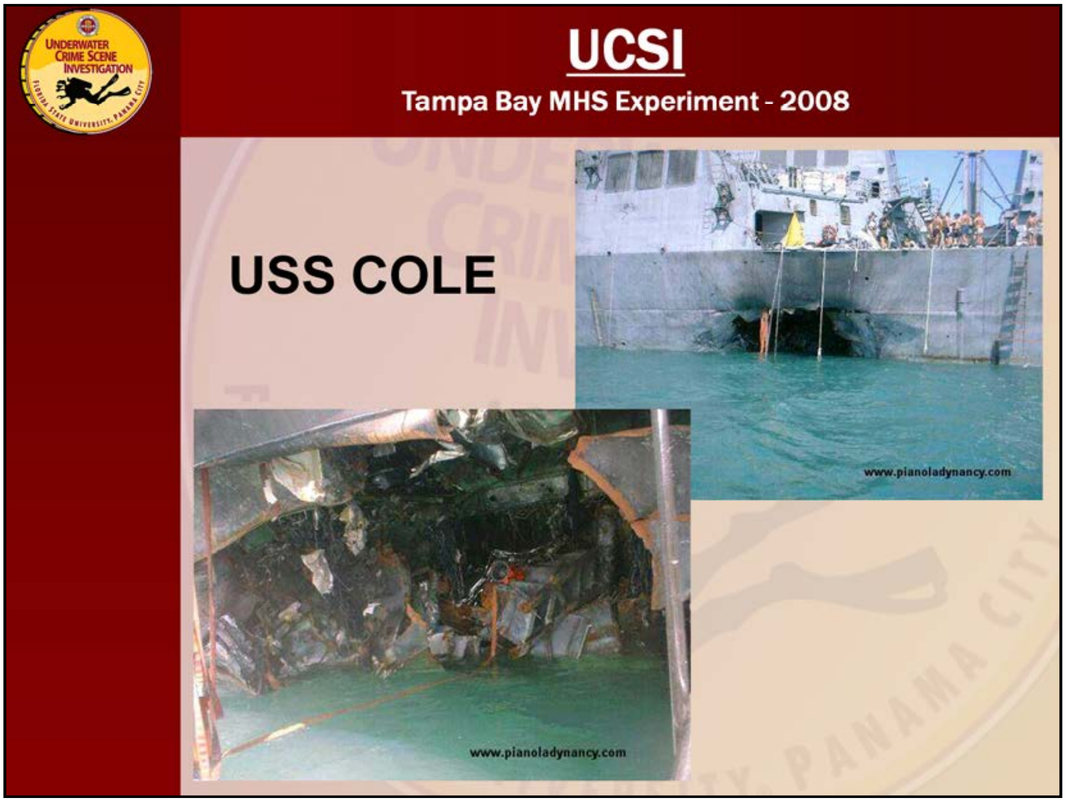
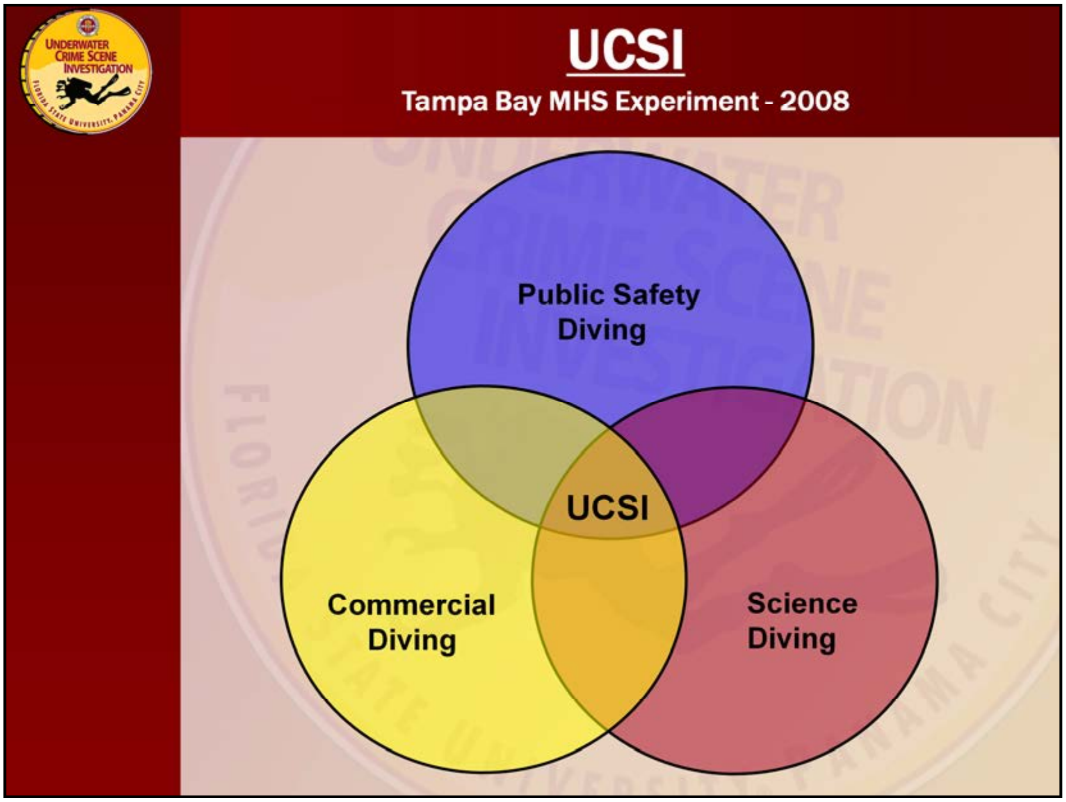

