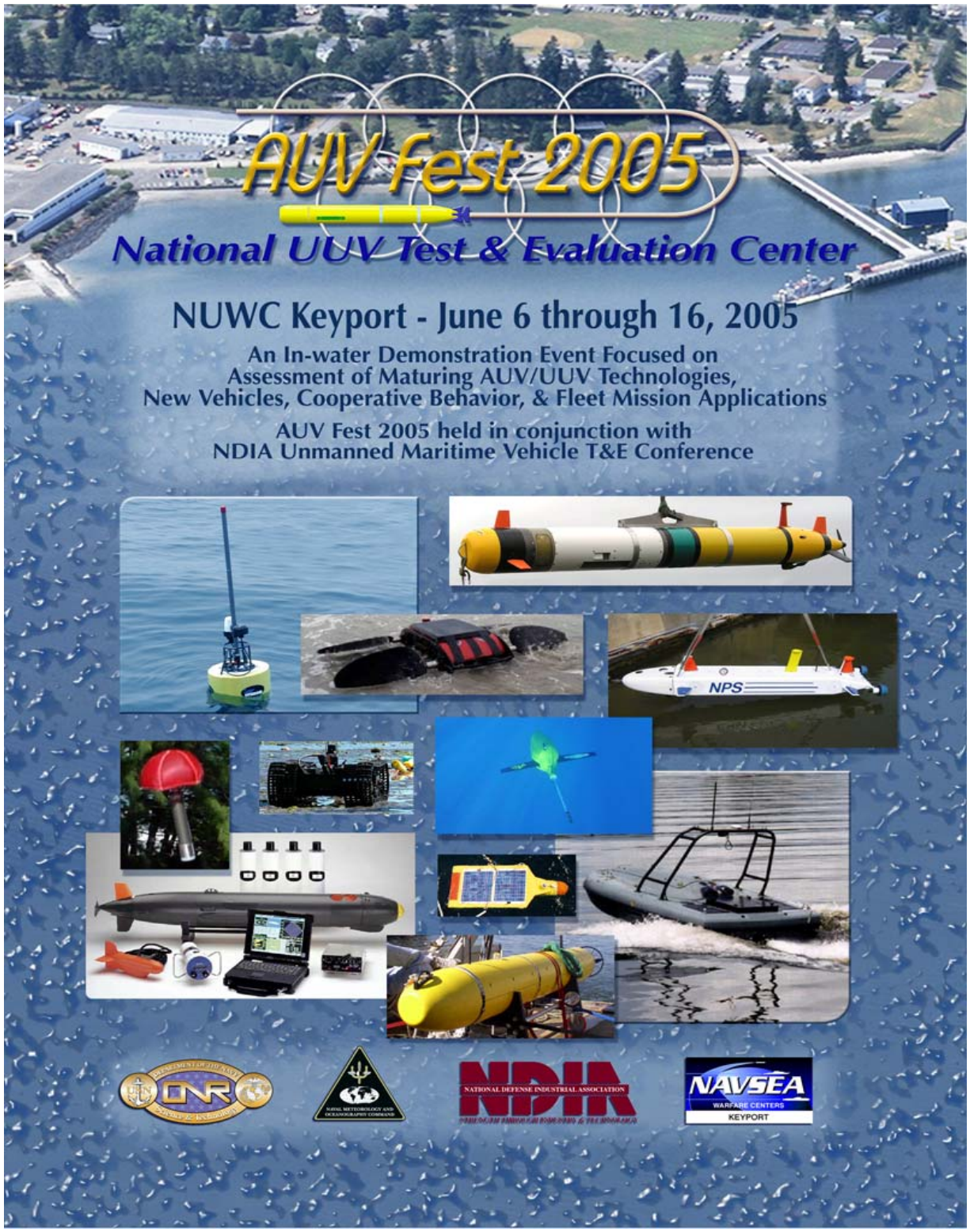
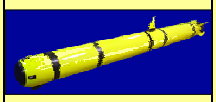
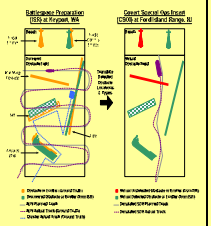
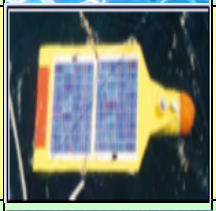
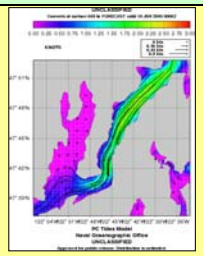


AUV Fest 2005: Technologies

Project Info	Picture	What it Does	How it Works	Standout Talent
REMUS-600 UUV [Remote Environmental Monitoring Units] Woods Hole Oceanographic Institution		Very long range search, survey, and target identification, with the ability to localize proud and buried targets.	**REMUS-600**: 5 kW rechargeable Li-Ion Battery, Inertial Navigation, 600 meter depth rating, acoustic modem, wireless network and Iridium communications, GPS, Doppler Velocity Log.	**REMUS-600:** Endurance, Navigation, and reliability. Ease of operation is similar to field proven REMUS-100. Stability control is ideal for SAS imaging.
