NAVAIR SBIR / STTR PROGRAM

10 July 2023

Presented To:

NAVAIR SBIR Open Topic Information Session

Rules of Engagement

- Microphones are muted
- Put questions in chat
- Responses will be verbal, not in chat
- Technical questions only, no programmatic questions
- Presentation with audio to be posted to NavySBIR.com

Introduction

- Topic Author presentation of mission critical needs + Q&A
- Future Events
  - — Information Session (Technical) July 12, 1:00 PM ET
  - — Ask Me Anything Session (Programmatic) July 18, 1:00 PM ET
- Sessions are virtual and free
- Registration required at https://navysbir.com/open_topic.htm

DoN BAA Questions
usn.pentagon.cnr-arlington-va.mbx.navy-sbir-sttr@us.navy.mil

Locating Instructions and Topics

- DoN participates in the DoD Broad Agency Announcement (BAA)
- DoD 23.4 BAA Preface https://www.dodsbirsttr.mil/submissions/baa-schedule/active-baa-announcements (dodsbirsttr.mil)
  - Overarching Guidance/Requirements
  - Submission Requirements and Process
- DoN 23.4 BAA Instructions https://navysbir.com/open_topic.htm
  - DoN-specific requirements
  - Topics

Read the DoD Preface and DoN Instructions

Conventional vs. Open Topics

- Conventional Topics
  - —identify a specific Naval problem
  - —a desired technical objective
  - —an output
- Open Topics
  - —identify mission critical needs
  - —soliciting proposals to adapt commercial products or solutions
    - to close capability gaps
    - improve performance
    - or provide technological advancements in existing capabilities

NAVAIR Overview

Presented by: Kristi DePriest
NAVAIR SBIR/ STTR Program Manager

NAVAIR's Role in Naval Aviation

DEVELOP, acquire and support aircraft, weapons and related systems which can be operated and sustained at sea

PROVIDE analysis and decision support for cost / schedule / performance trades and investment decisions

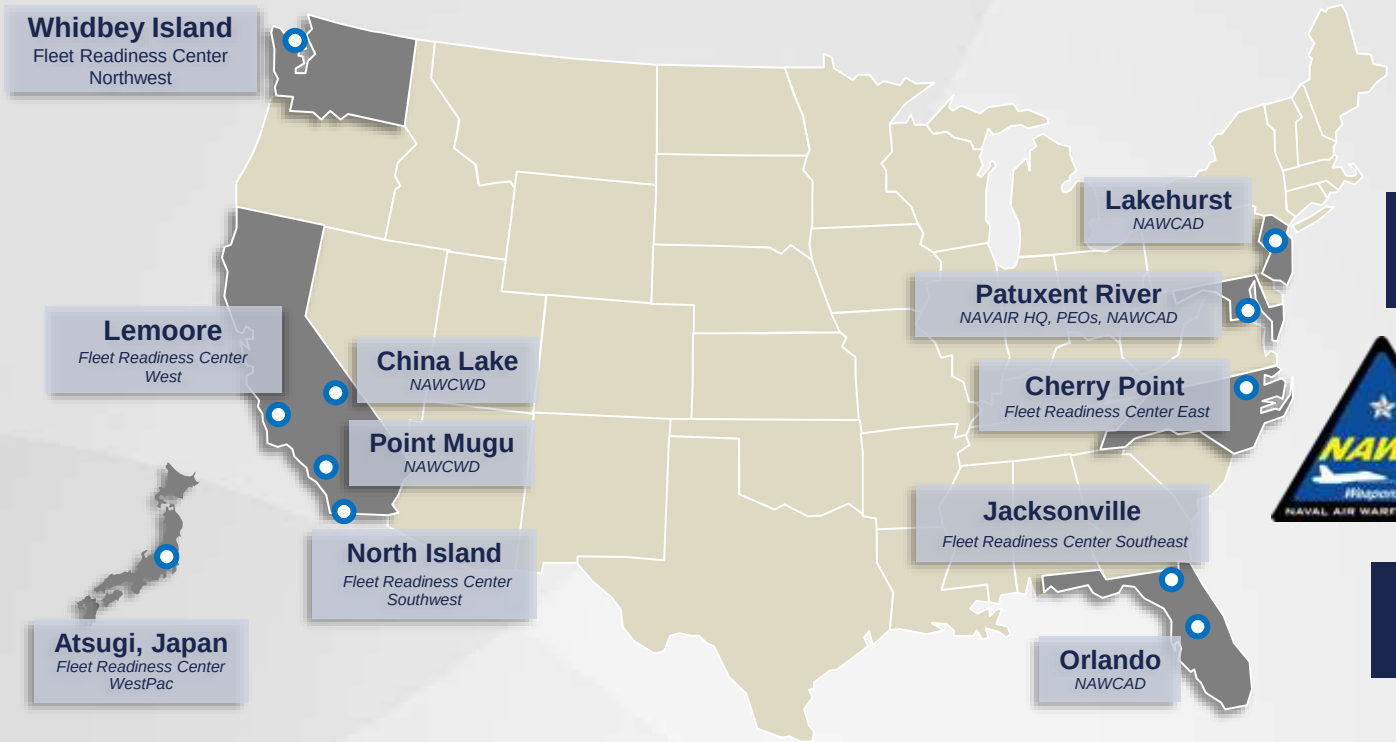
INCREASE Navy and Marine Corps capability, readiness and affordability in a joint / coalition environment