fsu
PANAMA CITY
UNDERWATER
CRIME SCENE
INV
Underwater Crime
Scene Investigation

This talk will discuss the use of the Videoray ROV in a Maritime Homeland Security Experiment in Tampa Bay this past summer. The MHS experiments are multiagency operations that are meant to test our ability to respond to a variety of threats, and to gauge the ability of different Federal, state, municipal, and military agencies to coordinate a response to an incident. During this talk, I will cover the role we played in the experiment, how the Videoray was deployed, some of the challenges we encountered, and a few of the lessons we learned. But first, I would like to quickly explain who "we" are for those of you who are not familiar with UCSI.

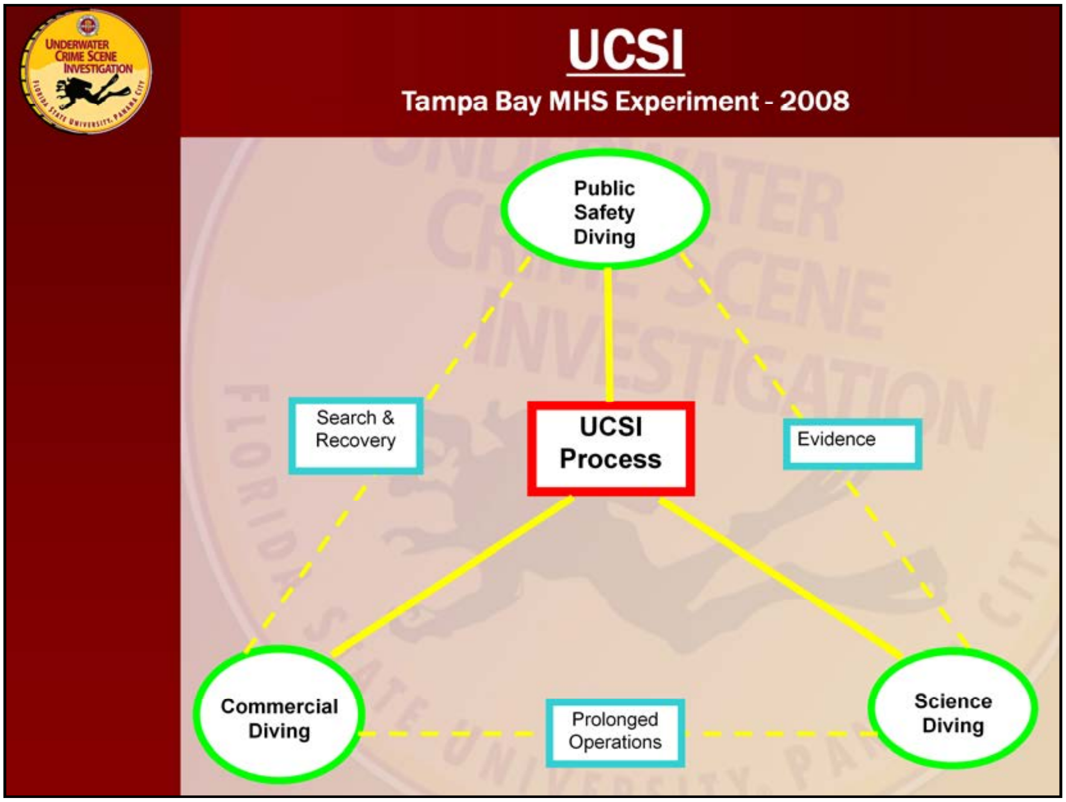
Many of the individuals who are involved in criminal activities tend to use an aquatic environment as a safe haven to hide the evidence of their crimes. Additionally, a number of accidents and criminal activities occur on the water. The collection of evidence from an aquatic environment is just as critical is the proper collection of evidence performed on land when investigating Boating, Diving and Drowning.



The need for establishing the techniques for bringing crime scene investigative skills to the submerged environment was somewhat highlighted in the bombing of the USS Cole. While materials associated with the incident were effectively covered, the use of these materials as evidence in a court of law may have been questionable due to the lack of a standard system for collecting submerged materials, techniques for properly handling them, and procedures for maintaining the proper chain of custody. It was the discussion of these issues during a backyard fishfry that led to conception of UCSI.