SSAM [Small Synthetic Aperture Minehunter] installed on a REMUS-600 UUV **NSWC Pan. City**	 SSAM: A specialized payload of the REMUS-600, above	Combines synthetic aperture sonar (SAS), CAD/CAC and UUV technologies to detect, classify, and localize proud and buried targets.	System records high frequency (HF) and broadband low frequency (BBLF) SAS data while executing predefined UUV search patterns. Post mission, the data is retrieved and processed to generate very high-resolution HF and BBLF underwater imagery. The imagery is then fed into CAD/CAC algorithms for automated detection, classification, and localization of proud and buried contacts.	The **SSAM** system provides underwater imagery resolution previously nonexistent in its size class.
MARV [Mid-sized Autonomous Research Vehicle] **NUWC Newport**		Serves as a research platform for various payloads undergoing testing	Conducts a search pattern over an area of interest using various payloads to satisfy mission or testing requirements. Payloads include chemical sensors and color video. Capable of communicating with other vehicles and conducting joint exercises.	Payload flexibility allows execution of multiple missions
CETUS II [Composite Endoskeleton Testbed UUV System] Lockheed Martin		Conducts survey missions to collect images that can be viewed by operators. Capable of conducting Reacquire, Identify and Neutralization missions.	Hovers near target using thrusters; gathers data and, if appropriate, latches onto the target to deliver a neutralizing payload.	The smallest hovering AUV; hovering ability provides data collection capability not found in other AUVs.
CTEC-ISR Scenario [Collaborative Test and Evaluation Center - Intelligence, Surveillance, and Reconnaissance Scenario] **SAIC Keyport, NUWC Keyport, NUWC Newport**		Live, remote, virtual Intelligence, Surveillance, and Reconnaissance (ISR) information support to SEAL Delivery Team -1 (SDVT-1), providing Command and Control linkage w/SEALs in Hawaii. Goal is to integrate environmental and intelligence data, real and simulated AUV/UUV assets, and operational units in a battlespace preparation and mission planning test, training and evaluation (TT&E) exercise taking place over 8 days and at multiple locations. Demonstrates remote and distributed T&E capability, a precursor to CTEC.	Day 1: Naval Oceanographic Office (NAVO) and Joint Intelligence Center (JIC) will give an environmental and mock intelligence briefing on the scenario site (OP area A). Day 2: **NCST-1 Hydroid REMUS** will survey underwater obstacles. Day 3: **MARV** will take underwater video to verify obstacles; **SAUV** will survey chemical plumes. Day 4: MARV and **SAUV,** and then **MARV** alone, will survey chemical plumes. Day 5: **HUSCy** will further survey obstacles, using different sensors than **REMUS.** Days 6-8: **21-UUV**, simulated from NUWC Newport, will survey shore-based RF transmitters. **(MARV** and **SAUV** will also be active in the chemical mission on days 6-8. All chemical detections will be simulated.) **SDVT-1** in Hawaii will receive briefings and analyzed data daily, assess the emerging battle-space picture, and develop a mission plan.	Demonstrate CTEC and NUTEC capability to support distributed, live-virtual-constructive (LVC) TT&E Satisfies National Capabilities Requirement
Crawlers **NSWC Panama City**		In the Very Shallow Water (VSW) environment, reacquires targets, identifies them, and neutralizes them. In the surf zone, crawlers survey and map potential approach lanes.	Crawls autonomously. Using its sonar, the object is reacquired and imaged using a camera and neutralized using explosive charges carried onboard. Crawlers can carry many different payloads in support of different missions.	Crawlers operate in breaking surf, strong surge, and currents, and they can perform missions from VSW up onto the beach.