Deliver integrated air warfare capabilities to enable the fleet to compete, deter and win – tonight, tomorrow and in the future.

NAVAIR Snapshot

Full Life-Cycle Management

Requests, Risks from Fleet, OPNAV	Materiel Solution Analysis	Technology Maturation & Risk Reduction	Engineering & Manufacturing Development	Production & Deployment	Operations & Support



NAWCAD
East Coast Hub

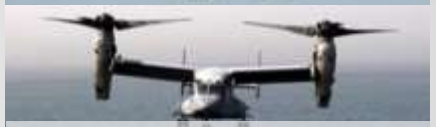
NAWCWD
West Coast Hub

COMFRC
Fleet Readiness Centers

45,600	31,000	1,600	13,000
FY20 Workforce	Civilians	Military	Contractors

Products

Tactical Aircraft



Air ASW, Assault & Special Mission

Unmanned Aircraft & Strike Weapons

Common Systems, Mission Systems, Training, ALRE

PEOs

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Introduction Brief for Contested Logistics SBIR Open Call 23.4

Matt Cosner
NAWCAD Contested Logistics S&T Lead
July 10, 2023

NAVAIR Contested Logistics: Scoping the Problem

Logistics is the planning and executing the movement and support of forces (DOD Joint Publication 4, Joint Logistics, 2015)