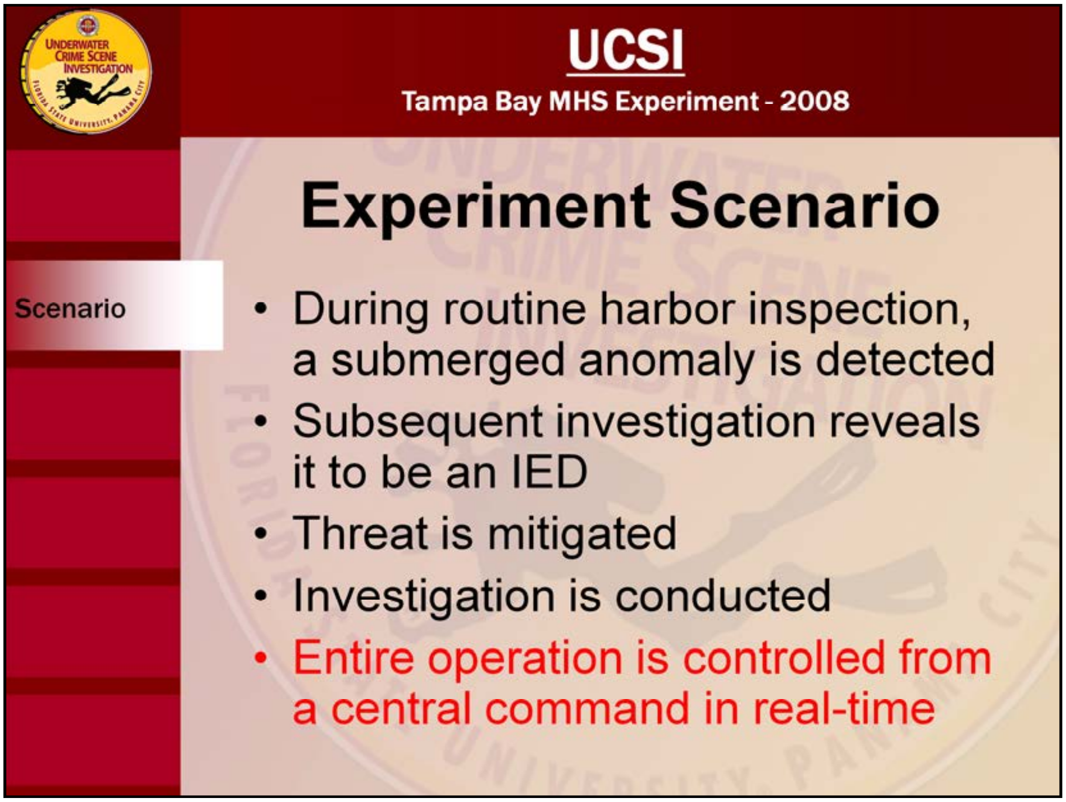
This Venn diagram demonstrates the conceptual approach taken in the development of UCSI. Instead of creating something entirely new and independent, the initial program sought to combine the most relevant aspects of established diving disciplines. The three areas involved were science diving, commercial diving, and public safety diving, each bringing a significant component to the table. Science diving provided the background in underwater data collection, advanced undersea technologies, and aquatic scene documentation. Commercial diving provided the advanced dive training and skills for more sophisticated underwater operations. And public safety diving brought in the law enforcement component, which provided the expertise and experience in the search and recovery of evidential materials. Experts from each of these disciplines were recruited and utilized to develop the UCSI process.



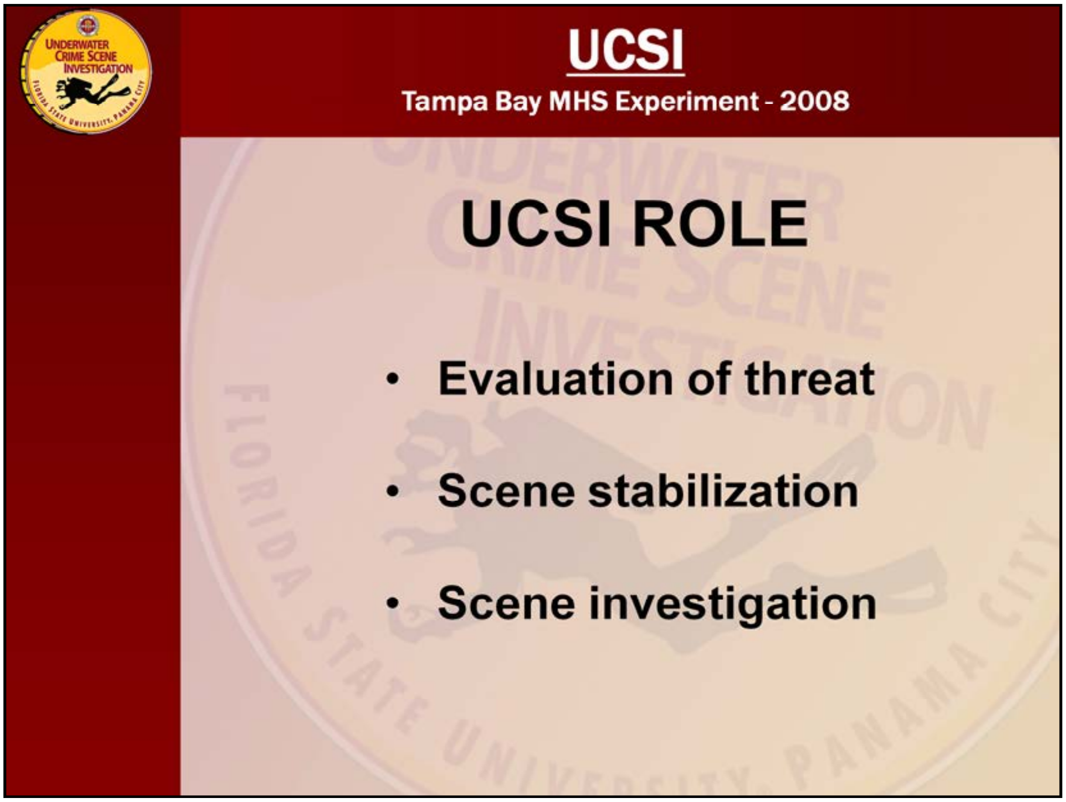
The UCSI process, anchored in its parent disciplines, established the basic procedures and techniques for investigating the submerged crime scene. The process used the combined tools of science diving, public safety diving, and commercial diving to conduct prolonged investigations in challenging environments for the purpose of locating, documenting, and recovering evidence in a manner that credible and legal manner for the courts. This process was fully described in the recently published UCSI Protocols Manual. The development of the UCSI protocols was initially supported by a grant from the Defense Threat Reduction Agency (DTRA). The first UCSI team was tasked with identifying the tools and developing the techniques for conducting underwater investigations, and to demonstrate them at a multiagency exercise in Niceville, FL. A key component of their task was to train an existing public law enforcement team to serve as the underwater investigators for the operation.

