USSOCOM PEO-NS Technology Needs Briefing Center of Excellence for Research in Ocean Sciences

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The overall classification of this briefing is:
UNCLASSIFIED

USSOCOM Acquisition Mission








Provide Rapid and Focused Support to SOF Warfighters

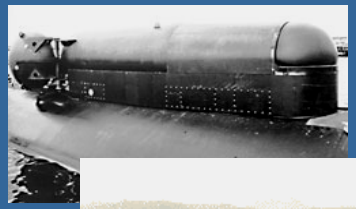
Undersea & Maritime Systems

Hydrographic Mapping Unit (HMU)

Semiautonomous Hydrographic Reconaissance Vehicle (SAHRV)

Non-gasoline Burning Outboard Engine (NBOE)

Mk 16/Mk 25 UBA



Swimmer Transport Device (STD)

SEAL Delivery Vehicle (SDV)

Dry Deck Shelter (DDS) Host Submarine SSN/SSGN

Conceptual

Shallow Water Combat Submersible (SWCS)

Conceptual

Joint Multi-Mission Submersible (JMMS)

Surface Mobility and Supporting Systems

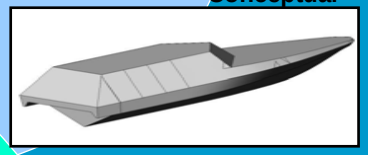
Combat Rubber Raiding Craft (CRRC)

Naval Special Warfare Rigid Inflatable Boat (NSW RIB)

MK V Special Operations Craft (MK V SOC)

- Amphibious Ships
- Maritime Support Vessel
- Joint High Speed Vessel
- Littoral Combat Ship

Conceptual



Combatant Craft Medium-Mk-1

Special Operations Craft Riverine (SOCR)

ROSAM

CCFLIR

Nine Technology Areas of Interest

- Undersea Vehicle Energy Storage Systems
- Advanced Surface Craft Power Systems
- Combat Swimmer Thermal Protection Systems
- Lightweight, Small Volume, CO_2 Removal Technology for Underwater Breathing Apparatus and Undersea Platforms
- Lightweight, Submersible, Multi-Fuel Outboard Engine
- High Speed Communications
- Low-Cost Dry Submersible Hull, Mechanical & Electrical Technology
- Dynamic Ride Impact Mitigation
- SDV Automated Launch & Recovery System

Undersea Vehicle Energy Storage Systems

- **Current Status:**
  - Undersea vehicles require energy storage systems which are significantly higher density (e.g., energy/volume and energy/weight) than those currently available.
  - Silver-Zinc and Lithium-Ion batteries provide 90 to 1,300 Kilo-Watt Hours (kWh) of electrical energy (approximately 0.30 kWh/liter and 0.12 kWh/kilogram displacement (including the pressure proof housing).
- **Where We Want to Be:**
  - Store and deliver 1.5 kWh/liter and/or 0.6 kWh/kilogram of electrical energy.

Advanced Surface Craft Power Systems

- **Current Status:**
  - SOF combatant craft require advanced power systems that provide significantly better power to weight ratios (e.g., maximum hp/lb) at top speed and significantly better fuel efficiency (e.g., (lb/hp-h)) at the most efficient speed (cruise speed).
  - Current craft engines have a power/weight ratio of approximately 0.38 hp/lb at maximum speed and a specific fuel consumption of 0.35 lb/hp-h at cruise speed.
- **Where We Want to Be:**
  - Power to weight ratio of 1.0 hp/lb and/or a fuel efficiency of 0.1 lb/hp-h at cruise speed. Acoustic and thermal signatures are also a consideration.

Combat Swimmer Thermal Protection

- **Current Status:**
  - Combat swimmers require thermal protection from cold and warm ambient water temperatures.
  - Current diving suits utilize materials such as Thinsulate or Polartec as an insulation material to provide protection for short periods of immersion, or electrical resistive systems.
- **Where We Want to Be:**
  - Thermal protection in ambient water temperatures anywhere between 2^{o}C and 35^{o}C for a minimum duration of 12 hours. Maintain diver's dexterity and core temperature at 37^{o}C.
  - Provide protection for diver's extremities and core, such that the diver will not have a reduced off-gassing in the extremities due to decreased blood flow.

