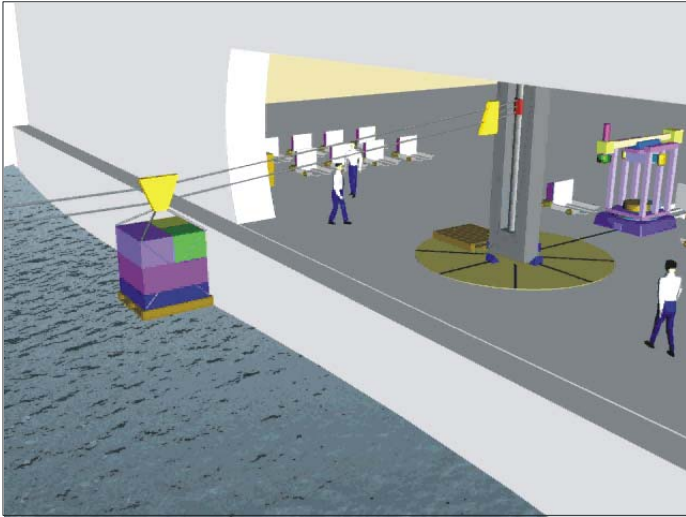


# AUTONOMOUS MOBILE CARGO HANDLING FOR CARRIER AUTOMATION

## The Vision of the Cargo Handling Program

Orbital Research will produce a flexible, extensible infrastructure of hardware and software components that will improve the performance of existing human controlled materials handling equipment aboard existing carriers and other Navy ships while providing an evolutionary path toward a fully autonomous materials handling system.



View of Components  
of a Notional Automated  
Handling System Receiving Cargo

## Summary

Orbital Research was awarded a Phase I feasibility program by the Navy's CVNX SBIR program office. This feasibility study was to evaluate modular and mobile cargo handling units for optimizing material handling on board future aircraft carriers. Orbital Research has developed a discrete event simulation to enhance the evaluation and trade-offs between various notional automated handling systems. This system is designed to allow the evaluation of different hardware platforms and guidance and control algorithms while under various operational scenarios. The resultant platforms will have the ability to be back-fit as well as forward fit onto aircraft carriers and surface combatants to assure smooth integration and acceptance over time. Thus, the original shipboard systems may have humans in-the-loop but will be upgradeable to a completely autonomous future system.

## SBIR Program Overview

Orbital Research has proposed the following work for each critical phase for this program.

**Phase I (Completed)** - Develop a notional automated cargo handling system targeted for materials UNREP aboard aircraft carriers. Simulate the system and perform a preliminary analysis of the resulting system performance.

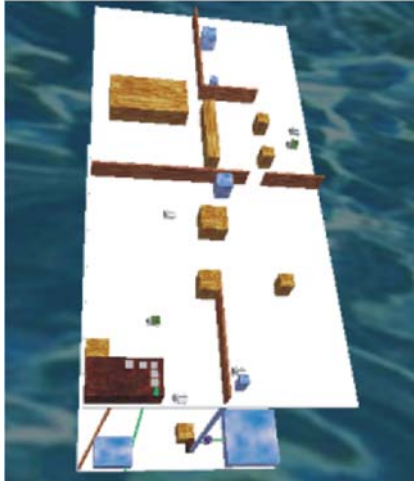
**Phase I Option - (Completed)** Enhance the simulation and begin design of automation demonstrator.

**Phase II - (Started 12/02)** - Implement a high-fidelity model of an aircraft carrier in simulation. Refine automated cargo handling system features and guidance & control systems by simulation optimization. Perform hardware demonstration of critical components of the automated cargo handling system.



### Who Can Benefit?

The system is a culmination of several innovative advanced software solutions that can be forward- or back-fit on a variety of cargo movement equipment. These hardware platforms cover all forms of cargo transport through out a ship including weapon stowage, and loading, horizontal and vertical conveyors, semiautonomous or autonomous vehicles (forklifts, pallet trucks) and unmanned vehicles.



**Simulation Graphics**

Key government applications for the Unified Control Solution include:

- Cargo movement operations including strike-up and strike-down

- Ship semi-automation and fully automated systems

- Weapon systems both for the ship as well as aircraft stationed on the ships.

- Unmanned air, ground and underwater vehicles

- Satellite control

The key advancement over competitive controls technology is its flexibility and modularity which permits rapid decision making with or without a human in the loop and coordination of other vehicles or tasks for greater reliability and savings.

The system is designed to be implemented in discrete elements, independent of other components to simplify back-fit. It also has the ability to provide enhanced situational awareness, guidance and coordination to human controlled materials handling equipment thereby improving the efficiency of existing systems and allowing phased deployment. Thus, this technology spans multiple military disciplines as well as military applications. This technology can be utilized by all Navy program offices.

**Orbital Research's ship automation mission** is to develop and commercialize innovative modular and flexible hardware and software technologies and services to meet manpower reduction needs of ships at sea while enhancing crew members' quality of life. The modular components will facilitate automation of vessels under dynamic sea-states and will significantly expedite the stowage or breakout of stores and weapons. We are dedicated to implementing and supporting our state-of-the-art technologies working closely with the Navy or ship manufacturer to produce a cost affordable and robust automation system.

### Navy Payoffs

Feature	Payoff
Improve performance of existing materials handling systems	Reduce Risk & Cost while Improving Warfighting
Back-fit and forward-fit capable system to enhance materials handling system commonality for both carriers and other Navy ships	Reduce Risk & Cost
Provide simulation to evaluate effect of specific system enhancements	Reduce Risk & Cost
Improve Cargo Movement Efficiency	Improve Warfighting
Reduce Required UNREP Time	Improve Warfighting
Reduce Crew Size	Reduce Cost

Orbital Research Inc., established in Cleveland Ohio (1991), is a high technology company. Our corporate mission is to develop and commercialize innovative solutions for the medical, controls and transportation industries through leveraging our expertise in MEMS devices and advanced control software. Orbital Research applies these core technologies to solve technical challenges using low cost and commercially viable solutions.