The DTRA exercise at Niceville involved teams from the military, local law enforcement and first responders, as well as a number of other players such as ourselves. The scenario involved the release of an unknown, but deadly, contaminant into the air from a barge in Niceville's harbor. A significant component of the exercise was that evidence associated with the event was submerged in the water at some point, necessitating the work of an underwater investigative team.

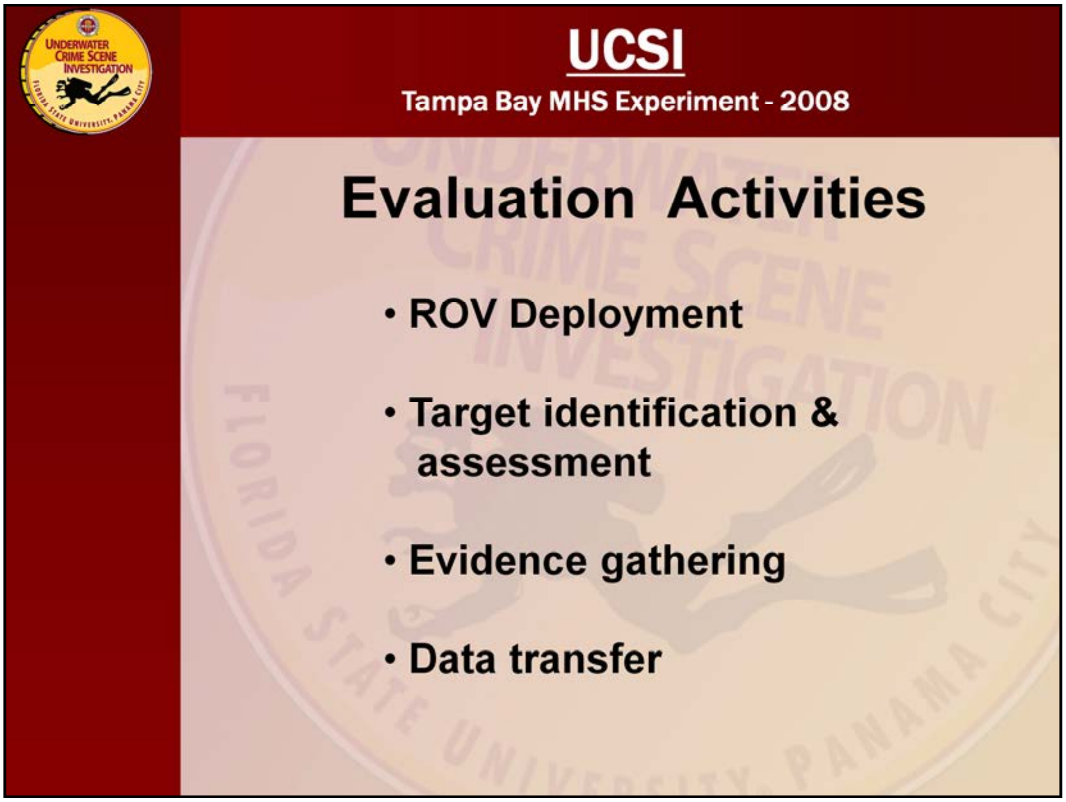
A very large wrinkle in the operation was the HAZMAT situation, which necessitated the divers to be fully encapsulated to be protected from potential contamination. This slowed down the operation, and increased the level of difficulty experienced by the divers in performing their investigative functions. While the forensic divers did a great job, it was determined that the use of remotely operated technologies in hostile environments would greatly alleviate the pressure on the divers. Such technology would not necessarily preclude the use of divers, but it would greatly facilitate their efforts and expedite the investigation. This background is important because the MHS experiment in Tampa was a continuation of the DTRA effort.



