



Meridian Passages

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Bringing Home the INS DAKAR

NAUTICOS Returns to the Site of the DAKAR to Recover the Sail and Determine Cause of Sinking

In this issue:

- Return to the DAKAR Site
- Nauticos News
- Employee Spotlight

When Nauticos found the missing Israeli submarine, DAKAR, in May of 1999, there were still many unanswered questions. What had made the submarine sink? Had it been hit by a passing ship? Had it been sunk by enemy fire at the end of the Six Day War? Was there a diving accident?

The Israeli Navy asked Nauticos to return to the site of the DAKAR to objectively and scientifically

determine the fate of the submarine, to conduct a forensic investigation into the cause of the loss, and to recover the detached forward section of the submarine's sail to be used as a memorial in Haifa.

Planning

Months before the mission, marine forensics expert, Robin Williams, joined the team to determine what information to gather in order to answer questions about the sinking of

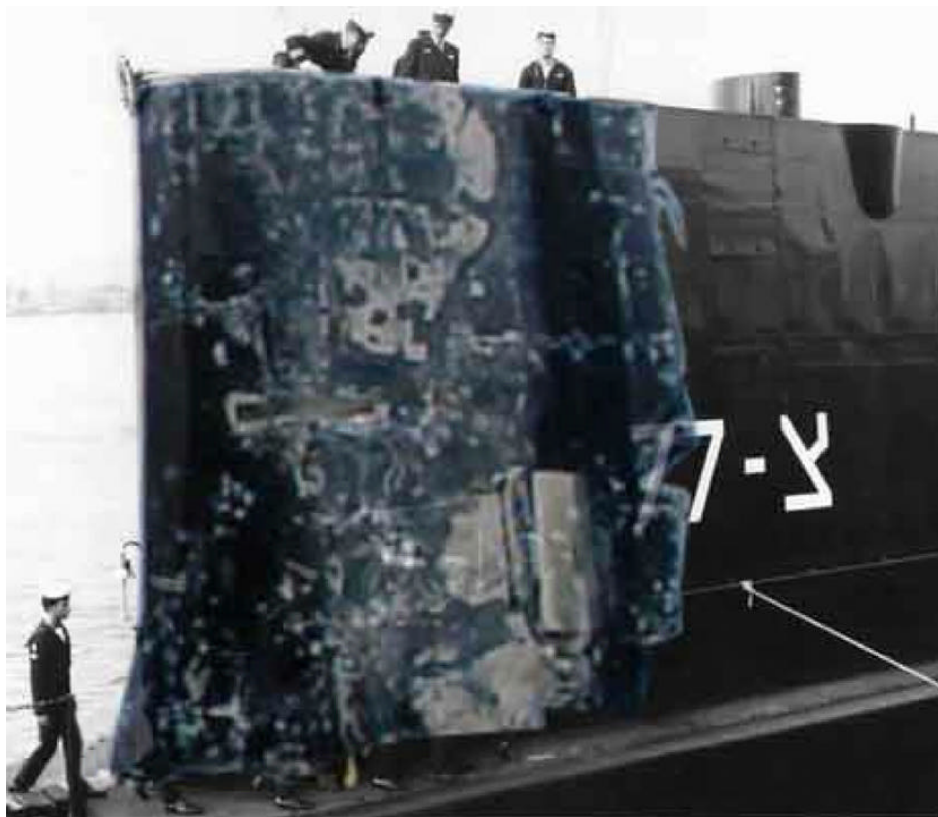
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DAKAR Sail Recovered by Nauticos Team



Recovered Section of Sail Superimposed onto a 1968 Photo of DAKAR

the submarine. Nauticos and the team of experts created a plan to collect all the necessary data to answer these questions.

Salvage

One of the interesting things discovered in the first mission was that the forward third of the sail was found separated from the wreck by 100 meters. The DAKAR's sail had been customized with a 10-man escape chamber with a ladder to allow divers to exit the submarine through the bridge while submerged. This unique feature, coincidentally, was the one item that had positively identified the wreck as the DAKAR. Nauticos had theorized that the escape chamber had imploded during the sinking, and the force of the implosion had expelled the leading edge of the sail before the submarine hit the sea floor.

Because the weather was so perfect, plans were made to recover the sail early in the mission; but this was no

small task! Although reportedly constructed mostly of aluminum, the sail was quite large, weighed four tons, and was at a depth of nearly 10,000 feet! Nevertheless, the salvage was conducted in a short time using mostly off-the-shelf equipment carried to the ocean bottom in a simple custom recovery basket.

Using video records from the 1999 discovery, the team planned to recover the sail using several potential lifting points. The REMORA 6000 ROV (Remotely Operated Vehicle), operated by subcontractor Phoenix International, dove on the first day to conduct close-in imaging and provide a short orientation period for the ROV pilots who sat in the control van aboard ship. The pilots easily navigated the ROV to the site of the detached sail using Remora's forward-looking scanning sonar, dead-reckoning, and a map of the debris field made on the first mission. Once the sail was inspected in detail, the best method

of lift-line attachment was evident and the ROV was brought to the surface to be rigged with the first stage of lifting equipment. More lifting gear was loaded onto the recovery basket including a 4-kilometer length of Dyneema Rope, an incredibly strong, slender, and positively buoyant polyester line. The rope was attached to a 10-ton crane and nitrogen-filled, 5-ton-rated motion compensator. The line was then spooled onto a 220-ton-capacity towing winch aboard the ship.

The ROV was launched over the port side, and the recovery basket deployed using a 10-ton mobile crane on the stern. Descent to the bottom was carefully monitored to prevent possible entanglement of the equipment.