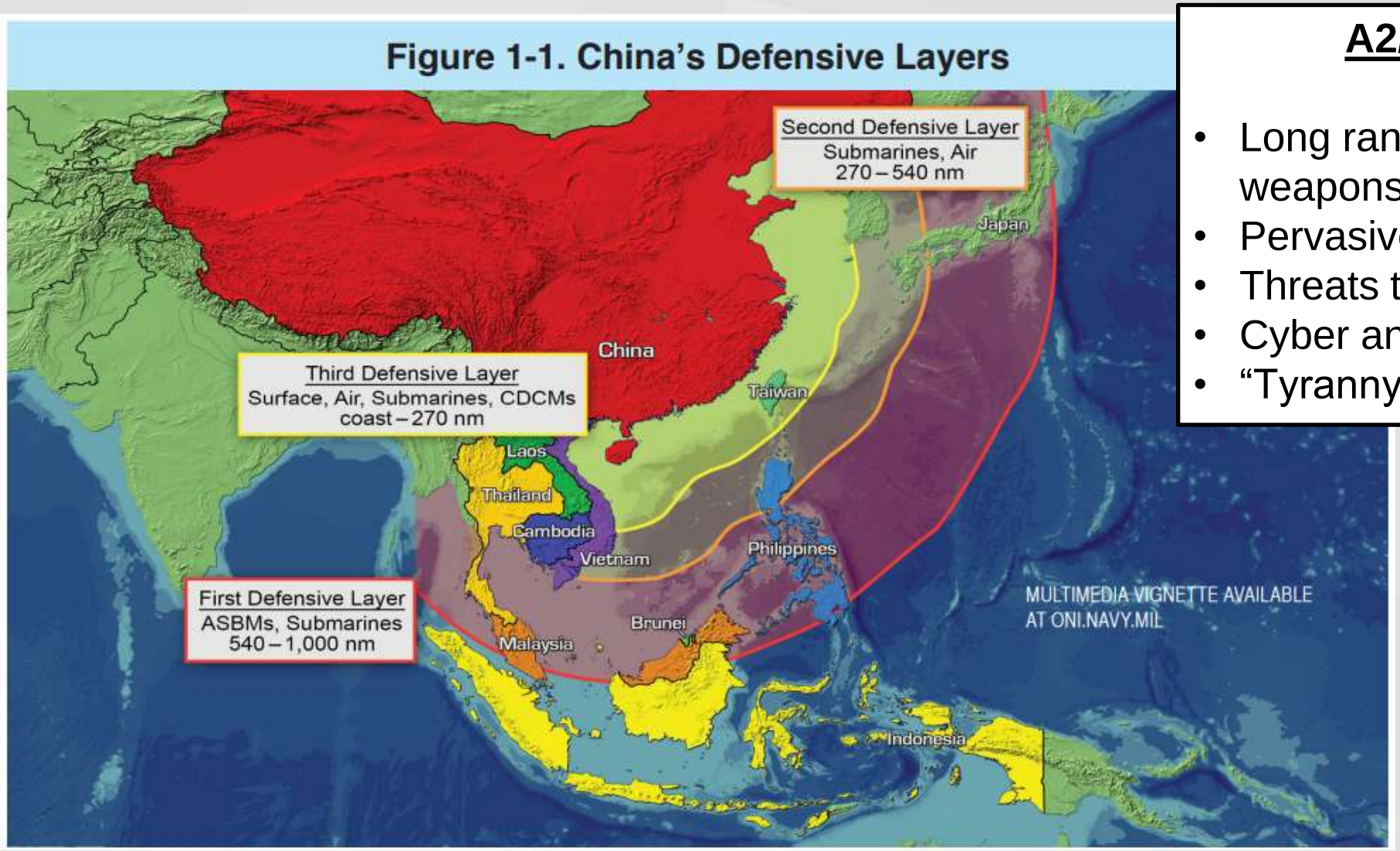
Intra-theater logistics is the portion of the transportation chain that delivers materiel from a port of debarkation to the point of use by an operational unit. Referred to as the "Last Tactical" Mile or "Last Logistical Mile". *Contrast with Strategic Logistics which moves and supports from the Continental US into theater: TRANSCOM, Military Sealift Command, Air Mobility Command*

Contested logistics is an environment in which the armed forces engage in conflict with an adversary that presents challenges in all domains and directly targets logistics operations, facilities, and activities (Title X, US Code).

Focused on intra-theater and tactical level of logistics, specific to naval aviation,
within the context of a peer adversary attacking our logistics system.

Sources: listed above

The Contested Environment



A2/AD Threats

- Long range precision weapons
- Pervasive ISR&T
- Threats to fixed bases
- Cyber and comms denial
- "Tyranny of distance"

Sources: Graphic: the PLA Navy, 2015

Who Thinks This Is A Problem?

	"[A key challenge is]… the proliferation of **advanced anti-access/area-denial capabilities** by adversaries, that would **degrade logistics capabilities**, capacities and responsiveness". - Joint Concept for Logistics v2.0, 2015
	"Resilient logistics connecting the foundry to the fleet—enabled by **secure communications** and **information technology—refuel, rearm, resupply, repair**, and **revive** distributed naval forces **down to the last tactical mile**". - CNO Navigation Plan, 2022
	"I think **logistics in a contested environment** is a huge challenge for us. Not insurmountable, but we need to acknowledge that we should assume…**[China is] going to challenge our sustainment.** We have work to do." **-** Commandant, USMC comments July 2022
	"We have been **spoiled by two decades** of conducting strategic and operational logistics in a permissive environment." – Deputy Commandant USMC for Installations and Logistics comments March 2023
	"Peacetime **efficienc***y* and **cost savings** have driven changes in the naval logistics force since the end of the Cold War, changes which could **reduce combat effectiveness** and **survivability** in the security environment we face today," –Naval Warfare Development Center, September 2017

Sources: listed above

Littoral Operations in a Contested Environment (LOCE) (2017)

SELECTED NAVAL SUSTAINMENT CAPABILITIES

(1) Ability to **protect logistics capabilities**, and provide **selective redundancy** for critical requirements.

(2) Ability to sustain distributed naval forces with **precision munitions** and **sufficient fuel** in high intensity combat.