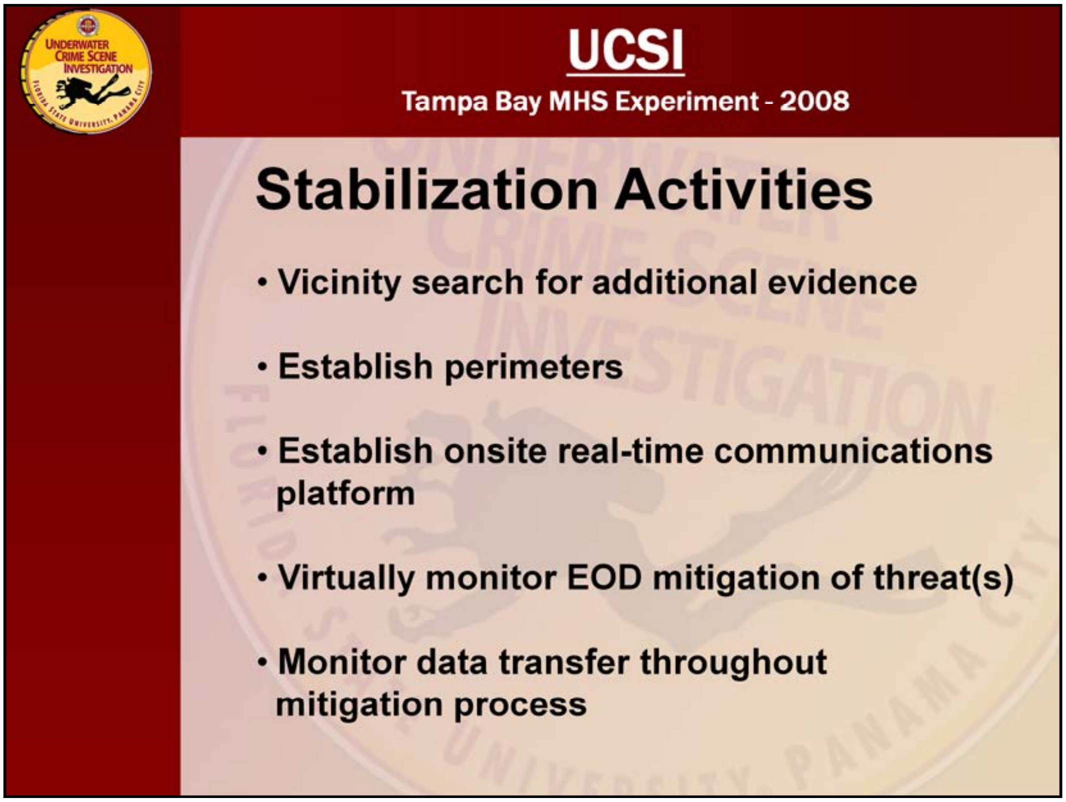
The Tampa Maritime Homeland Security Experiment presented a new scenario as well as some adjusted goals. This is reflected in it being referred to as an experiment rather than an exercise. The focus was upon testing the tools and techniques that may be employed by various agencies, and testing the Incident Command System that would be used to coordinate a multiagency effort. The new scenario involved the planting of a submerged IED by unknown agents in the channel leading into the harbors of Tampa Bay. The agencies involved in this experiment included Naval Surface Warfare, EOD, UCSI, the local Coast Guard station, and others.



The UCSI team was to perform three primary functions. First was a close inspection of the device to evaluate the threat and initiate the investigation. We were also to identify the extent of the scene and stabilize it, seeking to preserve or document as much evidence as possible through the threat mitigation process. Our overall task was to conduct the investigation of the incident site, which reached from the initial identification of the threat through the mitigation phase and into the follow-up activities. The behind-the-scenes focus of the UCSI team for this operation was not so much the development of diving capabilities, but was upon the use of technology to alleviate the burden of the divers as well as greatly increasing safety.

