



CCT PROJECT SPOTLIGHT

LAUNCH AND RANGE TECHNOLOGY

Intelligent Launch and Range Operations Testbed

Cape Canaveral, FL

CCT and NASA have developed a concept and prototype for an advanced "testbed" facility for investigating new space transportation operational concepts that could reduce operations cost and complexity of future launch vehicles. When complete, the testbed will provide simulation and modeling tools for experimenting with physical, procedural, software, hardware, and psychological aspects of space flight operations. A mockup of a space flight operations control center, similar to NASA's [FutureFlight Central](#) (which simulates airport operations from a virtual control tower, shown at upper right) will be added to allow researchers to investigate new human performance and operations techniques using a variety of simulated missions, vehicles, flight anomalies, and human controller scenarios. Researchers will simulate experimental operations concepts and analyze alternate approaches to system design to better understand human factors and performance issues. As a result, system designers will be able to produce more effective operations concepts, information systems, and decision support systems for launch, range, and flight op-



NASA's FutureFlight Central simulates ground operations at major airports around the world. The Intelligent Launch and Range Operations Testbed adapts this concept to space launch operations.

erations. The ultimate outcome of this project could be replacement of today's space flight procedures and systems with intelligent systems that are highly responsive, safe and can accommodate high flight rates, globally-dispersed range operations, and mixed fleet operations with fewer human controllers at much lower cost.

Officially designated the *Intelligent Launch and Range Operations Testbed*, this facility will also provide a framework in which research and operations organizations can work together to address practical problems associated with launch and range operations. Collaborators will explore the operational issues associated with human performance, human factors and automation, human cognition and human perception in a variety of simulated ground control environments. Research results should lead to more streamlined concepts of operations and easily operated information systems for future vehicles and spaceports.

Flight	Ground	Operations	Regulatory
<ul style="list-style-type: none"> ▪ Integrated vehicle health management ▪ Thermal material tests (orbital and suborbital) ▪ Radiation-resistant electronics ▪ Laser and satellite communications ▪ Automated landing aids ▪ Magnetic launch assist ▪ Towed launch assist ▪ Propulsion technology 	<ul style="list-style-type: none"> ▪ Real-time range surveillance ▪ Definition of standard interfaces ▪ COTS ground stations ▪ Cryogenic management ▪ Weather prediction/impact ▪ GPS tracking ▪ "Smart" range ▪ Spaceport network 	<ul style="list-style-type: none"> ▪ Turnaround/cycle time improvement techniques ▪ Abort modes (simulation and flight test) ▪ Air/space traffic control integration ▪ Airport-like operations methods ▪ Multi-vehicle/fleet operation ▪ Ground-based cockpits ▪ Internet-aided operations ▪ Multi-vehicle launch pads 	<ul style="list-style-type: none"> ▪ Standard license application data packages ▪ Development of standard benchmarks and metrics ▪ Alternative E_c analysis algorithms ▪ Component/subsystem certification ▪ Flight test programs ▪ Certification regimes ▪ Licensing regimes ▪ Reliability testing

Examples of programs and technologies suitable for demonstration at the Operations Testbed.

Benefits

Potential payoffs include new methods for decreasing workload on space and air traffic controllers, distributing highly specialized launch preparation skills beyond the spaceport, and reducing the cost and labor required to recycle the Space Shuttle orbiter between flights. In another example, spaceport experiments could be conducted to determine how, or if, a future launch vehicle could be prepared for flight with the same size ground crew that prepares a commercial jetliner for flight today. New technologies associated with range operations, propellant management, spaceport command and control, process engineering, and communications could also be explored at the facility.