Lightweight, Small Volume CO2 Removal Technology

- **Current Status:**
  - Existing underwater breathing apparatus (UBA) systems (Mk 25 and Mk 16) have an absorbent volume between 2.9 and 4.0 liters.
  - The ratio of CO_2 volume absorbed to absorbent volume ($VRCO_2$) at 21°C for each of these systems is $VRCO_2$=120.
  - As the temperature decreases, present systems remove less CO_2.
- **Where We Want to Be:**
  - CO_2 removal technologies that can meet or approach a performance objective of 240 $VRCO_2$ over a temperature range of 2°C to 35°C and demonstrates equivalent or decreased breathing resistance as current systems.

Lightweight, Submersible Multi-Fuel Outboard Engine

- **Current Status:**
  - **Combat swimmers currently use lightweight, submersible 30 hp Improved Military Amphibious Reconnaissance System (IMARS) gasoline outboard engines.**
    - The IMARS is projected to become obsolete due to parts unavailability
    - DoD has directed the phase out of gasoline fueled engines from all shipboard operations to improve shipboard safety and simplify logistics
  - **Currently fielded 55 hp multi-fuel engine weighs 250 lbs, which is too heavy for some missions and is not submersible.**
- **Where We Want to Be:**
  - **SOF has a requirement for a 30 hp multi-fuel engine that will:**
    - Operate on JP5, JP8, kerosene, gasoline and as an emergency fuel, marine diesel.
    - Weigh no more than 150 lbs.
    - Fit through a 30-inch diameter circular hatch.
    - Be capable of being submerged to a minimum depth of 66 feet seawater for a period of 18 hours, then brought to the surface and started within 10 minutes.

High Speed Communications

- **Current Status:**
  - Mobility craft have low to medium HF/VHF/UHF speed communications that provide data rates on the order of 64 Kbps.
  - These systems restrict ability to receive and distribute timely, robust, situational awareness information to and from other theater participants.
  - Existing high data rate satcom antennas are too big or too expensive to be used on combatant craft.
- **Where We Want to Be:**
  - Equip craft with IP-67 rated, low-mass (<100 Lbs), low-profile (<10” in height), low-cost (<$100K), high data-rate Ku-band SATCOM communications capability that provides zenith to near-horizon coverage achieving data rates up to 1.5 Mbps downlink and 512 Kbps uplink while the craft is on-the-move. LPD and LPI are also considerations.

Low-Cost Dry Submersible Hull, Mechanical & Electrical (HM&E) Technology

- **Current status:**
  - **SOF Combatant Submersibles (CS) consist of low-cost, wet swimmer delivery vehicles. Dry submersible design and construction must meet stringent underwater vehicle and hyperbaric system safety standards overseen by independent certification/classification agencies (e.g. NAVSEA, ABS).**
    - **Wet vehicle performance is inherently limited by the human factors limits associated with diving.**
    - **Most recent dry submersible was the ASDS, with a design and construction cost of $200-400M, approaching that of a warship. A significant portion of that cost is in construction of the HM&E sub-systems.**

- **Where we want to be:**
  - **SOF is interested in dry submersible HM&E technologies that can be certified/classified and can meet or approach a unit construction cost of $20M.**

Dynamic Ride Impact Mitigation

- **Current Status:**
  - Current craft have rigid hull form with passive, shock-absorptive seats with damping characteristics that are platform specific, location and occupant agnostic, and generally fail to ameliorate injurious shock accumulations over time.
  - Current systems provide a daily equivalent static compression dose, normalized to an 8-hour day ($S_{ed}8$) rating of no better than 4.7 MPa per ISO 2631-5:2004.
- **Where We Want to Be:**
  - Hull forms and / or seating systems / combinations that significantly mitigates both short and long-term shock effects on all occupants in all sea-state conditions and speeds, achieving a $S_{ed}8$ value of less than 3.8MPa.

SDV Automated Launch & Recovery System

- **Current Status:**
  - Utilizes an operator intense manual procedure to capture the Swimmer Delivery Vehicle (SDV) in stratum and then electrically winch it into the Dry Deck Shelter (DDS).

- **Where We Want to Be:**
  - A completely automated SDV launch and recovery system from DDS in stratum operations that requires little or no operator input other than the activation of the system.

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Questions?