After landing the recovery basket, the ROV navigated back to the sail and began rigging it for the lift using its manipulator arms to attach T-handled beam clamps. The ROV returned to the lift basket, pulled out the figure-eighted Dyneema lift line and rigged it to the beam clamps.

continued at bottom of page 3

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Nauticos News & Information

NAUTICOS RECEIVES ACCOLADES FROM NAVY CUSTOMER

Our West Coast team recently received rave reviews from the Navy! 2001 was a roaring success for the "Shark Team." Their "Mission 2001" was overwhelmingly successful. "Their hardware, software, and peopleware performed flawlessly. This nation has entered a time of renewed patriotism and you are all true patriots!" the customer exclaimed in a recent email to the staff. Well done!

DAKAR FAMILIES BRIEFED

One of the most rewarding events at Nauticos has been the appreciation expressed by the Israeli families of those lost at sea. This January the Israeli government briefed the families on the findings of our recent DAKAR mission. Although the submarine was lost 34 years ago, the memories of the crew are still alive. The thank you letters and emails have been very heartwarming.

NEW FACES AT NAUTICOS

Each newsletter finds at least one new person at Nauticos, and this time it is **Julie Smith**. Julie will be an analyst at our Navy office here in Washington, D.C.

Another addition to the Nauticos "family" is newborn **Mathew John**, born to Nauticos software engineer **John Galleher** and his wife **Carolyn** in December. Welcome Aboard, Julie and Mathew!

ACES TEACHERS AND STUDENT INTERNS AT NAUTICOS

For the past six years we have hosted an ACES Teacher's night at Nauticos. ACES is a program where teachers visit local businesses and are briefed on the workplace, so that they can better prepare their students. Each year the Howard County teachers kindly tell us that we were their most interesting destination.

Nauticos employees volunteer their time to do short presentations, and this year an overwhelming favorite

was our Hammond High intern, **Heather Brundage**. She is being mentored by our software engineer **Mike Davis**. Over the course of the year Mike has had Heather assist him in everything from designing electronics to soldering LED's for use on our search system, NOMAD. Heather has recently been accepted to M.I.T. Congratulations, Heather!



Heather Brandishes a Soldering Iron

continued from page 2

After hours of tedious work, with everything well secured, the sail was lifted off the bottom and moved slowly through the water. The ROV was pulled in at the same rate with its cameras monitoring the four-ton sail's progress.

Nine hours later the sail arrived at the surface, was lifted over the stern of the ship, and was secured in a vertical position for inspection and preservation. When Tom Dettweiler climbed the ladder of the sail to attach the lines that would secure it for the ride home to Haifa, he was struck by the fact that this was the first time anyone had stood on this bridge in more than 32 years.

Forensic Analysis

The ROV was then reconfigured to collect horizontal video imagery of the entire main-hull. A flexible probe was rigged with lights and a camera to photograph the interior of the submarine. Water samples of the interior were taken in the same way. Hundreds of photographs were taken and a photo mosaic was created outlining the entire wreck.

In the months of analysis that followed the mission it was determined that the submarine had been proceeding unhindered on course to the port of Haifa. Structural analysis of the hull showed no marks of collision, and that the most likely cause of sinking was simply a diving

accident, complicated by flooding in the forward compartment.

The vessel pitched forward in a steep and rapid dive, which could not be controlled by planes, propulsion, or blowing tanks. Despite the best efforts of the crew the vessel exceeded crush depth and the hull imploded catastrophically.

For the crew of the DAKAR those last seconds before the hull collapsed would have been very busy with all working as a team to try to save the vessel. In their honor, a plaque was left on the bow of the wreck:

"To the Men of DAKAR ... Never Forgotten."

Tom Dettweiler





Jeff Palshook came to work at Nauticos after attending a symposium on underwater Archaeology in the Great Lakes during the summer of 1997. While he was there, Jeff was intrigued by a lecture given by Nauticos vice president, Tom Dettweiler. A few months later, Jeff joined the Nauticos team.

Prior to joining Nauticos, Jeff spent nine years as Nuclear Submarine officer, serving aboard the USS Boston and the USS Polk. He was also a technical instructor at the Naval Nuclear Power School, where he taught a college level engineering course. Jeff earned his under graduate degree from University of Michigan. He went on to earn two master degrees, the first in Atmospheric and Space Sciences (Remote Sensing concentration) and the other in

Naval Architecture and Marine Engineering.

For the past four years, Jeff has been involved in Nauticos' *RENAV* analysis, a tool that we use for Navy submarine navigation and for our ocean discovery projects. Jeff performed the *RENAV* analysis for the search for the Japanese aircraft carrier, KAGA (sunk at the Battle of Midway), and participated in the at-sea operations for the successful search. He appeared on television in the Nauticos documentary of this discovery, *The Search for the Japanese Fleet*, which aired on The Discovery Channel in December 1999.

Jeff's newest *RENAV* project is the analysis for the Amelia Earhart Discovery project. Starting with data provided by pilot Elgen Long's years of research, and integrating the work of the Collins Radio and other analysts, Jeff has been busy narrowing down the search area for Amelia's Lockheed Electra. Nauticos plans to conduct the search this Spring.



Jeff at Midway Island

Jeff is originally from Richfield, Ohio (half way between Cleveland and Akron), where his parents, Pete and Helen Palshook, raised their three children, Gayle, Marcia and Jeff. Jeff returns home every August for blackberry picking. There is nothing better than his mother's fresh baked blackberry pie. Jeff enjoys reading, hiking and scuba diving, and he is an eligible bachelor!

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