

NASA LANGLEY RESEARCH CENTER FLIGHT SIMULATION FACILITIES

A National Strategic Asset for Aerospace Research, Test, and Evaluation

Since the 1950s, NASA Langley's Flight Simulation Facilities (FSF) have served as a cornerstone for advancing space exploration, aeronautics, and scientific development. This national strategic asset provides world-class simulation capabilities essential for research, design, and testing concepts through real-time, high-fidelity simulation environments.



CUTTING EDGE CORE CAPABILITIES

- **Real-time, high-fidelity flight simulation** with full mission scenarios
- **Human-in-the-loop operations** for realistic pilot interaction studies
- **Hardware-in-the-loop testing** capabilities for integrated system validation
- **Robust hardware and software** designed to withstand airborne testing rigors
- **Collaborative networking** with NASA Centers, DOD, FAA, industry, and academia
- **Monte-Carlo** Simulation Studies

GROUNDBREAKING KEY APPLICATIONS

- **Advanced vehicle design** for crew and cargo space missions including **flight deck** and **flight control** systems
- **Next-generation air vehicle** development and testing
- **Uncrewed Aircraft Systems (UAS)** integration and validation
- **Next Generation Air Transportation** System initiatives
- **Lunar and Mars** surface operations simulation
- **Commercial transport** and **General Aviation** research
- **Autonomous Simulation and Flight Operations**

COCKPIT MOTION FACILITY (CMF)

Advanced Motion and Fixed Base Simulators

The CMF provides critical research capabilities utilizing various simulator sites

- Four fixed-base sites and one motion base site
- State-of-the-art 76-inch six-degree-of-freedom synergistic motion system
- Bridge crane system enabling simulator interchangeability
- Flexible motion-base or fixed-base operation capability



RESEARCH FLIGHT DECK (RFD)

All-glass reconfigurable cockpit with programmable side stick controls and collimated panorama system



INTEGRATION FLIGHT DECK (IFD)

Conventional transport cockpit with programmable wheel/column controls and collimated panorama system



EXPLORATION FLIGHT DECK (EFD)

Futuristic all-glass cockpit with interchangeable programmable controls and collimated panorama system



DEVELOPMENT AND TEST SIMULATOR (DTS)

Fixed-base advanced all-glass transport simulator featuring programmable side stick controls, pedal control inceptors, and panorama visual system. Currently configured with twin-engine transport aircraft dynamics for aeronautics research applications.



TEST AND EVALUATION SIMULATOR (TES)

Medium to low-fidelity simulator designed for rapid prototyping research. Fully reconfigurable to represent aircraft, UAS, or planetary vehicles with panorama visual system. Supports lunar landing spacecraft handling qualities, piloted aviation, UAS operations, and rotorcraft flight deck research.



RECONFIGURABLE AND PORTABLE INTERACTIVE DEMONSTRATOR (RAPID)

Low-fidelity portable simulator used to test and validate Human Landing System software deployed to the Disorientation Research Device (aka 'Kraken') at Wright-Patterson AFB. The Kraken is a key element in Crew training/familiarization for lunar landing.

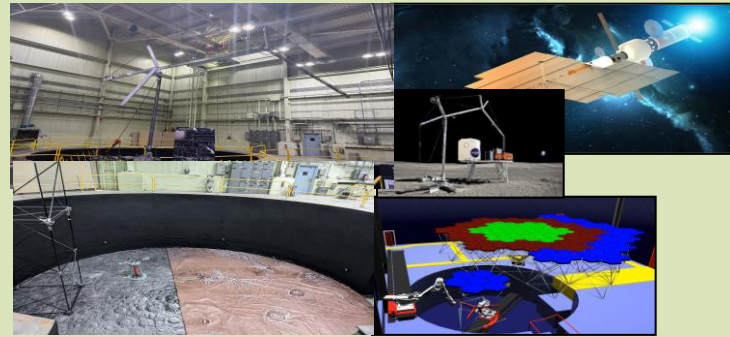


FSF Labs and Capabilities

MULTI-LEVEL AGILE CROSS-DISCIPLINARY REVOLUTIONARY OPERATIONS (MACRO)

State-of-the-art facility for **full-scale, high-fidelity verification** and validation of multi-agent operations critical for Moon to Mars mission elements. Features elevated ceilings and recessed flooring providing ideal testing environments for:

- Assembly of Lunar and Martian surface infrastructure (e.g., power towers, radiation shelters, etc.) with accurate solar lighting condition
- Lunar lander payload offloading and manipulation
- Mars transit vehicle assembly and deployment
- Assembly of orbital research stations and large-diameter telescopes
- Autonomous robotic excavation, construction, and outfitting (ECO)
- On-orbit and Lunar crater edge construction scenarios
- Advanced air vehicle concept validation



Multi-Level Agile Cross-Disciplinary Revolutionary Operations (MACRO)

MISSION OPERATIONS & AUTONOMOUS INTEGRATION CENTER (MOSAIC)

Centralized UAS fleet management facility leveraging NASA Langley's City Environment Range Testing for Autonomous Integrated Navigation (CERTAIN) "Smart Center" capability. **Enables routine UAS missions without field personnel through beyond-line-of-sight** operations, including:

- Weather sensing and event assessment
- Wildlife inventory and surveillance
- Infrastructure inspections (structural and energy monitoring)
- Road/taxiway deterioration assessment
- Spill response and security operations



Mission Operations and Autonomous Integration Center (MOSAIC)

UAS INTEGRATION AND VALIDATION LABORATORY (SIVL)

Provides **comprehensive UAS systems integration, validation, and diagnostics** through hardware-in-the-loop simulation capabilities. Enables critical safety studies including:

- Failure mode analysis and effects propagation
- Criticality assessment and mitigation strategies
- Certification standards development support
- Safety, reliability, and design data generation
- Integration with large-scale simulation networks
- Training for UAS pilot proficiency



UAS Systems Integration and Validation Lab (SIVL)

RESEARCH COLLABORATION FACILITY (RCF)

- Supports **Live, Virtual, and Constructive (LVC)** capability enabling collaborative, distributed, and integrated simulation and flight testing.
- Facilitates mixed aerospace asset operations across various geographical locations with **advanced audio, video, and data** connectivity.



Research Collaboration Facility (RCF)

SPACE FLIGHT RESEARCH SIMULATORS

- Lunar and Mars environment simulation
- Lunar and planetary lander operations
- Crew exploration and launch vehicle testing
- Lifting body vehicle research

AERONAUTICS RESEARCH SIMULATORS

- Commercial transport aircraft systems
- General aviation applications
- Uncrewed Aircraft System integration
- Electric Vertical Takeoff and Landing (eVTOL) vehicles
- Fighter jet systems and operations

FACILITY BENEFITS

- ✓ **World-Class Technology:** Unique, high-performance pilot-in-the-loop flight simulators with advanced oculometer technology
- ✓ **Superior Reliability:** High-quality systems with low operating costs and minimal maintenance requirements
- ✓ **Collaborative Network:** Seamless connectivity to NASA Centers, DOD, FAA, commercial, and university facilities for large-scale multi-vehicle simulations
- ✓ **Comprehensive Research Support:** Advanced flight deck design, vehicle operations research for space missions, air vehicles, and next-generation transportation systems
- ✓ **Strategic Impact:** Critical support for Langley Research Center and NASA Agency strategic priorities through innovative simulation capabilities

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