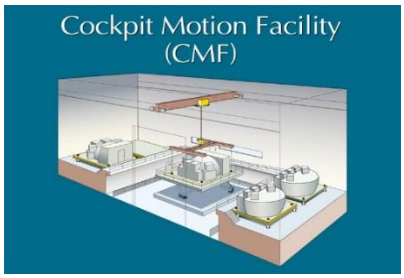
National Aeronautics and Space Administration

NASA's Space Environments Testing Management Office

NASA LANGLEY RESEARCH CENTER
THE FLIGHT SIMULATION FACILITIES

The NASA Langley Research Center (LaRC) Flight Simulation Facilities consist of the Cockpit Motion Facility (CMF), Development and Test Simulator (DTS), Test and Evaluation Simulator (TES), Uninhabited Aircraft Systems (UAS) Integration and Validation Laboratory (SIVL), System Integration Laboratories (SIL), and Research Collaboration Facility (RCF). The flight simulators provide real-time, high fidelity, full mission, human-in-the-loop, and hardware-in-the-loop flight simulation capabilities to conduct world-class state-of-the-art, preeminent aerospace research.

The CMF is a multifaceted motion and fixed-base flight simulation research laboratory. It is designed to support aeronautics and space flight vehicle research studies in which motion cues are critical to the realism of the experiments being conducted. The CMF consists of four fixed-base simulator sites and one motion base simulator site. The simulators are the Research Flight Deck Simulator (all-glass reconfigurable cockpit with programmable side stick and pedal control inceptors), the Integration Flight Deck Simulator (conventional transport cockpit with programmable wheel/column and pedal control inceptors), and the Generic Flight Deck Simulator (all-glass reconfigurable futuristic cockpit with interchangeable programmable control inceptors). Each of these simulators is designed to operate as a motion-base simulator or as a fixed-base simulator. The CMF is designed around a state-of-the-art, high-performance, 76-inch six-degree-of-freedom synergistic motion system. The simulators are moved from their fixed-base sites to the motion system through the use of an overhead bridge crane system.



Cockpit Motion Facility


Research Flight Deck


Integration Flight Deck


Generic Flight Deck

The DTS is a fixed-base, advanced all-glass transport with programmable side stick and pedal control inceptors and a panorama visual system. The simulator is currently configured with twin engine transport aircraft dynamics to support aeronautics research. The aircraft mathematical model can be changed to any vehicle for which data is available.


Development and Test Simulator

The TES is a medium to low fidelity simulator for rapid prototyping research and is reconfigurable to represent any type of aircraft, UAS, or planetary vehicles. The simulator has a panorama visual system for piloted operation. The simulation research included piloted aviation, spacecraft handling qualities, Uninhabited Aircraft Systems, and Rotorcraft flight decks.


Test and Evaluation Simulator

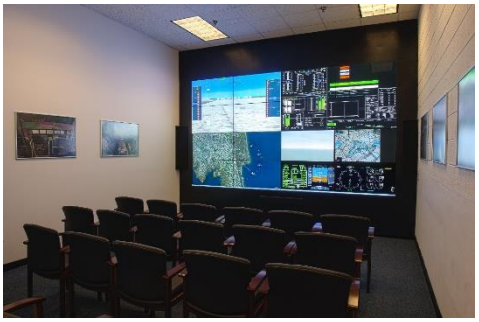
UAS SIVL provides a UAS systems integration, validation, and diagnostics hardware-in-the-loop simulation capability to facilitate safety studies of typical UAS missions. SIVL provides a robust and flexible simulation framework that enables the study of failure modes, effects, propagation paths, criticality, and mitigation strategies to help develop safety, reliability, and design data that can assist with the development of certification standards, means of compliance, and design best practices for UAS. Capabilities include software representations of different types of UAS with wide ranges of performance capabilities, commonly-used hardware interfaces, and integration of SIVL with other large scale simulations.