(4) Ability to provide logistics forces the **mobility, protection, and agility** to support **widely dispersed forces** with diverse support requirements.

(5) Ability for **logistics at-sea forces** to sustain forces in the contested littorals.

(6) Ability to utilize **auxiliary platforms** to augment logistics sustainment capacity, **spread sustainment risk**, and **enhance operational tempo**.

(8) Ability to operate in a **communications contested / degraded environment**.

(9) Ability to **synchronize distributed logistics forces**.

(10) Ability to achieve battlespace awareness, **manage signal control** and **conduct dynamic maneuvering**.

(11) Ability to safeguard and **improve the integrity of logistics data**.

(12) Ability to conduct **expeditionary maintenance** and **battle damage repair**.

(13) Ability to conduct **casualty and medical treatment** and evacuation.

Source: LOCE, 2017

NAVAIR SBIR Contested Logistics Priorities

For this SBIR call, seeking industry projects for Naval Aviation that support and advance CNOs vision for Contested Logistics across four supporting subtopics:

CL Subtopics	Desired capabilities from the call
Next Generation Logistics Aircraft	Design refinement/ experimentation of tactical unmanned resupply aircraft that are attritable and/ or offer reduced detectability; large capacity, intra-theater, cargo and medevac aircraft which are not reliant upon large airfields. Novel shipboard launch and recovery and automated cargo handling systems. Air to Air refueling capability.
Aircraft Battle Damage Repair	Non-destructive inspection methods. Expedient battle-damage analysis. Safe flight envelope modification. Composite and low-observable materiel repairs. Fiber-optic repairs. Damage tolerant/resistant structures and systems. Access to maintenance data with limited or no reachback to home station.
Reduced Fuel / Supply Demand	Increased energy efficiency and/or methods to generate energy or fuel substitutes for aircraft and support equipment. Electric or Hybrid-Electric STOL/ VTOL systems. Reliable engines for UAVs that utilize common, existing aviation fuels. Reduced consumable usage and/or ability to manufacture consumables and limited-life parts in austere locations.
Logistics C4 Improvements	Sense and avoid systems for UAS. Increased autonomy for unmanned resupply aircraft. Alternative PNT systems, including optical ship-relative navigation. Reduced data-exchange requirements. Low Probability of Intercept/Detection (LPI/D) communications methods. Innovative air traffic control and/ or space de-confliction systems.

Further details provided in accompanying briefs.

Additional Unclassified References

1. **Joint Concept for Logistics v2.0**. Chairman of JCS. 2015.

2. **Littoral Operations in a Contested Environment**, CNO and CMC, 2017

3. **Tentative Manual Expeditionary Advanced Base Operations**, HQMC, 2021.

4. **Navigation Plan**, Chief of Naval Operations, 2022.

5. **The PLA Navy: New Capabilities and Missions for the 21st Century**. ONI, 2015.

Contested Logistics SBIR Open Call

Next Generation Logistics Aircraft

Colin Wilkinson
NAWCAD Air Vehicle Engineering S&T Lead

Kevin McCarthy
NAWCAD Advanced Aircraft Design Branch Head

July 10, 2023

Next Generation Logistics Aircraft

- From the Call:
  - Design refinement/ experimentation of tactical unmanned resupply aircraft that are attritable and/or offer reduced detectability (last-tactical mile delivery); large capacity, intra-theater, cargo and medevac aircraft which are not reliant upon large airfields. Short takeoff and landing (STOL), vertical takeoff and landing (VTOL), novel shipboard launch and recovery and automated cargo handling systems. Air to Air refueling capability.
- Breakdown
  - Application 1:
    - Tactical unmanned resupply aircraft that are attritable and/or offer reduced detectability
  - Application 2:
    - Large capacity, intra-theater, cargo and medevac aircraft which are not reliant upon large airfields
  - Enabling technologies:
    - Short takeoff and landing (STOL)
    - Vertical takeoff and landing (VTOL)
    - Novel shipboard launch and recovery
    - Automated cargo handling systems
    - Air to Air refueling capability.
- Flying vehicles are encouraged (new or mods to existing vehicles) but enabling technologies are acceptable

