

# NAVAIR SBIR / STTR PROGRAM

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*Presented To:*

NDIA Small Business Innovation Summit

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# NAVAIR Potential 23.1/A Topics Topic Workshop

13 Dec 2022

Presented to: National Defense Industrial Association

Presented by: Tony Archer  
Technology Portfolio Manager



# Intro to the NAVAIR topics

Within the 23.1/ A Broad Agency Announcement, NAVAIR expects to complete:

- 22 Phase I SBIR topics
  - Three of the topics are Digital Engineering
- One (1) Direct to Phase II topic
  - This is a Digital Engineering topic
- Eight (8) Phase I STTR topics
  - Four of the topics are Digital Engineering



# N231-007



Source: Navy.mil

**Topic Title:** DIGITAL ENGINEERING

Digital Modelling and Simulation of Maneuvering Hypersonic Weapons

**Endorsing PEO/PMA:** PMA-201 Precision Strike Weapons

**Objective:** Develop and advance computational simulation tools for modeling of weapon maneuvers in the hypersonic flight regime.

- In practice, low-fidelity physics models (i.e., zeroth to first-order models) are used to simulate the environment and response of the vehicle across its intended trajectory.
- New computational tools and methods are desired, which leverage high-performance computing and surrogate/reduced-order modeling without degrading model fidelity while utilizing reduced computational resources for full-trajectory and mission-effectiveness simulations.



# N231-008



Source: Navy.mil

**Topic Title:** DIGITAL ENGINEERING  
Broadband Real-time Data Bus

**Endorsing PEO/PMA:** PMA-209 Air Combat Electronics

**Objective:** Develop an open protocol, software and hardware to support the use of IP devices (e.g., an Ethernet-enabled sensor with an Ethernet-enabled mission computer system) over a STANAG-7221 link without interfering with a MIL-STD-1553 connection being used concurrently.

- The proposed solution should support Standard Network Management Protocol v3 (SNMP) for management and statistics, or an equivalently acceptable standard.
- The design should consider warfighter ease of use to create a data bus that is legacy compatible and does not impact the standard 1553 bus configuration, effectively “plug and play,” to enable STANAG 7221 speeds for IP-based traffic simultaneously.



# N231-009



Source: Navy.mil

**Topic Title:** DIGITAL ENGINEERING  
High-Speed Data Return for Tactical Environments

**Endorsing PEO/PMA:** PMA-281 Strike Planning and Execution Systems

**Objective:** Develop a solution to utilize data that would otherwise be wasted, and use it to determine near real-time solutions for ongoing and soon to be executed missions.

- While much of the mission data collected from sensors informs battlespace management teams, often subtle, useful data returns with the platforms after a mission, without being analyzed and exploited.
- There is no current process to cull and analyze such data; therefore, the Navy requires high-speed data returns for tactical environments.
- Today there exists a need to create/enhance the ability to download, aggregate, and analyze seemingly innocuous or inconclusive data gathered by tactical and strategic sensors and provide possible tactically relevant conclusions for timely (hours/days) exploitation to mission planners.



# N231-D01



Source: Navy.mil

**Topic Title:** DIGITAL ENGINEERING  
DIRECT TO PHASE II

Improved Fiber Laser for Spectral Beam Combination

**Endorsing PEO/PMA:** PMA-265 F/A-18 Hornet/Super Hornet

**Objective:** Develop a robust, spectrally stabilized, continuous wave fiber-laser system with < 15 GHz spectral bandwidth that is free from stimulated Brillouin scattering and thermal mode instability at kW power levels.

- Fiber-laser sources are highly desired for high-energy laser (HEL) applications due to their compactness and robustness.
- The performance of high-power fiber lasers is hindered by two instabilities: stimulated Brillouin scattering (SBS) and thermal mode instability (TMI).
- New fiber-laser systems are required that can overcome these limitations.



