



SERC/AIRC Annual Research Review Capstone Marketplace Update November 2022

WRT-1064: CAPSTONE MARKETPLACE 2022-2023

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SPONSORS: OFFICE OF THE UNDER SECRETARY OF DEFENSE FOR RESEARCH & ENGINEERING (OUSD(R&E)) AND THE US SPECIAL OPERATIONS COMMAND (SOCOM) SCIENCE AND TECHNOLOGY DIRECTORATE



ANNUAL RESEARCH REVIEW 2022

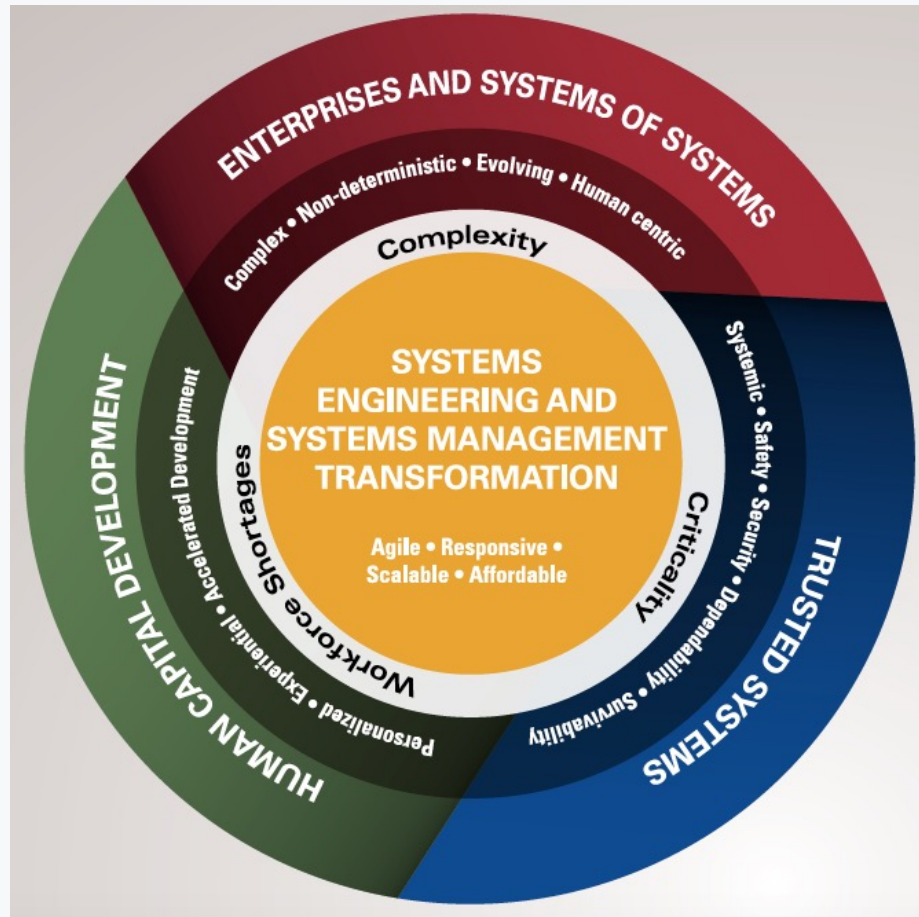
Capstones Extend SERC's Network

“Outside” Capstone Universities:

- San Jose State University
- Oklahoma State University
- US Naval Academy
- University of South Alabama
- University of Texas-Austin
- Connecticut College
- University of Rhode Island
- University of Hawaii at Manoa
- Tuskegee Institute
- Sweet Briar College
- Coast Guard Academy
- United States Military Academy
- Smith College
- Johns Hopkins
- Michigan Technical University

Capstone
Marketplace
works with
ANY
accredited
U.S.
University

Capstones Develop Future Engineers



Enterprises and System of Systems (SoS)

- Enterprise Analysis
- System of Systems Modeling and Analysis

Trusted Systems

- Systemic Security
- Systemic Assurance

SE & Systems Management Transformation

- Affordability and Value in Systems
- Quantitative Risk
- Interactive Model-Centric Systems Engineering
- Agile Systems Engineering

Human Capital Development

- Evolving Body of Knowledge
- Experience Acceleration
- System Engineering (SE) and Technical Leadership Education

SERC Capstones are Different

Typical University Capstones


- Professors organize teams and generate topics
- Two semester design projects
- Can include Industry sponsorship and participation
- Some Capstones research only