Next Generation Logistics Aircraft

- Application 1 (Tactical Unmanned Resupply) Guidance (not requirements)
  - Mission: Fully autonomous ship-to-ship / ship-to-shore / shore-to-ship resupply, operating from DDG flight deck or larger
  - Operating radius: 10's of miles
  - Speed: Faster is better
  - Payload: 10's / low 100's of lbs
  - Weight/Size: Smaller is better
  - Cost: attritable ("affordable mass")
  - Other Considerations
    - Low detectability
    - Minimal ship infrastructure
    - Compact storage / innovative packaging / auto-configuring based on payload and range
    - Launch and recovery mechanism for minimal personnel
    - Cargo handling mechanism for minimal personnel
    - Rapid production
    - Heavy fuel capable or electric/hybrid-electric
    - Comms / sensors / PNT will be addressed by "Logistics C3 Improvements" sub-area
      - Collective proposals are encouraged

Next Generation Logistics Aircraft

- Application 2 (Large Intra-Theater Lift) Guidance, (not requirements)
  - Mission: Ship-to-ship / ship-to-shore / shore-to-ship (without need for long runway)
  - Operating radius: 100's of miles
  - Speed: Faster is better
  - Payload: 100's / 1000's of lbs
  - Weight/Size: no guidance
  - Cost: no guidance
  - Other Considerations
    - Low detectability
    - Minimal ship infrastructure
    - Launch and recovery mechanism for minimal personnel
    - Cargo handling mechanism for minimal personnel
    - Robust adaptive controls for battle damage and irregular external cargo
    - Heavy fuel capable or electric/hybrid-electric
    - Comms / sensors / PNT will be addressed by "Logistics C3 Improvements" sub-area
      - Collective proposals are encouraged

Contested Logistics SBIR Open Call

Aircraft Battle Damage Repair

Calvin Faucett
NAWCAD Hypersonic Advanced Hot Structures Materials Lead
July 10, 2023

Aircraft Battle Damage Repair

OBJECTIVE:

The Department of the Navy is seeking proposals for enhancing existing prototypes or concepts to improve operations in contested environments for extended periods of time through heightened tensions and conflict by significantly enhancing or reducing or eliminating the need for replenishment or sustainment.

TECHNOLOGY AREAS:

1. Integrated Sensing and Cyber
2. Advanced Computing and Software
3. Trusted AI and Autonomy

BAA Sub-Topics for AIRCRAFT BATTLE-DAMAGE REPAIR

- ❑ Non-destructive inspection methods
- ❑ expedient battle-damage analysis
- ❑ safe flight envelope modification
- ❑ composite and low-observable materiel repairs
- ❑ fiber-optic repairs
- ❑ damage tolerant/resistant structures and systems
- ❑ access to maintenance data with limited or no reachback to home station.

Aircraft Battle Damage Repair

Guidance (not requirements)

- Minimal Tools and Complexity to support field operations.
- Affordable and Rapid Non-destructive inspection methods and techniques to support field operations and assessment of battle damage.
- Component damage progression models and material based statistical uncertainties associated to prediction of component life can be rolled into expedient battle-damage analysis.
- Tie NDI and materials damage progression models to safe flight envelope modification
- Affordable, simple, rapid composite and low-observable materiel repairs implemented in field operations not depot.
- Rapid durable on-sight “fool proof” fiber-optic repair technologies
- Leveraging material properties/architecture, structural topology/behavior can address the damage tolerance and resilience of structures.
- Access to platform agnostic maintenance/repair data with limited or no reachback to home station.

Aircraft Battle Damage Repair

- Considerations
  - Consider S&T solutions which work within the limits of US supply chain availability and cost. (i.e. AM materials etc.)
  - Aircraft Battle Damage Analysis may need to tie in data, properties, and/or statistics from the materials and structural scales in order to support prediction of life and flight hours availability.
  - S&T efforts associated with battle damage, composite, or LO coating repairs should consider the Navy oceanic environment.
  - Consider S&T solutions that do not depend on tools that may or may not be available in the warfare environment.
  - Simple means of material and structural testing to assist replacement or repair in field. This replace materials must have certain properties which can be tested in the field that verifies it's ready to use.
  - Consider shelf life of repair technologies so they are effective in the field when needed.
  - Simple techniques to determine strength, stiffness, and other structural considerations when can be used in the field prior to repair or replacement of part.
  - There may be security considerations concerning this topic.

