NX19-001 TITLE: Compact Inflatable Structures for Submerged Payload Launch & Recovery

TECHNOLOGY AREA(S): Ground/Sea Vehicles

ACQUISITION PROGRAM: Virginia Class Submarines

OBJECTIVE: The U.S. Navy (USN) seeks to develop enabling technologies for the use of soft inflatable structures as components to undersea payload launch and recovery (L&R) systems. Inflatable structures using seawater as the inflation medium are particularly attractive to the USN because of their ability to produce large developable shapes possessing significant load-carrying capacities and stiffness when inflated and for their ability to achieve smaller form factors and volume reductions when deflated.

DESCRIPTION: The current state of inflatable soft structures technologies can provide unique solutions to many challenges limiting today's Undersea Warfare (USW) launch and recovery operations. Inflatable soft structures have been successfully developed for DoD, NASA, industry, etc. and are generally categorized in the following sectors:

- Inflatable control surfaces,
- Deployable energy absorbers,
- Temporary "on-demand" structures

NX19-002 TITLE: On Demand Structures – Submarine Launch of UUVs

TECHNOLOGY AREA(S): Ground/Sea Vehicles

ACQUISITION PROGRAM: Virginia Class Submarines

OBJECTIVE: The U.S. Navy (USN) seeks to develop enabling capabilities for launch and recovery (L&R) operations of Unmanned Underwater Vehicles (UUVs) from submarines at prescribed submergence conditions. More specifically, there is a need to launch vehicles of different hull diameters from a standard 21-inch diameter by 25-foot long tube (ocean interface). To prevent damage to the tube and vehicles, and to stabilize the vehicle's orientation throughout the launch event, a UUV Sabot System (UUVSS) is sought. Vehicles will be launched under their own power and the UUVSS will separate from the vehicle upon exiting the tube. The UUVSS can be designed as either expendable or nonexpendable.

DESCRIPTION: The current state of inflatable soft structures technologies can provide unique solutions to many challenges limiting today's Undersea Warfare (USW) operations, capabilities and system designs. Inflatable soft structures have been successfully developed for DoD, NASA, and industry and are generally categorized in the following sectors:

- Inflatable control surfaces
- Deployable energy absorbers
- Temporary "on-demand" structures

NX19-003 TITLE: Flow Conditioning for Improved Piping Arrangement

TECHNOLOGY AREA(S): Ground/Sea Vehicles

ACQUISITION PROGRAM: Columbia Class Submarine

OBJECTIVE: In order to minimize straight pipe length requirements, a technology is sought that can expedite the establishment of a fully-developed flow profile after non-straight pipe sections such as elbows and bends. The solution should readily integrate with existing piping and should produce minimal pressure drop. Furthermore, it is required that the solution does not induce cavitation and does not produce excessive vibrations.

DESCRIPTION: Pumps and flow meters require a consistent, developed flow profile to function properly. Typically, a developed flow profile is achieved after direction changes, or flow disturbances, through a minimum required length of straight pipe. This length requirement negatively impacts packaging as ship arrangement space is extremely valuable. Additionally, minimum straight length requirements can drive the suction inlet of pumps high in the ship to the detriment of net positive suction head. Thus, minimizing straight pipe requirements can have a significant impact on the final product (e.g. ship design and layout of spaces within the ship, manufacturing requirements, and maintenance times). The goal is to minimize straight pipe length requirements without significant drops in flow pressure, or affecting suction inlet positive pressure in pumps located higher in the ship.

NX19-004 TITLE: Quiet Bunks

TECHNOLOGY AREA(S): Human Systems, Materials/Processes

ACQUISITION PROGRAM: Columbia Class Submarine

OBJECTIVE: Today's sailors are asked to perform ever increasing tasks and thus need to be at peak performance. Restful sleep is essential to achieving this peak performance, yet the close working quarters inside submarines can be detrimental to sleep cycles. Therefore, materials and uses of materials to bolster the natural sleep cycle for more restorative rest are desired. Additionally, sound damping materials may be used to reduce mechanical or other noises onboard platforms.

DESCRIPTION: Solutions are sought that provide the acoustic performances necessary to meet the objective described above for sailors. Proposed solutions may be new materials with improved acoustic properties, or they may be established materials used in new, creative manners.

NX19-005 TITLE: Cool Suits

TECHNOLOGY AREA(S): Human Systems, Materials/Processes

ACQUISITION PROGRAM: Columbia-Class Submarine Program of Record

OBJECTIVE: Columbia-Class submarines have a higher steel preheat requirement than previous classes. Currently, welders suffer from heat exhaustion (especially during the summer months) and the new Columbia requirement will only exacerbate this problem. Increasing weld times by just a half-hour in aggregate would yield immense productivity gains. Clothing materials that reduce the thermal body temperature of welders while maintaining ergonomics and dexterity will significantly mitigate this issue. Furthermore, this heat reducing material can be leveraged to decrease equipment heat loads and thus increase performance periodicities.

DESCRIPTION: Solutions are sought that provide the thermal control performance necessary to meet the objectives described above for shipyard personnel. Proposed solutions may be new materials with improved thermal control properties, or they may be established materials used in new, creative manners.

NX19-006 TITLE: High Power Compact Fuel Cell System

TECHNOLOGY AREA(S): Ground/Sea Vehicles

ACQUISITION PROGRAM: Columbia Class Submarine

OBJECTIVE: Develop a compact fuel cell system (e.g., stackable fuel cells, hydrogen and oxygen fuel sources, all balance-of-plant equipment including by-product management components) capable of producing, at a minimum, 500 kW of power. Minimize the overall volume and weight of the overall system and system complexity, which is vital for deployment (e.g., underwater manned and unmanned platforms, surface ships, forward operating bases). Ensure that the system has a fast start-up time (<5 minutes), demonstrates high reliability, and shows ease of maintenance and repair of its lowest replaceable units.

DESCRIPTION: Fuel cell systems have performance advantages (e.g., higher operating efficiencies, lower maintenance costs) and arrangement flexibility in a power distribution system over diesel generators. The fuel sources for a diesel generator are diesel and air while the sources for a fuel cell are hydrogen and oxygen. Hydrogen does not exist on its own in nature and must be extracted or reformed from another compound (e.g., water, fossil fuels). Some fuel cell systems use stored hydrogen that has already been extracted elsewhere, while others reform hydrogen from liquid or solid fuels when needed. The desired output voltage from the fuel cell system shall be between 700 and 850 Volts Direct Current (VDC).