SERC Capstone Marketplace

- Students can select their Capstone topics—SERC connects students with military operators--Real Customers with Real Problems
- Two semester projects are preferred
- Introduction to common business tools and practices
- Collaboration with Universities encouraged
- Tangible deliverables are required—prototype software and/or hardware

SERC Capstone Customers - FY 2023

- **US Special Operations Command
Tampa FL**
- **Naval Special Warfare Group EIGHT and
SEAL Delivery Team TWO Little Creek VA**
- **US Army Special Operations Command
Ft Bragg NC**
- **Special Operations Support Activity
Lexington KY**



SOF Untethered Logistics Forum

Sponsor: SERC, Mr. Bill Shepherd

**USSOCOM: PEO SOFSA
SOCOM J45**



Program Executive Office Special Operations Forces Support Activity (SOFSa)

ROTARY WING



PLATFORMS

- MH-47Gs
- MH-60Ms
- AH/MH-6Ms
- Non-Standard
- Depot Level Maintenance

SUPPORTING

- PEO Rotary Wing
- ARSOAC

SOF SYSTEMS



EQUIPMENT

- SOF Weapons
- SPEAR / Tactical Combat Casualty Care
- C4 / Electronic Countermeasures
- SR – Surveillance / Reconnaissance
- 12XX



SUPPORTING

- PEO SOF Warrior
- PEO C4
- PEO SR

GROUND



PLATFORMS

- MATVs / MRAPs
- NSCVs
- MRZR
- LTATVs
- GMV 1.1

SUPPORTING

- PEO SOF Warrior

PEO SOFSA TEAM



ON-SITE STAFF

- Expeditionary Support PM
- Program Support
- Business Management
- Enterprise Management
- Finance
- Acquisition Attorney
- Strategic Plans
- DCAA
- DCMA
- Prime Contractor

PEO SOFSA

MISSION

Enable Global SOF Operations Through Dedicated Life Cycle Sustainment

VISION

Trusted Experts for SOF Logistics & SOF Peculiar Modifications

CORE COMPETENCIES

1. Production & Integration
2. Streamline Design & Rapid Prototyping
3. Life Cycle Sustainment Activities

PM-ES

- JOS
- MTRC
- FUTURES



SUPPORTING ALL USSOCOM

PEO SOFSA OPERATION



ENTERPRISE

- 2.7M sq. ft. of facilities
- Climate Controlled Storage
- Weapons Storage / Range
- Reverse Engineering
- Fabrication / 3D Printing
- Depot+ Aviation Capability
- Safety – Security – IT

BUSINESS & FINANCE

- 10YR \$8B IDIQ
- 10 KO's - 1 Unlimited Warrant
- Accept All Funding Types

FIXED WING



PLATFORMS

- AC/MC-130Js
- CV-22s
- MQ-9s
- CASA 212, C-12
- C27Js
- UAS

SUPPORTING

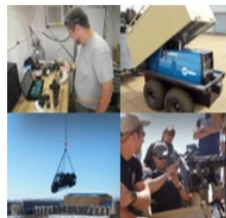
- PEO Fixed Wing
- AFSOC
- USASOC (ARSOAC)

PM EXPEDITIONARY SUPPORT

Mobile Technology Repair Complex (MTRC)

Joint Operational Stock (JOS)

Future Capability Development



MARITIME



PLATFORMS / EQUIPMENT

- SURFACE
 - Combat Craft Heavy
 - Combatant Craft Medium
 - Combatant Craft Assault
- UNDERSEA
 - S351
- DIVE LOCKERS

SUPPORTING

- PEO Maritime
- NSWC



Potential NASA & DOD Collaborations

Logistics Considerations for Lunar Exploration

- Closed Loop Environmentals
- In-Situ Resource Utilization
- Advanced Electric Power Systems
- Telepresence and Advanced Robotics

2020-2021 Capstone at University of Alabama Huntsville

Interior Storage for a Submersible

Objective: Design and build a prototype of an internal storage system to accommodate necessary items within a submersible vehicle.

