Sea-Based Automated Launch and Recovery System

The Navy and Marine Corps will increasingly need to operate highly capable unmanned air vehicles (UAVs) from ships at sea. The MQ-8B Fire Scout is the first naval UAV of this type, operating from small deck ships, using the UCARS radar-based recovery system to provide precision ship-relative navigation (PS-RN) for its fully automated landings. The Unmanned Combat Air System Demonstration (UCAS-D) program will in the near future demonstrate the capability for an advanced UAV (represented by the X-47 demonstration aircraft) to operate from aircraft carriers, using a GPS-based PS-RN system for its automated launch and recovery capability. Analyses of and experience with both of these PS-RN approaches indicate that backup or alternative system options are desirable in order to ensure that highly reliable UAV operations can be conducted under demanding at-sea conditions.

In addition to enabling UAV operations, PS-RN systems can provide navigation and guidance to manned aircraft, both fixed-wing and rotary wing. In addition to sensor-based PS-RN systems, guidance could be provided by ship-based displays coupled with pilot displays (e.g., superposition of head-up display symbology over a stabilized ship reference display). PS-RN capability could greatly assist pilots in landing aircraft in conditions of restricted visibility. Ultimately, this capability could be used to fully automate manned aircraft launches and recoveries, with pilots acting as a system monitor. Potential benefits include reduced training requirements, expanded operating envelopes, greater efficiency in degraded conditions, reduced structural loads on landing, and enhanced safety. PS-RN capability could also enable automation of aircraft carrier air traffic control (ATC). Potential benefits include reduced fuel consumption, increased efficiency, increased safety, and reduced ATC manning.

Research Challenges and Opportunities:
- Non-GPS Precision Ship-Relative Navigation systems performance in:
  - Degraded weather
  - High deck motion
  - EMI/multipath/jamming
  - Alternate missions (e.g., landings ashore, landings on non-surveyed ships, etc.)
- Ship reference displays, and aircraft cockpit displays for manned aircraft
- Automated aircraft carrier air traffic control

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