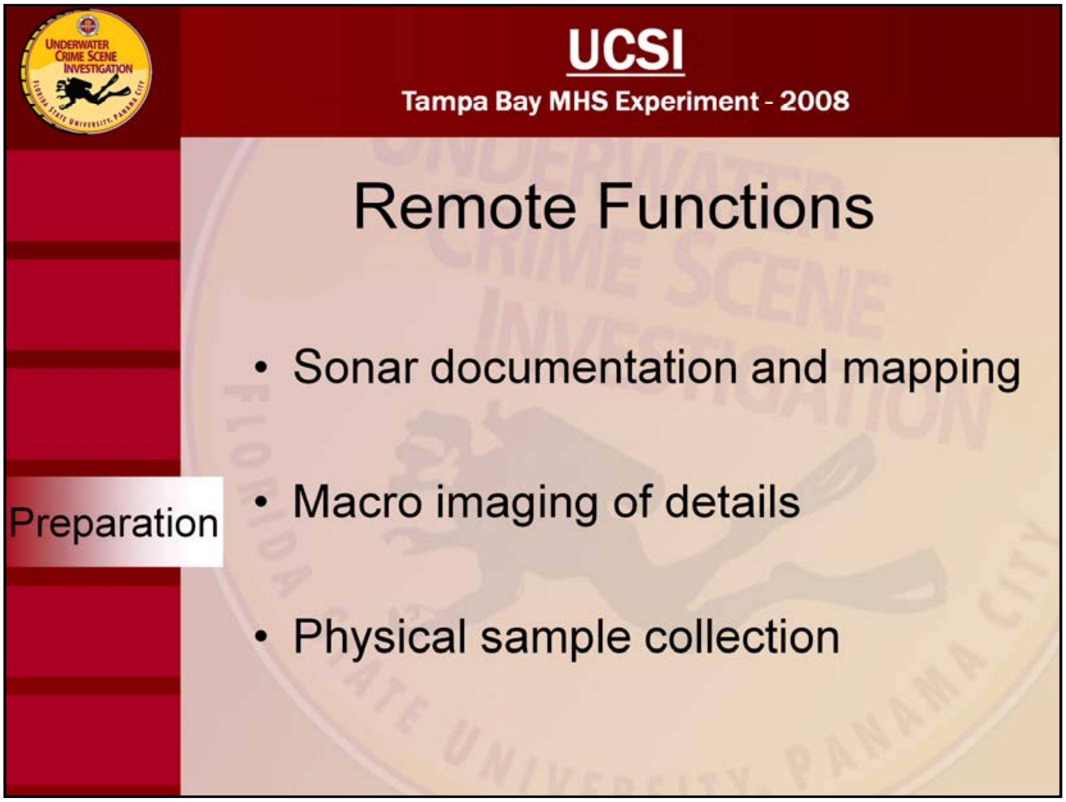


A large portion of activities involved the use of remote sensing technologies. This was due to the hazard posed by the device in the simulation. In real-world situations, divers from our team would not enter the water when unexploded ordnance is involved. Therefore, until the EOD mitigation of the threat was completed, our operations involved using sonar and ROVs to complete are initial tasks. Another facet of the evaluation phase was the identification and preservation of any evidence found associated with the IED. This provided a significant challenge to overcome.



The scene stabilization was rather straightforward, and much of this activity was shared amongst the agencies involved. The AUVs deployed by the Navy did almost all of the necessary data gathering to facilitate this process. The significant feature of this phase was the sharing of information between the agencies to facilitate the planning and coordination of subsequent activities. The evaluation of this transfer of information up the chain-of-command to the Incident Command Post and that back down to the various players was one of the key objectives of the experiment. Some of these activities were simulated because the focus of the exercise was on the testing of specific elements.

While investigative activities were initiated at the outset of the incident, and a number occurred simultaneously with the execution of other components of the exercise, the post-mitigation actions wrapped up the investigative process. This involved the deployment of forensic divers to conduct the final documentation of the scene and recover any remaining evidence. This was done in coordination with the other agencies, synthesizing the information generated by the AUVs, the Videoray, sonar equipment, and EOD divers to provide the best overview of the site possible and thereby facilitate the final investigation.



Several key functions were identified to be conducted remotely. First, we determined that acoustically mapping the site would provide a great deal of information without deploying divers, as well as assist in the navigation of the ROV and the later deployment of divers. This was a fairly straightforward need that did not require the development of anything special. The use of a multibeam sonar from Didson covered this need. The macro imaging of evidential features was another matter, and did require some effort at putting something together. The last function was to physically gather samples using the ROV, which turned out to be a rather simple operation.

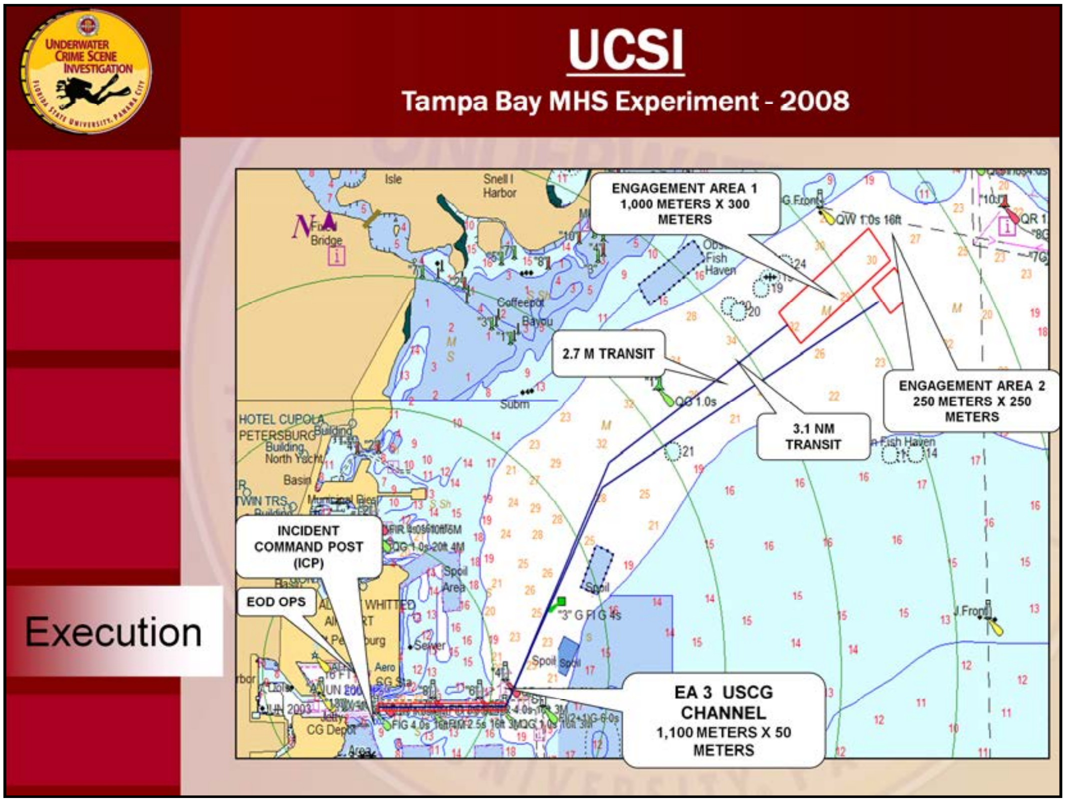
To obtain a macro image using the technology we had at hand, we initially sought to build an optical magnifier using a submersible drop camera. We built a housing for three lenses that were optimally placed to achieve the level of magnification desired, and secured the lenses within it. The housing was then secured to the camera and mounted underneath the Videoray. The cable for the camera was to be whipped to the ROV tether to reduce entanglement hazards. While the system provided the imaging we desired, we identified two major problems during testing. One was that the system was cumbersome, and would require an independent monitor that would be attached to an independent recorder. The images would then have to be retrieved from the recorder and uploaded into the Command network. The other problem was that the housing leaked due to a failure to seal it properly. Though neither problem was defeating, they both presented a great deal of more work beforehand and a high potential for in-field troubleshooting being required during the exercise. It was during this test that I took the Videoray and held a lens in front of its camera to view a fingerprint on a target in the water. This provided a fairly good image, one that we could potentially work with. We determined that while mounting magnifying lenses in front of the camera would get the macro image we desired, it would inhibit visually piloting the Videoray. This is where idea of a lever system to raise and lower the lenses into view came into being.