Gateway Buoy **Florida Atlantic University**		Self-Mooring and air-deployable Gateway Navigation and Communications Buoy for support of littoral AUV missions	Takes acoustical communications from Woods Hole Oceanographic Institute (WHOI) and Florida Atlantic University (FAU) modems and transmits them using RF Freewave to shore. Can provide navigational information to the AUV via Acoustical Communications (**ACOMMS**). Capable of Global Positioning System (GPS) self-location.	Rapidly deployable from the air or a fast boat
REMUS Very Shallow Water AUVs [Remote Environmental Monitoring Units] Woods Hole Oceanographic Institution		Search, Classify, and Map (SCM) Mines in very shallow water areas (depth < 100 ft). Communicates with, and provides autonomous redirection to, other vehicles.	Using a variety of sensors including Side Scan Sonar (SSS), Forward Looking Sonar (FLS), video cameras, and various oceanographic sensors. **REMUS** sweeps an area, looking for mine-like objects.	**REMUS** is able to work in very shallow water with other vehicles to Search, Classify, and Map mine-like objects. Proven as a most effective vehicle for this duty.
ACOMMS [Acoustic Communications] **Woods Hole Oceanographic Institution**		Provides acoustic networking for MCM AUVs including **REMUS, Bluefin, CETUS** and **Crawlers.** The acoustic network provides command and control information to vehicle operators ashore.	This modem uses a time-division protocol to allow acoustic transmissions at data rates from 80 bps to 5700 bps. Packets are broadcast so that every node in the network has a full picture of the mission as it proceeds.	The use of standard message formats by all underwater vehicles enables a real-time picture of underwater operations as they progress.

Project Info	Picture	What it Does	How it Works	Standout Talent
COIN [Common Operator Interface] ARL Univ. of Texas, Naval Special Clearance Team -1, SPAWAR		COIN is a software application that provides mission planning, execution, analysis and reporting with a common and consistent graphical user interface among the Naval Special Clearance Team-1 (NSCT-1) Mine Countermeasures (MCM) supported systems.	COIN gathers data from a variety of vehicles and sensors and allows this data to be displayed in one software application.	COIN makes planning, execution and analysis much easier because it can be done in one standard environment.
REMUS Shallow Water [Remote Environmental Monitoring Units] Hydroid Inc.		Large area/long duration Search, Classify, and Map (SCM) missions as well as high-resolution sidescan and/or video Reacquisition and Identification (RI) in the shallow-water environment (10'-300')	Uses dual frequency sidescan sonar to conduct Search and Map (SM) and RI surveys. Also uses Computer Aided Detection/Computer Aided Classification (CAD/CAC) processing: Inertial Navigation System, GPS and 600kHz DVK/Acoustic Doppler Current Profiler-aided navigation; and an acoustic modem and Iridium communications provide in-mission monitoring, redirection, and command interface.	Small and lightweight, with versatile mission adaptive capabilities satisfying both SCM and RI missions in shallow waters.
ACDS [Acoustic Communication and Data Storage Unit] Naval Research Laboratory		Long-term unattended recording and storage of underwater acoustics with point-to-mobile-point channel characterization in shallow and very shallow water environments.	Bottom moored **ACDS** units, with 8-channel receive arrays, collect ambient noise and periodically transmit probe signals to other ACDS units as well as receive various AUV sources of opportunity for acoustic channel characterization. Acoustic data is processed and relayed to shore station via WiFi for monitoring and further analysis.	Ability to record 360 GB of data and operate unattended for extended 7-day durations. Provide empirical measures of shallow water and very shallow water acoustic channel adversity for AUV ACOMMS users.