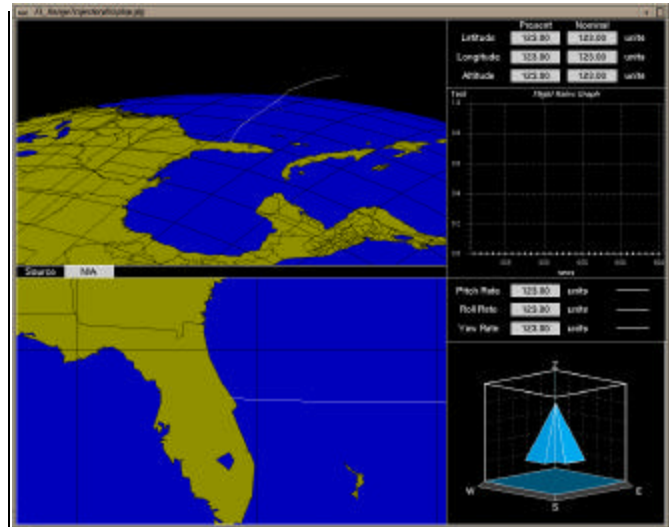
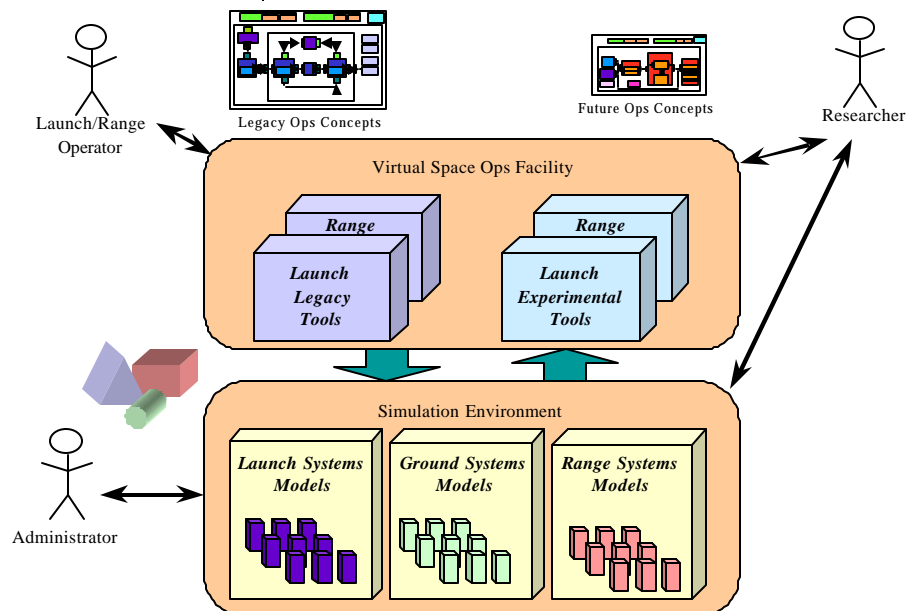
Summary

The operations testbed will provide a facility for experimenting with new ground and operational concepts in a controlled environment. Beginning with increased dialogue between researchers and operators, the facility will nourish partnerships between industry, government and academia, leading to improved space flight operations and economic dividends across the industry. The proposed testbed would provide opportunities to reduce costs and streamline operations by exploring new operations concepts, range safety procedures, flight planning and execution processes, and other improvements into their operations, including:

- A space flight simulation facility for experimenting with new techniques and operations concepts to improve launch, range, and mission operations.
- A focus for collaborative research involving NASA, DoD, academia, and industry.
- Influence design of future spaceport information systems to enable space flight operations cost reduction and safety improvement.

For more information on the testbed concept, see

The proposed testbed architecture is based on a virtual space operations facility in which operations experiments are performed (top box) and a simulation environment (lower box) that drives the operations facility.



Today's state-of-the-art launch tracking and display programs offer virtually no flight path predictive information. Without this information, controllers must rely on their personal knowledge and training to remain continuously alert to respond to flight anomalies. This precludes a single human controller from managing more than one flight at a time; a key issue to be investi-

http://www.cctcorp.com/technical_papers/WP-OpsTestbed-120601.pdf.

Command and Control Technologies Corporation specializes in launch site automation for government and commercial space programs. CCT provides turnkey solutions by integrating commercial hardware and software with custom software as required to provide tailored solutions for our customers. Visit our web site at www.cctcorp.com, e-mail us at info@cctcorp.com, or contact Kevin Brown at (321) 264-1193 for more information.