Special Operations Forces Industry Conference

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Maritime Systems

Undersea Mobility Systems

Swimmer
Transport Device
(STD)
5 nm
2 hrs
2 Pax

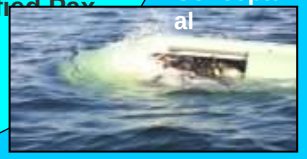
SEAL Delivery
Vehicle (SDV)
Classified Range
Classified
Endurance
Classified Pax

Advanced SEAL Delivery System
(ASDS)
Classified Range
Classified Endurance
2 Pilots, Class Pax

DDS

Dry Deck Shelter (DDS)
Host Submarine
SSN/SSGN
Unlimited range
90+days
36+ Pax

Conceptu
al

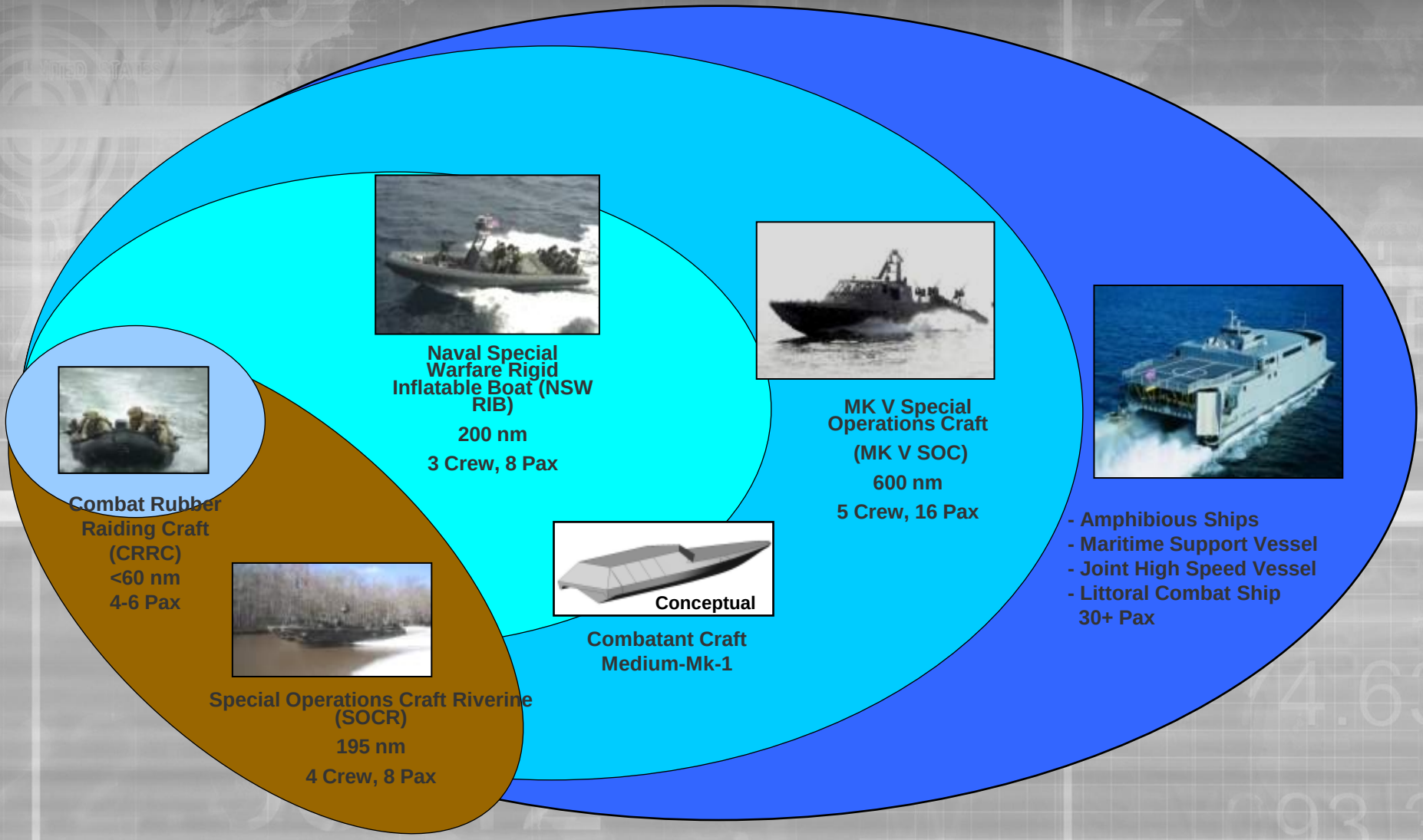


Shallow Water Combat
Submersible (SWCS)

Conceptu
al

Joint Multi-Mission
Submersible (JMMS)

Surface Mobility Systems



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
- Secure Wireless Intercom System
- High Speed Communications
- Low-Cost Dry Submersible Hull, Mechanical & Electrical Technology
- Dynamic Ride Impact Mitigation

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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).

Undersea Vehicle Energy Storage Systems

- 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/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.

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Advanced Surface Craft Power Systems

- Where We Want to Be:
  - Power/weight ratio of 1.0 hp/lb and/or a fuel efficiency of 0.1 lb/hp-h at cruise speed.

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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.

Combat Swimmer Thermal Protection

- **Where We Want to Be:**
  - **Thermal protection in ambient water temperatures anywhere between 2°C and 35°C for a minimum duration of 12 hours. Maintain diver's dexterity and core temperature at 37°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.

Lightweight, Small Volume CO2 Removal Technology

- 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.

Lightweight, Submersible Multi-Fuel Outboard Engine

- Where We Want to Be:
  - SOF has a requirement for a 30 hp multi-fuel engine that will:
    - Operate on JP5, JP8, kerosene, 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.

Secure Wireless Intercom System

- Current status:
  - AN/VIC-3 wired intercom
    - Constrains Crew mobility by restrictive length of intercom cables
    - Trip hazards and cable damage caused by SWCC and embarked SOF operator movement, an inherent wired intercom weakness
    - Temporary loss of communications caused by crew members disconnecting from one station to move to another station, creating situations when the craft Officer in Charge was unable to provide timely direction to crew during tactical operations
  - Each crew member currently carries AN/PRC-148 MBITR hand held radio
    - Type-1 encrypted, half duplex, no access to boat radios
  - Numerous manufacturers of Wireless Intercom systems, but none at the present time is capable of meeting the performance parameters

Secure Wireless Intercom System

- Where we want to be:
  - NSA approved Type-1 encrypted full duplex Wireless Intercom
  - Provide crew access to existing boat radios with no EMI/EMC issues
  - User worn transceiver as small as possible,

    battery life $\geq$ 12 hours
  - Water immersion at one meter for 12 hours and IP67 rated

High Speed Communication

- 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.

High Speed Communication

- 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.

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

- Current status:
  - SOF Combatant Submersibles (CS) consist of low-cost wet swimmer delivery vehicles and a large dry submersible. 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.
    - Current dry submersible is 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.

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

- 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.
  - Transportable in ISO Container
  - ABS Classed Diver Lock-Out Submersible
    - 100 NMI Range @ >5 knots
    - 5 Fully Equipped Personnel

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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.

Dynamic Ride Impact Mitigation

- 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.