Lack of a specific organization system makes access to essential equipment cumbersome and space is not maximized

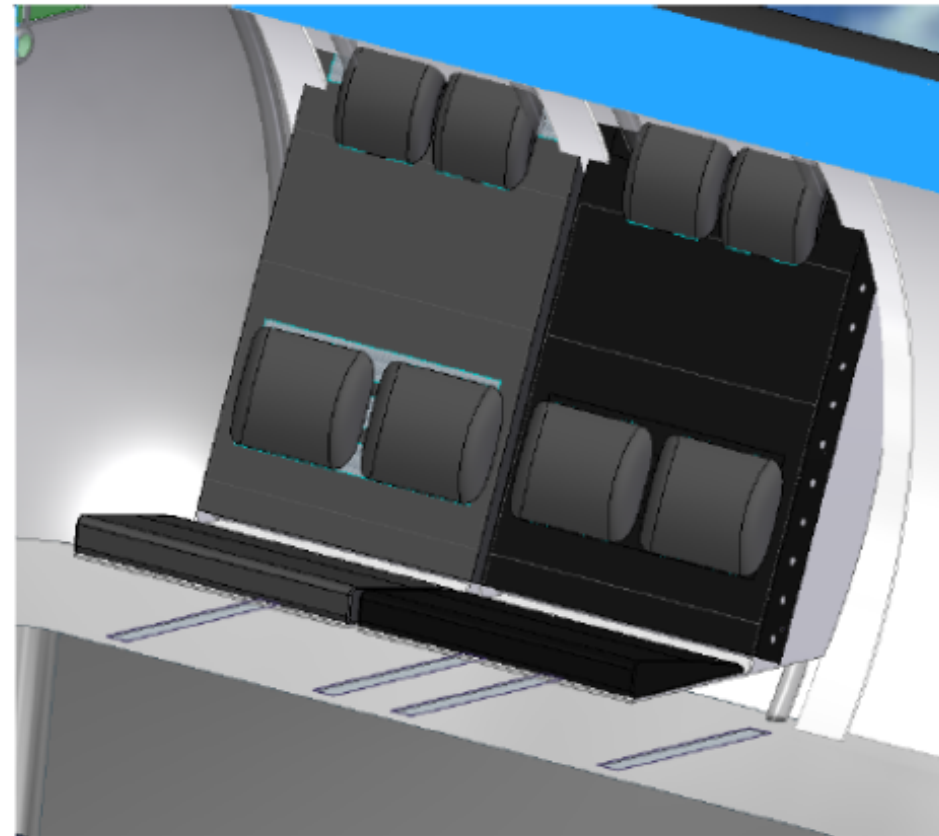


Figure 7.1.2.5: Curvature Storage in Operational Environment. The gray slits are velcro strips attached to the ballast tank (Credit: T. Ruffalo)

2021-2023 Capstones at UT Austin

Self Intubating Airway Device—Multiyear Project

Develop a Self-intubating snake, a multidirectional device that can be loaded with an endotracheal (ET) tube and advanced into the mouth of a warrior in need of an airway.

This device reduces the exposure of an operator to hostile fire.