# N23A-T001



Source: Navy.mil

**Topic Title:** DIGITAL ENGINEERING

Toolkit to Produce Common Adaptive Mesh for Virtual Reality-based Multidisciplinary Interactive Design of Naval Aircraft

**Endorsing PEO/PMA:** NAVAIR Chief Technology Office

**Objective:** Develop an innovative tool that autonomously generates a common mesh from Computer-Aided Design geometry with adaptive global and local refinement capabilities for coupled aero-thermal-structural analysis and optimization to enable Virtual Reality (VR)-based real-time interactive designs.

- An adaptive, common mesh generation tool is needed to facilitate the MDAO to accelerate aircraft development.
- The tool should enable autonomously-generated geometry-aware mesh generation and adaptation, which can be integrated into the simulation tools of aircrafts involving CFD (e.g., hypersonic flows), fluid-structure interaction, fatigue/damage, and thermodynamics.
- The toolkit should enhance the user's experience with virtual reality by improving visual understanding of the mesh with respect to the geometry through the interaction of the various physics.





# N23A-T002



Source: Navy.mil

## **Topic Title:** DIGITAL ENGINEERING

Integration of Fiber Optics Systems Design, Supportability, and Maintainability

**Endorsing PEO/PMA:** PMA-260 Aviation Support Equipment

**Objective:** Develop modeling approach for designing, maintaining, and supporting air and sea platform digital and analog fiber optic communications technology.

- Key fiber optics systems engineering design considerations include architecture, reliability, maintainability, and supportability.
- Integrating the disparate interfaces associated with digital and analog/RF fiber optic systems, and a model-based engineering approach, requires significant digital engineering research and innovation.
- This digital engineering research effort should develop models that include all of the platform components, support equipment, associated fleet maintainer training, reliability data, and digital and analog/RF fiber optic system design engineering principles.



# N23A-T003



Source: Navy.mil

**Topic Title:** DIGITAL ENGINEERING

Improved Physics Modeling for Sand Particulate Tracking and Deposition in Gas Turbine Engines

**Endorsing PEO/PMA:** NAVAIR Chief Technology Office

**Objective:** Improve time-varying modeling and simulation capabilities to couple representative reactive sand particulates with modern propulsion systems, including inlet and turbomachinery.

- Ingested particles can degrade compressor performance via surface erosion, deform leading and trailing edges of blade airfoils, and open rotor tip-clearances.
- Complex propulsion systems of interest include inlets, inertial separators, hot and cold rotating turbomachinery with and without secondary cooling air flow, as well as the coupling of multiple of these components.
- A focus on robust, parallel, highly efficient software improvements that can be utilized for complex geometries (such as inertial separators and rotating turbomachinery with secondary and cooling flows) with relevant sand particle constituents, size distributions, and cloud concentrations is required.



# N23A-T004

## **Topic Title:** DIGITAL ENGINEERING

Digital Twin-based Machine Control for Adaptive Additive Manufacturing Processing of Metallic Aerospace Components

**Endorsing PEO/PMA:** PMA-265 F-18 Hornet/Super Hornet

**Objective:** Develop a digital twin based system that can autonomously tailor local microstructure, heal defects, and minimize residual stresses and surface roughness in near real-time, to assure repeatable, reliable, and optimal fatigue performance for additive manufactured (AM) metallic aerospace components.



Source: Navy.mil

- Defects in AM processing can arise due to many causes, and significant attention has been given to different strategies to ameliorate these defects.
- The Navy requires an integrated DT-based system that can provide near real-time machine control for fully autonomous adaptive AM processing of metallic aerospace components.



# N23A-T005



Source: Navy.mil

**Topic Title:** Sensor System for Time-Resolved Temperature Measurements in High-Temperature/High-Velocity Exhaust Plumes

**Endorsing PEO/PMA:** PMA-265 F-18 Hornet/Super Hornet

**Objective:** Develop a time-resolved sensor system for measuring gas dynamic and compositional characteristics of high-temperature/high-velocity engine exhaust plumes.