Contested Logistics
SBIR Open Call

Reduced Fuel / Supply Demand

Rick Kamin, Fuel and Energy SSTM
Nathan Kumbar, Electrical Power Systems SSTM
Jordan Wedderburn, Acquisitions Electrical Power Branch Manager
Michael Allen, Electrical Power System S&T Lead
NAWCAD Propulsion and Power Department
July 10, 2023

Reduced Fuel / Supply Demand

- **From the Call:**
  - Increased energy efficiency and/or methods to generate energy or fuel substitutes for aircraft and support equipment. Electric or Hybrid-Electric STOL/ VTOL systems. Reliable engines for UAVs that utilize common, existing aviation fuels. Reduced consumable usage and/or ability to manufacture consumables and limited-life parts in austere locations.

- **Important Notes:**
  - Description within call is recognized to be very broad
  - NAWCAD will support via multiple competencies
    - Electrical Power Systems, Fuels, Engines, Air Vehicle, etc.
  - Ensure Aviation technology focused submittals
  - Collective proposals across topic areas are acceptable
    - i.e., Next-Gen Logistics Aircraft with impact on Reduced Fuel/Supply Demand
  - Technology will be restricted under International Traffic in Arms Regulation (ITAR) 22 CFR Parts 120-130

Reduced Fuel / Supply Demand

- **Guidance (not requirements)**
  - **Perspective:**
    - "Integrated systems" optimization vice "individual system" optimization for energy utilization to meet mission objectives; component optimization is still acceptable
    - Component reliability improvement plays a role in reducing the logistics demand, i.e., traded vs. cost ($)
    - Manned and Unmanned Vehicle interests
  - **Technologies of interest:**
    - Internal Combustion Engines (i.e., aviation grade, ruggedized, heavy fuel compatible)
    - Turbogenerators (i.e.. turbine component, generator component, power conversion/management)
    - All-electric platform optimization (i.e., batteries, fuel cell systems, power conversion/management, electric motors)
    - Hybrid Electric platform optimization (i.e., various configurations, coupled systems with electric components and diesel or gasoline engine or turbomachinery)
    - Forward Deployed / Produced Fuels and Fuel Management Systems
    - Air Vehicle Drag Reduction
  - **Areas of improvement:**
    - Specific Fuel Consumption (SFC)
    - System-Level and Component-Level Efficiencies (input to output)
    - Energy and Power Density
    - System State Awareness (i.e., software, prognostics, controls…)
    - Thermal Management, Heat Transfer

Contested Logistics SBIR Open Call

Logistics C4 Improvements

William Humphrey
NAWCAD Avionics Engineering
July 10, 2023

Littoral Operations in a Contested Environment (LOCE) (2017)

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Source: LOCE, 2017

Logistics C4 Improvements

- From the Call:
  - **Enable UAV Autonomous Logistics Operations**
    - Situational Awareness and Visibility of Sensors, Equipment, and Planning
    - Logistical Data Assimilation and Workload Reduction
    - Automated Load Balancing (aircraft)
  - **Reduce Communications Detectability**
    - LPI/LPD waveforms
    - Assured Precision Navigation and Timing (APNT)
    - EMCON/Denied GPS Environment Operations
    - Architecture and Protocols
  - **Planning Tools**
    - Predictive Logistics Tools
    - Asset Maintenance and Operational Logging
    - UAS Route Planning

Logistics C4 Improvements Methodology

1. Advance logistical exploitation under simultaneous scenarios. Provide quick and accurate decision-making through advanced processing, artificial intelligence, machine learning or deep learning algorithms;
2. Advance the state-of-the-art in modeling and simulation of complex environments/systems/missions;
3. Provide affordable, accessible data collection and analysis of logistical data in operationally relevant environments;
4. Develop compact, efficient sensors, components, and architectures that are compatible with manned or unmanned platforms; and
5. Provide a more robust integration of engineering and mission models for assessing complex mission scenarios.

Logistics C4 Improvements Goals

- Design, develop, and transition **Command, Control, Communications, and Computers** (C4) systems to improve the **operational readiness or supportability** of all aircraft and off board logistical operations. Seeks hardware and software solutions to address performance gaps and improve the Warfighter's ability to conduct the mission.
- Design, develop, and transition **processing, autonomy, and data assimilation solutions that provide perception, reasoning, and continuous learning capabilities for significant reduction in human intervention and workload**, while enabling effective warfighter performance. Seeks hardware and software solutions to address the current and future complexities of operations in the battlespace.