Nekton Ranger [VSW MCM] Nekton Research		An expendable autonomous vehicle used for Very Shallow Water (VSW) Reacquire and Neutralize (RN) mine countermeasure missions.	Commanded by RF or acoustic link to execute mission. Navigation assisted by GPS. Homes to mine intercept using Blazed Array sonar. Ranger has been designed to support a 10 lb mine neutralization payload.	Small size (A-size hull diameter) is ideally suited for easy single-operator deployment, which is critical in rapid-response situations.
Transphibian Nekton Research		Hunts mines in hazardous areas where control is difficult such as the surf zone or choppy waters around piers.	Paddles using four oscillating fins that mimic sea creature locomotion. It can sink to the bottom and crawl to the mine for neutralization.	It's the only AUV that can swim and crawl, returning itself to the ocean if washed ashore.
SAUV [Solar AUV] Falmouth Scientific and Technology Systems, Autonomous Undersea Systems Institute		A solar powered vehicle that conducts Intelligence, Surveillance, and Reconnaissance (ISR) missions from the surface or submerged.	Swims in cooperative groups of SAUVs, maintaining continuous operations while other SAUVs recharge. Communicates and reports results in real time via RF or satellite link. Capable of providing gateway communication services with other types of AUVs via ACOMMS.	Solar powered system allows for extended persistent surveillance in excess of one year. Using Autonomous Underwater Systems Networking (AUSNet) to provide network capability over ACOMMS
SCOUT [Surface Craft for Oceanographic and Undersea Testing] Massachusetts Inst. of Tech.		Low cost platform using COTS hardware. Provides navigation assistance to AUVs. Cooperative behavior. Autonomous operation.	Uses WiFi, RF and acoustic modems, GPS, and a compass to create a scaleable network of "location aware" assets that assist subsurface vehicle operations.	Low Cost and low manpower operations. Rapid deployment, flexible, robust architecture. Behaviors developed with surface craft will be transitioned for use in AUVs.
ARIES [Acoustic Radio Interactive Exploratory Server] Naval Postgraduate School		Demonstrates obstacle detection and avoidance behavior and collects data for further avoidance algorithm development.	Uses Blazed Array Forward Looking Sonar (FLS) to map area in front of vehicle. Will adjust course and altitude based on processed sonar images.	FLS can "see" sea mounts and other undersea obstacles and avoid them.
Gavia AUV Hafmynd ltd. Naval Special Clearance Team -1, SPAWAR		Performs both SCM and RI tasks for MCM missions.	Uses GPS and inertial navigation to provide over the horizon deployment capability. Modular construction allows for rapid configuration changes with payloads tailored to meet mission needs. Payloads have included Side Scan Sonar and video surveillance.	Modular configuration for rapid mission tailoring and quick vehicle turn around.
Sea Lion Bluefin-9 Naval Special Clearance Team -1, SPAWAR, Naval Support Activity-Pan. City		Search, Classify, Map (SCM) Mine-like objects. Capture video for Reacquire and Identification (RI) missions.	Uses GPS and inertial navigation to provide over the horizon deployment capability along with SCM mission capabilities without transponders.	Can change program mission quickly at sea, as well as the battery.

Project Info	Picture	What it Does	How it Works	Standout Talent
Sea Glider **Applied Physics Laboratory, Univ. of Washington**		Acquires and telemeters ocean water column property data between surface and 1000 m depth with scientific precision and can be commanded remotely via Iridium to fly to desired waypoints and/or station-keep. Ocean parameters measured: conductivity, temperature, optical scattering, fluorometry, and dissolved oxygen. Computed onboard: depth-averaged and surface ocean currents, salinity, and sound speed. Demonstrated capabilities: 1800+nm horizontal range, 190+days continuous operation.	Employs a buoyancy engine for vertical thrust, and a hydrodynamically efficient shape and a mass-shifter element (glider's battery pack) to achieve controlled flight. Command and waypoint files are downloaded and data uploaded from the glider with each profile using an Iridium link.	Persistent, autonomous battlespace characterization platform.