- High-temperature, high-velocity exhaust plumes present a uniquely challenging measurement environment.
- Wetted sensors, such as thermocouples and pressure transducers, degrade rapidly in reactive, particle-laden, high-temperature, high-velocity plume flows, emphasizing a need for noninvasive measurement approaches.
- Similarly, noninvasive optical techniques are hampered by low-transmission, large-density gradients, and high-thermal, spontaneous emission in hot, fast, particle-laden flows.
- An innovative sensor system is desired for measurements in high-temperature and high-velocity exhaust plumes.



# N23A-T006



Source: Marines.mil

**Topic Title:** Microwave Curing Process Modeling for Continuous Carbon Fiber Reinforced Thermoset Composites

**Endorsing PEO/PMA:** PMA-276 (FVL) H-1 USMC Light/Attack Helicopters

**Objective:** Develop simulation models and visualization tools for microwave curing process of carbon fiber reinforced composites, and demonstrate the feasibility to manufacture high quality carbon fiber reinforced composites using microwave radiation.

- Autoclaves are widely utilized to process and manufacture high-performance aircraft composite materials.
- This conventional method provides laminate consolidation by application of elevated pressures and temperatures; however, the high costs and extensive process times associated with this technique have generated an interest in the implementation of out of autoclave curing methods.
- Microwave curing is gaining increasing attention as an alternative tool for composite industrialization, due to its potential for reduced cure times, low energy consumption, and mass production.
- This STTR topic seeks to develop a multi-physics based model that simulates and optimizes the microwave curing process of thick fiber reinforced composites (up to 10 mm).



# N23A-T007



Source: Marines.mil

**Topic Title:** Ultra-Compact, Lightweight MWIR Zoom Imaging Optics Based on Flat Lens Technology

**Endorsing PEO/PMA:** PMA-263 Navy and Marine Corps Small Tactical Unmanned Air Systems

**Objective:** Develop ultra-compact, lightweight Mid-wave infrared (MWIR) zoom imaging optics based on flat lens technology and with 7 times improvement in SWaP.

- MWIR imaging systems are essential to intelligence, surveillance, and reconnaissance (ISR) missions.
- Conventional IR optics are thick, heavy, costly, and often require bulky mechanical mounting system to keep their multiple optical elements stable and well-aligned.
- Current systems weigh 400 g or more, often necessitating heavy-duty gimbals for aiming.
- The goal is to dramatically reduce size and weight versus comparable state-of-the-art conventional zoom lens systems, without reducing performance.



# N23A-T008



Source: Marines.mil

**Topic Title:** Ultra-fast Full-Wave Photonic Simulation and Optimization

**Endorsing PEO/PMA:** PEO (F-35) Joint Strike Fighter

**Objective:** Develop novel ultra-fast simulation technology capable of speeding up full-wave electrodynamic simulation by 1,000 times. This ultra-fast simulation technology will be used to develop long-wave infrared (LWIR) lens that are 100 times thinner and lighter than today's state-of-the-art LWIR optics and with fully customizable aperture sizes and focal length.

- Flat metamaterial optical devices provide a unique opportunity for producing compact and high-performance components for manipulation of light
- Flat optics is particularly interesting in the long-wave infrared region because the lack of high-quality imaging optics.
- Traditional lenses are costly and bulky and possess limited aperture size in the infrared region.
- Developing integrated imaging optics in LWIR is of great interest especially for tactical surveillance and reconnaissance in this special range.