Using brass, one of our students tooled the system of levers that would raise and lower the lenses. The levers would be actuated by the manipulator arm of the Videoray Pro III, raising and lowering as the claw opened and closed. One interesting issue was that we had to mount the arm backwards on the ROV in order for the levers to work as we designed them.

The lever system was mounted to the skids of the ROV. We attempted to streamline their placement as much as possible to reduce drag issues and fouling problems. We also wanted to be as economical in our used of brass as possible, because we were adding a significant amount of weight to the Videoray, and we did not have the larger float block available!

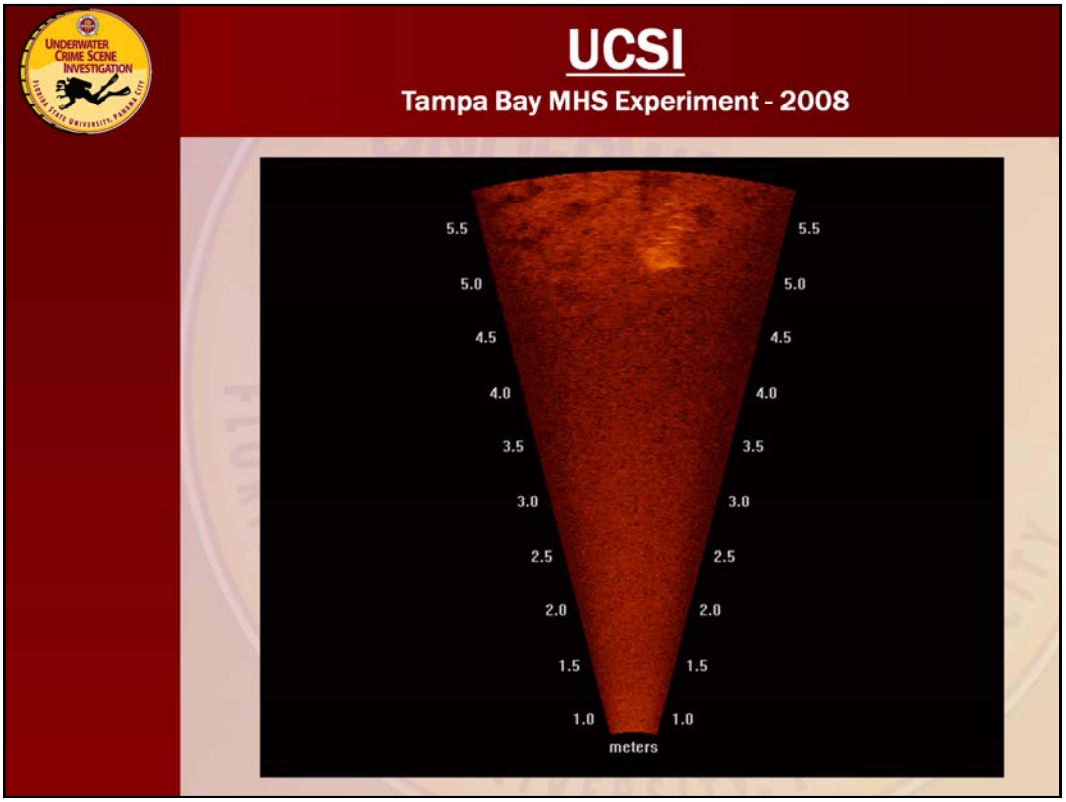
Even so, we had to add some buoyancy to the starboard side of the ROV. She was only slightly negative, but the Videoray had one heck of a list to starboard because of the brass. The magnifier itself consisted of two pairs of lenses mounted in rings that could be adjusted along the lever arm for optimal magnification.

An additional benefit was that the magnifier could be adjusted along a ninety degree range to optimize the viewing of oblique surfaces. The arm could be switched to operate in the top ninety range, from overhead to straight ahead, or in the lower ninety range, from straight down to straight ahead.



After the weather spun off of Hurricane Gustav cleared the area, we set about the exercise. We operated out of the port of St Petersburg, near the USCG station. The incident commander for the exercise was the Captain of the Port, and the ICP was housed at the station. There were three engagement areas in which various aspects of the operation were conducted on the water. The primary area for the scenario was Engagement Area Two, where the mock IED and debris field were planted. The area was surveyed several times using AUVs, both before and after the IED and debris were planted. This was to provide a baseline for comparison and simulate the “discovery” of something that did not belong there. The position of the targets were relayed to the UCSI team by the AUV unit through the ICP.

We deployed to the site to investigate the “anomaly” that had been located by the AUV survey. A polemount was used to deploy the multibeam sonar, which was used to locate the target and navigate the ROV to the device.