Figure 1. Overview of Proposed Solution

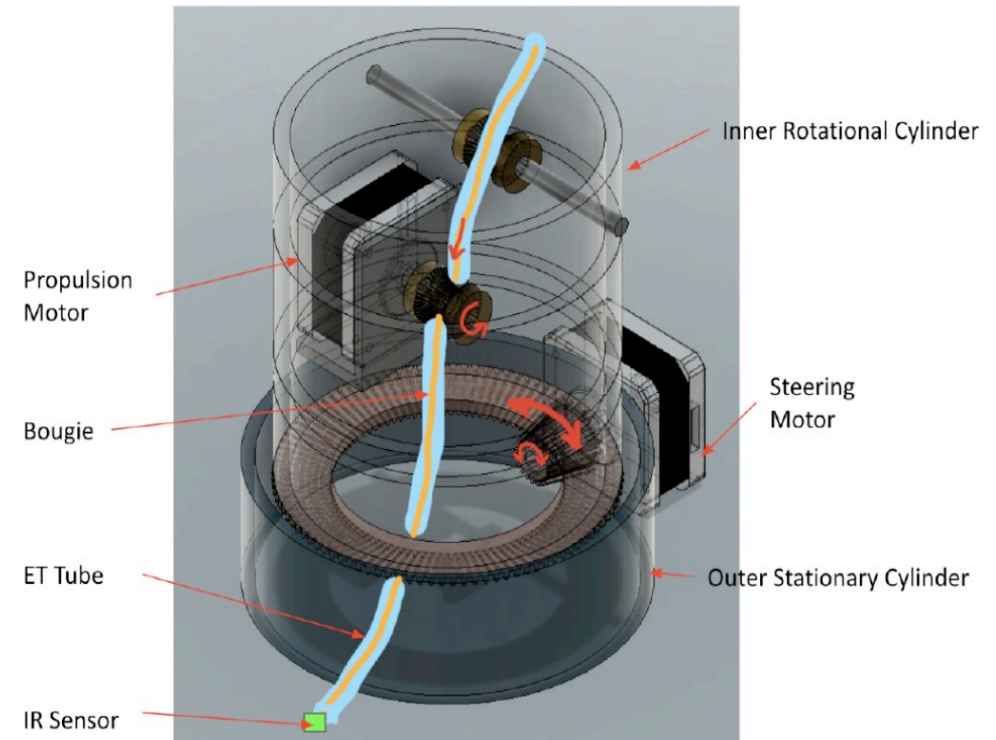


Figure 1. This figure demonstrates how the subsystems will work together. Note the inner and outer cylinders. The outer cylinder will be stationary and will hold the motor that controls steering. The inner cylinder will rotate as a unit, including the propulsion motor, the roller, and the ET tube and bougie.

SERC Capstone Universities 2022-2023

George Mason University

Michigan Technical University

Stevens Institute of Technology

University of Massachusetts Boston

US Naval Academy

University of South Alabama

University of Texas Austin

Virginia Tech

2022-2023 Capstones for SOFSA

Research Topic	Teams	Customer
Air-transportable Lithium Batteries	U of S Alabama	SOFSA
Efficient Warehouse	GMU	SOFSA
Vehicle Emergency Electronic Bypass	VT-TBD	SOFSA
Optimized Shop Work Planning Tool	TBD	SOFSA
Near-Net Rapid Prototyping in Metals	TBD	SOFSA
Non-GPS Precision Navigation		SOFSA
Virtual Reality for Vehicle Maintenance		SOFSA
Autonomous Small Unit Resupply		SOFSA
Advanced Off-Road Suspension Design		SOFSA

2022-2023 Capstones for Army Special Ops

Research Topic	Teams	Customer
Body Mounted Sensors	MTU	USASOC
Automatic Intubation Device	UT Austin	USASOC
"Any Donor" Blood Transfusions	UT Austin	USASOC
Covert Communications to Working Dogs	UT Austin	USASOC
Emojis in Context	USNA	USASOC

2022-2023 Capstones for Army Special Ops-2

Research Topic	Teams	Customer
Friendly Forces ID	MTU, Stevens	USASOC
Drone Video to Cell Tower	MTU	USASOC
Structures Digital Twin	UMB	USASOC
Compact Aerial Photogrammetry System	UMB	USASOC
Celestial Positioning Accuracy	Stevens	USASOC

2022-2023 Capstones for Naval Special Warfare

Research Topic	Teams	Customer
Electronic Operations Manual for Submersible Maritime Platform (“Everything Tablet”)	MTU, GMU	NSW
Computer-Based Electrical Simulator for Submersible Maritime Platform	MTU	NSW
Onboard Human Performance Monitoring	UT Austin	NSW
External Cargo Pods	USNA	NSW

Benefits for DOD and US Govt

- Energizes “innovation” in government organizations
- Harvests “intellectual capital”, often from junior personnel
 - Ideas and solutions can be unconventional and “Out of the Box”
- Cultivates unit “MacGyvers” who understand innovation, and who want to work on important projects
- Increases “bandwidth” of traditional govt R&D efforts
- Low cost. Average project cost is \$4K-\$5K for 2 Semesters’ work
- Builds technical data in key capability areas
- Generates student interest in USG for future employment

How to Learn More

Capstone Marketplace website:

www.capstonemarketplace.org

Email us:

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Questions?