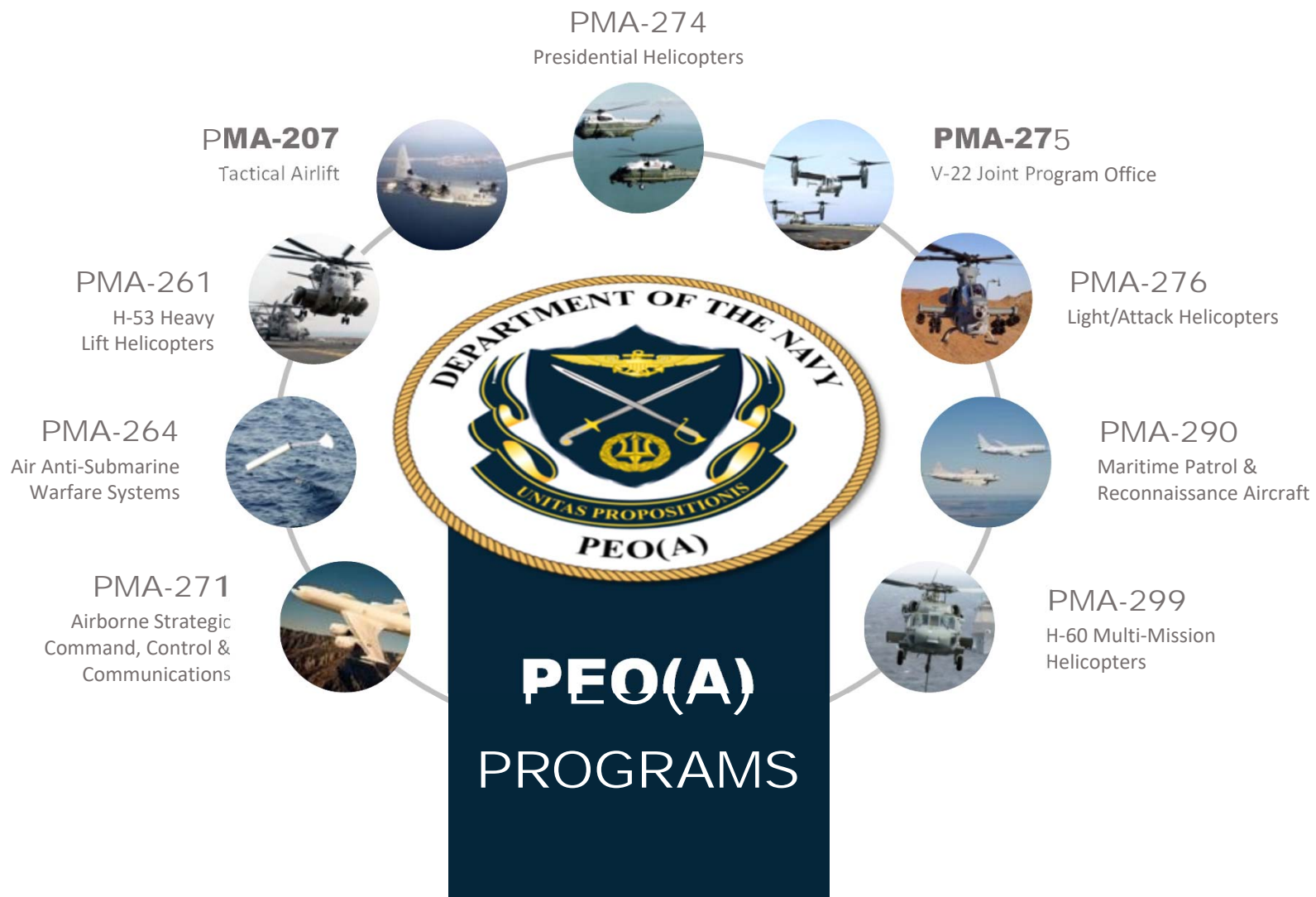


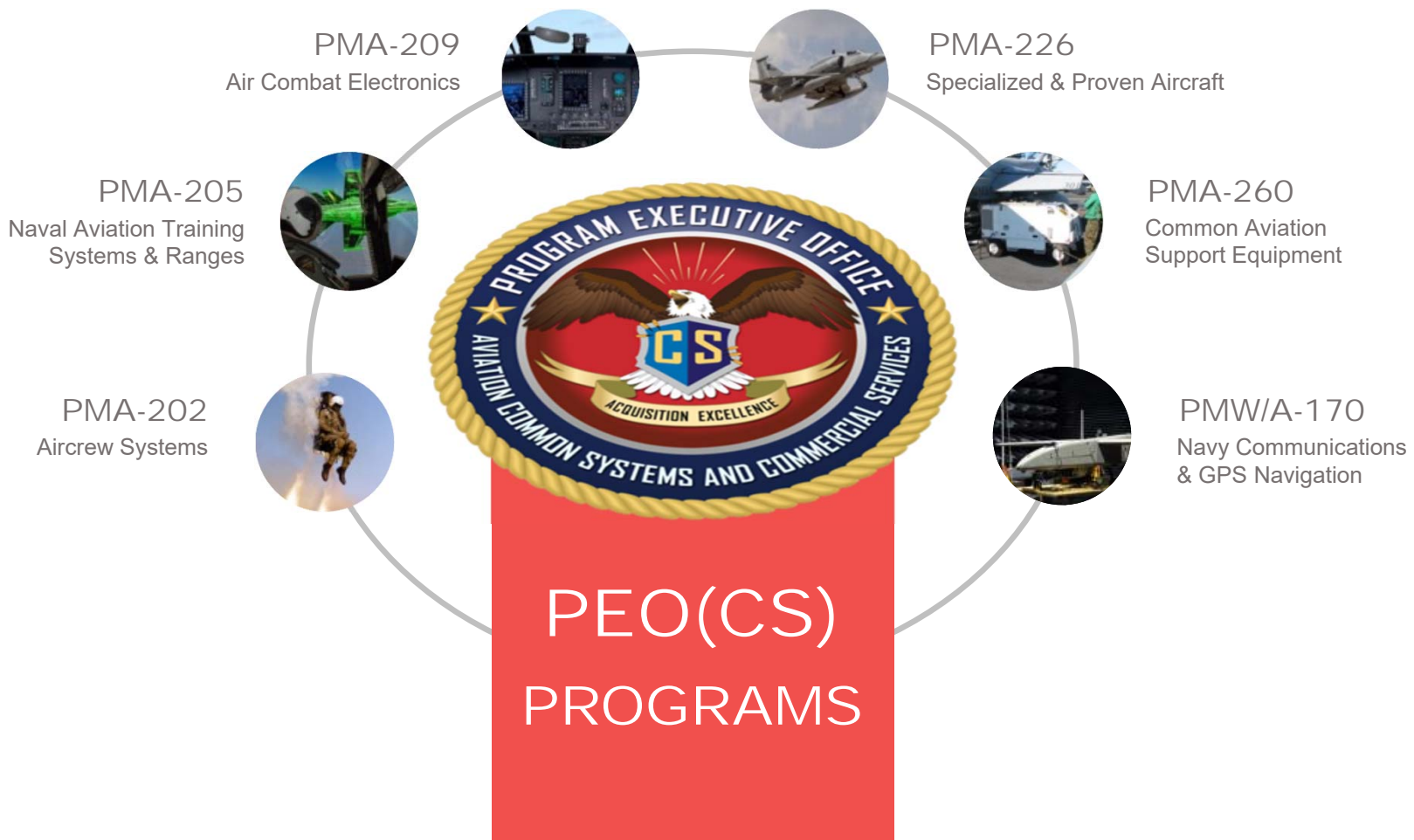
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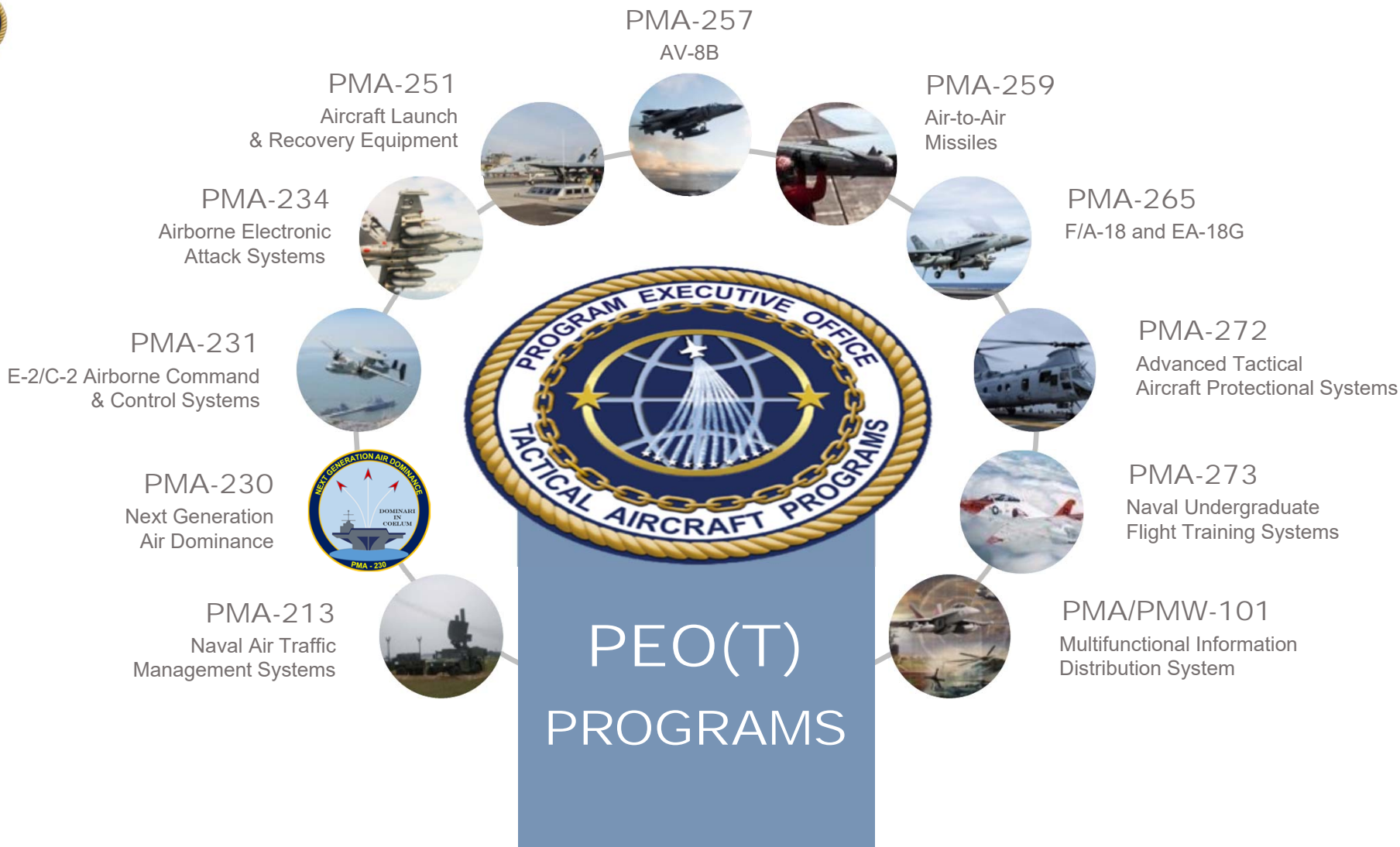




# Backup Slides











# PEO(JSF)



**MISSION:** The F-35 Lightning II Program (also known as the Joint Strike Fighter Program) is the Department of Defense's focal point for defining affordable next generation strike aircraft weapon systems for the Navy, Air Force, Marines, and our allies. The F-35 will bring cutting-edge technologies to the battlespace of the future.

*Critical to US and Allied  
Air Dominance for the  
Next 50 Years*

*Survivable Against World's Most  
Sophisticated Threats Now and in  
the Future*

