on December 7, 1941, representing the first shot of the U.S. involvement in WWII.
- Performing dives at Eniwetak Atoll in the Marshall Islands to study the environmental effects from the first hydrogen bomb test.
- Facilitating efforts to find Amelia Earhart's lost aircraft in the waters off Nikumaroro, an uninhabited island in the southwestern Pacific republic of Kiribati. In August 2014, Pisces IV and Pisces V will each dive with a pilot and two observers from The International Group for Historic Aircraft Recovery (TIGHAR).

To learn more, visit:

- www.intel.com/go/storage
- www.hp.com
- www.soest.hawaii.edu/HURL

Providing scientists with the ability to search the library may lead to even more widespread use of HURL video resources. "We anticipate that VARS will eventually enable people worldwide to directly query our database via the Internet. If they're looking for a particular organism, they'll be able to find all of the different dives that the organism was observed on, and then they'll be able to target which video they want to look at," Orange says. "The system helps us give everyone the ability to see what lives beneath the ocean in a way that very few people have actually observed."

In addition, the capabilities of the storage system and workstations are attracting other applications within HURL. Using the workstations, researchers can view 3-D fly-throughs to better visualize underwater terrain. Meanwhile, biologist Kelley is building online indexes of taxonomic information and literature, making the system even more valuable to scientists. Other groups at the University of Hawai'i are also requesting use of the system. Says Smith, "With all the headroom, HURL will continue to realize value from this system for years to come."

1 Based on anecdotal reports from HURL staff about data retrieval scenarios before and after installation of the new storage system. The cost reduction scenarios described in this document are intended to enable you to get a better understanding of how the purchase of a given Intel product, combined with a number of situation-specific variables, might affect your future cost and savings. Nothing in this document should be interpreted as either a promise or a contract for a given level of costs.

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