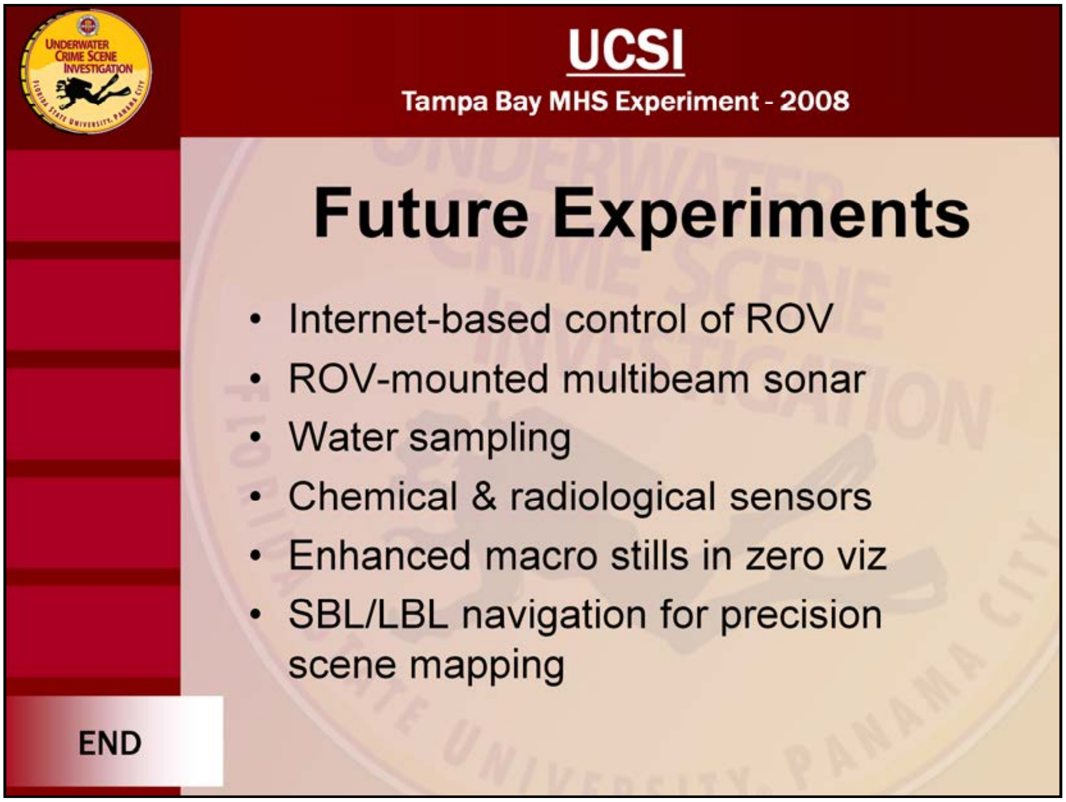
This footage displays the IED as detected by the Didson. You can see that the survey boat was positioned within five meters of the device, closer than we had planned. In a real-world situation, we would have repositioned the vessel further away, just in case the ROV detonated the device during its inspection of it.

Here are some enhanced images of the IED in the water. The Navy had provided an underwater photographer to document various aspects of the exercise, and these are some of the better images she captured, You can see here that there is a significant amount of material in the water cutting down on visibility. This was another of our concerns, which we hoped the magnifier would deal with. A variety of serial numbers and other identifying marks were present on the device. Additionally, we marked the surface of the device with fingerprints in a material that was not water soluble.

The magnifier worked extraordinarily well in obtaining macro images. Screen captures of the video pulled from the Videoray were relayed to the ICP and the mobile forensics lab onshore. Sufficient details were identifiable in several of the print images for the purposes of comparison. However, we identified one shortcoming—the need for a scale to properly reference the size of the print so it could be properly processed. The solution to this is straightforward. We plan to mount a laser to provide a visual reference on the surface on which the print is observed.

For the second objective of our ROV operations, we used the Videoray Scout. The Scout was used to obtain the swab sample of a substance detected during the first inspection. We selected the Scout due to the simplicity of the operation, and we did not want to conduct a lot of field maintenance to reconfigure the Pro III for this phase of the operation. To obtain the sample, we mounted the sampler from a field test kit to the end of a small fiberglass rod. It was positioned to be just within the FOV of the Scout, so the operator could see where the swab contacted the substance.

This movie clip shows the view from the Videoray Scout outfitted with the swab for gathering a sample of residue from the submerged IED. The residue was Vaseline impregnated with TNT residue, and the swab was part of a field test kit for explosive materials. Though piloting the ROV into position for scraping off a sample was difficult, we were able to gather enough residue for testing. In future iterations of this activity, we would look to use a more rigid mount for the swab to facilitate the sampling process.



In the end, the Videoray performed remarkably well during the exercise. It allowed the team to accomplish its tasks of information gathering, target evaluation, and initial evidence collection without exposing divers to any unnecessary risks. We anticipate deploying the Videoray in several more of these exercises over the next two years. In doing this, we plan to expand on the capabilities that were demonstrated in Tampa by highlighting other features of the Videoray. The foremost of these is the control of the Videoray through internet protocols. In so doing, we want to have ROV operators in the ICP taking control of the Videoray onsite for the completion of certain tasks.

QUESTIONS???

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