

February 23, 2017
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REMUS 6000

WHOI's Autonomous Deep Water Search System

The Woods Hole Oceanographic Institution (WHOI) REMUS 6000 Autonomous Underwater Vehicle (AUV) represents the latest in advanced deep water search technology. Unlike a towed sonar or an ROV which are tethered to a surface vessel by a long and massive cable, AUVs swim freely and can operate with great

and must navigate, follow terrain, and avoid obstacles autonomously. If something goes wrong, it must sense the problem and take action to return safely to the surface without human intervention.

The system has proven to be highly reliable. Greg Packard, lead engineer for our Amelia Earhart search expedition, says the REMUS on



efficiency. REMUS can dive to a depth of 6,000 meters (nearly 20,000 feet) and can stay down nearly a full day before it must return to the surface for fresh batteries.

Before a dive, called a sortie, the vehicle is given a mission plan by its operators specifying a search pattern and what sensors to use. Once in the water, REMUS is on its own

our expedition has performed 223 successful dives since it was launched.

The AUV can carry a number of sensors, principle of which are a sidescan sonar that can image a wide swath of seafloor with acoustic pulses, and an electronic still camera with strobe lighting. Its sophisticated navigation system includes an inertial system that senses accelerations and an acoustic Doppler sonar that senses velocity. For precision navigation, the system operates within a network of acoustic beacons that act like an underwater GPS. Also, REMUS can communicate with the surface ship to provide tracking and status reports. Unfortunately, it is impossible to send a lot of information over acoustic links, so the

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Plan of the Day February 23, 2017

- 0001-2400** Transit.
- 0800** All Hands, Sea Porch
- 0900** SEA School: Ops Center, Jon.
- 1000** Daily Progress Meeting, Ops Ctr.
- 1015** Nav Analysis Meeting, Ops Ctr.
- 1500** SEA School: Ops Center, Jon.



Captain Spencer King Operations Manager

For a young Spencer King, the Swan Island shipyard in Portland was a playground. He loved the smell and it stuck with him until adulthood. He went from crawling around the dismantled ships, to the Naval ROTC at Oregon State where he studied Ocean Engineering.

His school years melted away and Spence became a deep-sea diving officer for the US Navy. He spent twenty years in the Navy and

was stationed in San Diego, Pearl Harbor, and Sasebo, Japan. Spence commanded the salvage ship USS Brunswick (ATS-3) and he taught Senior Naval Officers at the Naval Command College. After the Navy, Spence became a cruise ship captain for five years. He was in charge of small high-end cruises of just 49 passengers each. On the trips from Maine to Florida, he would often give talks on all of the exciting Nauticos projects. Now working for Nauticos, he tells stories about the cruises.

The first time Spence met Dave Jourdan was in 1995, the day they found I-52. Surrounded by members of the media, Dave broke away for just enough time to ask Spence if they could meet again at another time. Now Spence is the Operations Manager for Nauticos. His job involved assembling the team and the equipment for our search.

When he's not working on the water, Spence can be found playing on the water on their sailboat or on the beaches in Florida with his wife Kathleen. Spence has three kids. Nolan and Ryan are both in the Navy, and though Spence highly encouraged his daughter, Amanda, to join the Marines, she chose Loyola and is now a nurse practitioner.



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operators must wait until the vehicle returns to the surface and is recovered aboard to download sonar and optical imagery for analysis.

Greg is supported by engineers Neil McPhee, Mark Dennet, and Christopher Griner who must wrangle the 12-foot long one-ton torpedo shaped vehicle out of the water using an articulated launch and recovery frame. Once on board, the system is winched into a container van where the team immediately begins preparing it for the next dive. Sonar data is downloaded; the camera is swapped with the spare (so images can be downloaded in the lab); the batteries are swapped for a freshly charged set; and a new mission sortie plan is uploaded into the vehicle's memory. Within two hours, the system is ready to be launched on another dive to the deep.

Survey Commencement. We expect to arrive in the survey area on Saturday late in the day. The plan is to go right to work.

Navigation Analysis Meeting. This is a technical meeting for survey planners to review the selection basis for new areas to be

searched, and ensure that new information is evaluated and included in the search area selection.



Today's Abandon Ship Drill

LESSONS LEARNED.

"Preparation, I have often said, is rightly two-thirds of any venture."
— Amelia Earhart

So if that's how she felt, then Spence says "Lessons Learned are rightly three-fourths of any mission plan." The Lessons Learned in 2006 were very helpful in ramping up this mission in short order. These were the things we learned in 2006 that we would do differently next time, or the things that worked so well that they should be done again. Since we have this leisurely transit, it would be a great time to write down those Lessons Learned while they are fresh in your mind. We have completed Pre-mobilization, Travel and Mobilization phases of

the AE III mission. Please send these to Spence. Please and thank you.

Category: (Phase of mission) [i.e., Pre-mobilization, Travel, Mobilization, Survey, De-mobilization, Travel, Post-Mission.]

Title: (Descriptive title)

Abstract: (Single sentence)

Discussion: (A paragraph or two describing the problem, consequences, remediation.)

MERMAID CLASSIFIEDS

PERSONALS 100

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WANTED 200

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