Noise Mapping (Slocum) Glider **Alaska Native Technologies, SPAWAR**		Acoustic noise mapping. Collect acoustic (ambient noise) and environmental (Sound Velocity Profile (SVP)) data.	Operate in shallow coastal waters (as shallow as 5m) where high maneuverability is necessary. Collect acoustic (ambient noise) and environmental (SVP) data and transmit these data over a broadband link for display at a shore site. With appropriate sensors it can monitor acoustic activity, communications, Nuclear, Biological, and Chemical (NBC) activity, report as required.	Inexpensive Resource for Denied Area Surveillance. Autonomous, high endurance operations. Autonomously establish a barrier patrol for denied areas (homeland defense). Relatively inexpensive, recovery not required.
HUSCy [Hydrographic Unmanned Survey Craft] **NAVOCEANO Sea Robitics**		Tactical hydrographic and environmental data gathering in shallow to very-shallow water environments	Freewave UHF data link to enable remote mission monitoring. GPS to navigate remotely or autonomously to areas of interest. Uses Side Scan Sonar, Acoustic Doppler Current profiler, CTD, transmis-someter, and an echo sounder to gather hydrographic and oceanographic data.	Low cost, autonomous shallow water littoral warfare environmental data gathering system.
R-I UUV **WHOI REMUS** **Naval Special Clearance Team -1,** **SPAWAR**		Reacquires and Identifies (R-I) mines in the very-shallow water regime.	Uses high-frequency side scan sonar and video camera for the identification mission. Also has on board Computer Aided Classification/Detection software for Classification missions.	Original dual-frequency side scan sonar vehicle, currently undergoing a User Evaluation with Naval Special Clearance Team-1 and Concept of Operations development with SPAWAR.
REMUS SCM **Hydroid** **Naval Special Clearance Team -1,** **Naval Support Activity-Pan. City,** **SPAWAR**		Performs Search-Classify-Map (SCM) missions in the very shallow water regime.	Uses side scan sonar, video cameras, transponder and GPS navigation for SCM Missions.	Vehicle is being evaluated for the 2nd generation UUV system at Naval Special Clearance Team-1.
Environmental Post Mission Analysis (PMA) **Naval Oceanographic Office**		Environmental Intelligent Preparation of the Battlespace (EIPB) that aids mission planning, mission execution, and sensor performance prediction, reducing tactical timelines and minimizing risks to the warfighter.	Use environmental knowledge to process and analyze on-scene vehicle sensor data, such as acoustic imagery, currents, inherent optical properties, and sound velocity profiles, to provide rapid turn-around of derived relevant operational products.	Flexible capability to process and fuse data from different sensor/vehicle systems and provide environmental information to Mine Warfare Environmental Decision Aids Library (MEDAL). Provides an interface to NAVOCEANO tidal current forecasts and historical environmental databases.
BAUV [Biorobotic Autonomous Underwater Vehicle] **NUWC Newport**		Prototype platform which can hover or transit laterally, vertically, forward, and reverse, enabling stealthy low-speed maneuvers in energetic environments.	Uses six heaving and pitching flapping fins to control vehicle in six degrees-of-freedom.	Provides six degree-of-freedom low speed maneuverability with efficiency and stealth in a scalable platform.
RDUST [Remote Delivery of Unmanned Systems Technology] **NSWC Pan. City**		Removes the warfighter from the area of risk when deploying autonomous underwater mine hunting vehicles. Provides communications to the mine hunter from well outside the threat area being searched. Provides UUV location and allows in-stride redirection.	Provides semi-autonomous positioning for UUV launch from beyond 10 miles distance. Allows surface awareness through infrared and color camera video feeds.	This speedy vehicle can greatly extend the reach and safety of the warfighter.