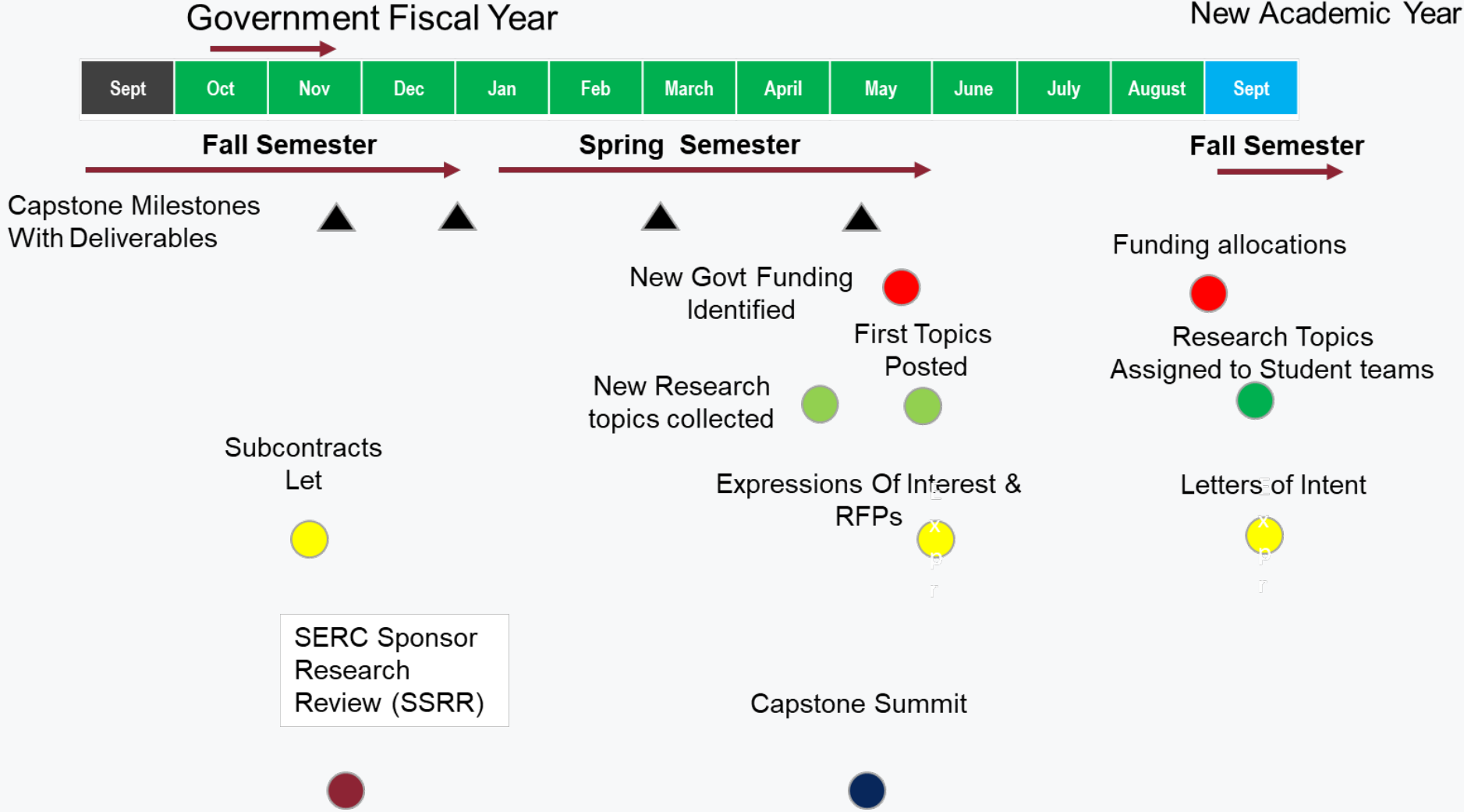
THANK YOU

| Stay connected with us online.



Backups

Capstone Timelines



The Student Point of View

Capstone Marketplace--

- Provides students and schools with “real” problems connected to “real people”
- Introduces students to “system engineering” thinking
- Creates model business environments—Students track Cost, Schedule, Technical Performance
- Focuses on working Prototypes—
Students have to “Build Something”

DOD Customer Quotes:

"Employment of a student team ensures that the results of the project reflect views unfettered by organizational prejudices and preconceptions...**a perfect 'tabula rasa'.**"

"In one project related to maritime issues, a student team outperformed a warfare laboratory that had been involved in the same project **for over ten years.**"

"This has probably saved us a million dollars" (Navy Commanding Officer)

2021-2022 Capstones

Research Topic	Number of University Teams	Customer
Dry Combat Submersible (DCS):		
DCS Atmospheric Monitoring	2	NSW
DCS External Life Support	1	NSW
DCS Fatigue/Stress Management	2	NSW
DCS External Stowage Pods	1	NSW
DCS Salinity Specific Configurations	1	NSW
DCS Smart Tow Cable	1	NSW
DCS Dive Computer	1	NSW
DCS Data Logger	1	NSW