UAS Integration and Validation Lab

The SIL is a ground-based facility used in the development and validation of flight/simulation experiments prior to implementation in research aircraft. Representative SIL hardware includes flight control computers, flight management computers, experimental electronics systems, and data link systems. Research software that supports simulation-to-flight experiments is developed and tested at the various simulators in conjunction with the SIL before actual flight validation. The SIL integrates with the FSF Human-In-the-Loop flight simulators for Hardware-In-the-Loop end-to-end mission simulations.

Systems Integration Lab

The Research Collaboration Facility supports live, virtual, and constructive (LVC) capability for collaborative, distributed, and integrated simulation and flight tests. It facilitates efficiency in testing concepts, technologies, and their integration and interoperability. Advanced aeronautics and space exploration research, development, test, and evaluation can be conducted with a mixed of live, virtual, and constructive aerospace assets that simultaneously operate in various geographical locations.



Research Collaboration Facility

FACILITY BENEFITS

- World-class, unique, high-performance, state-of-the-art pilot-in-the-loop flight simulators with one-of-a-kind oculometer technology for all types of aircraft and spacecraft.
- High quality, high reliability, low operating cost, and low maintenance simulators
- Linkable to simulation facilities at other NASA Centers, DOD facilities, FAA facilities, commercial facilities, and university facilities to conduct large-scale multivehicle simulations with audio, video, and data connectivity.
- Conduct research for advanced flight deck design and vehicle operations for crew and cargo space missions, advanced air vehicles, uninhabited aircraft systems, and Next Generation Air Transportation System.

FACILITY APPLICATIONS

- Aeronautical Research Simulators
  - Commercial transport
  - General aviation
  - Fighter jets
  - Uninhabited Aircraft Systems/Vehicles
  - Urban Air Mobility
  - Futuristic designs
- Space Flight Research Simulators
  - Crew exploration and launch vehicles
  - Lunar and Planetary landers
  - Lifting bodies
  - Lunar and Mars environments

MOTION SYSTEM CHARACTERISTICS

Cockpit Motion Facility: Leg Stroke: 76 in / Payload: 22,000 lb			
Axis	Excursion	Velocity	Acceleration
Vertical	±41 in	±32 in/s	±1.0 g
Lateral	±55 in	±38 in/s	±0.7 g
Longitudinal	+67 in/-55 in	±38 in/s	±0.7 g
Pitch	+28 deg/-25 deg	±23 deg/s	±225 deg/s/s
Roll	±28 deg	±23 deg/s	±225 deg/s/s
Yaw	±38 deg	±30 deg/s	±225 deg/s/s

COCKPIT CHARACTERISTICS

	Research Flight Deck Simulator	Integration Flight Deck Simulator	Generic Flight Deck Simulator	Development and Test Simulator	Test and Evaluation Simulator
Motion base/fixed base	Yes/yes	Yes/yes	Yes/yes	No/yes	No/yes
Mission profile	Full mission	Full mission	Full mission	- Full mission - Uninhabited aircraft systems & vehicles	- Space operations - Uninhabited aircraft systems & vehicles - Vertical lift vehicles
Crew station capacity	2 pilots/1 test engineer/ 2 observers	2 pilots/1 test engineer/ 2 observers	2 pilots/1 test engineer/ 2 observers	2 pilots/1 test engineer/ 2 observers	1 pilot/1 test engineer/ 5 observers
Programmable control inceptor	Side sticks (SS) Pedals	Wheel/column (WC) Pedals	SS, WC, center sticks (CS)	SS Pedals	SS
Visual system FOV	200 x 40 panoramic	200 x 40 panoramic	WAC window (4)	210 x 45 panoramic	135 x 67 panoramic
Cockpit instrumentation	Programmable displays, 4 x 17 in, Dual HUDs	B737-NG standard displays, HUD	Programmable displays, 4 x 21 in, 3 x 13 in, OTW Graphical HUD	Programmable displays, 4 x 17 in	Programmable displays, 6 x 23 in

CONTACT INFORMATION

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