



Armstrong Research Flight Center Flight Mechanics Capabilities

Flight Mechanics TDT Members from AFRC:
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Outline



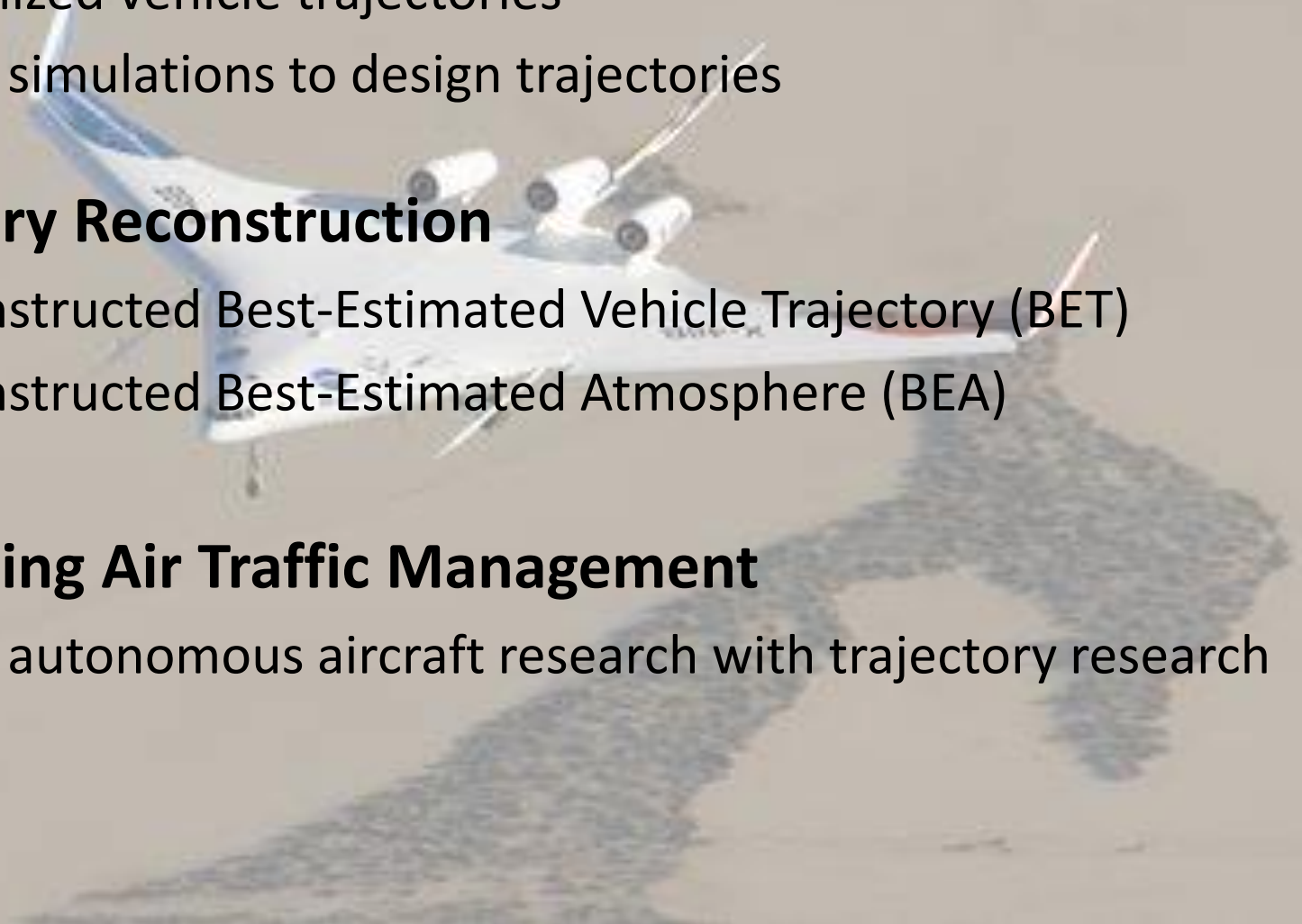
- **Trajectory Design and Analysis**
- **Flight Performance and Analysis**
- **Flight Mechanics Testing and Flight Operations**
- **Meteorology**
- **Modeling and Simulation for Flight**
- **Facilities**



Trajectory Design and Analysis

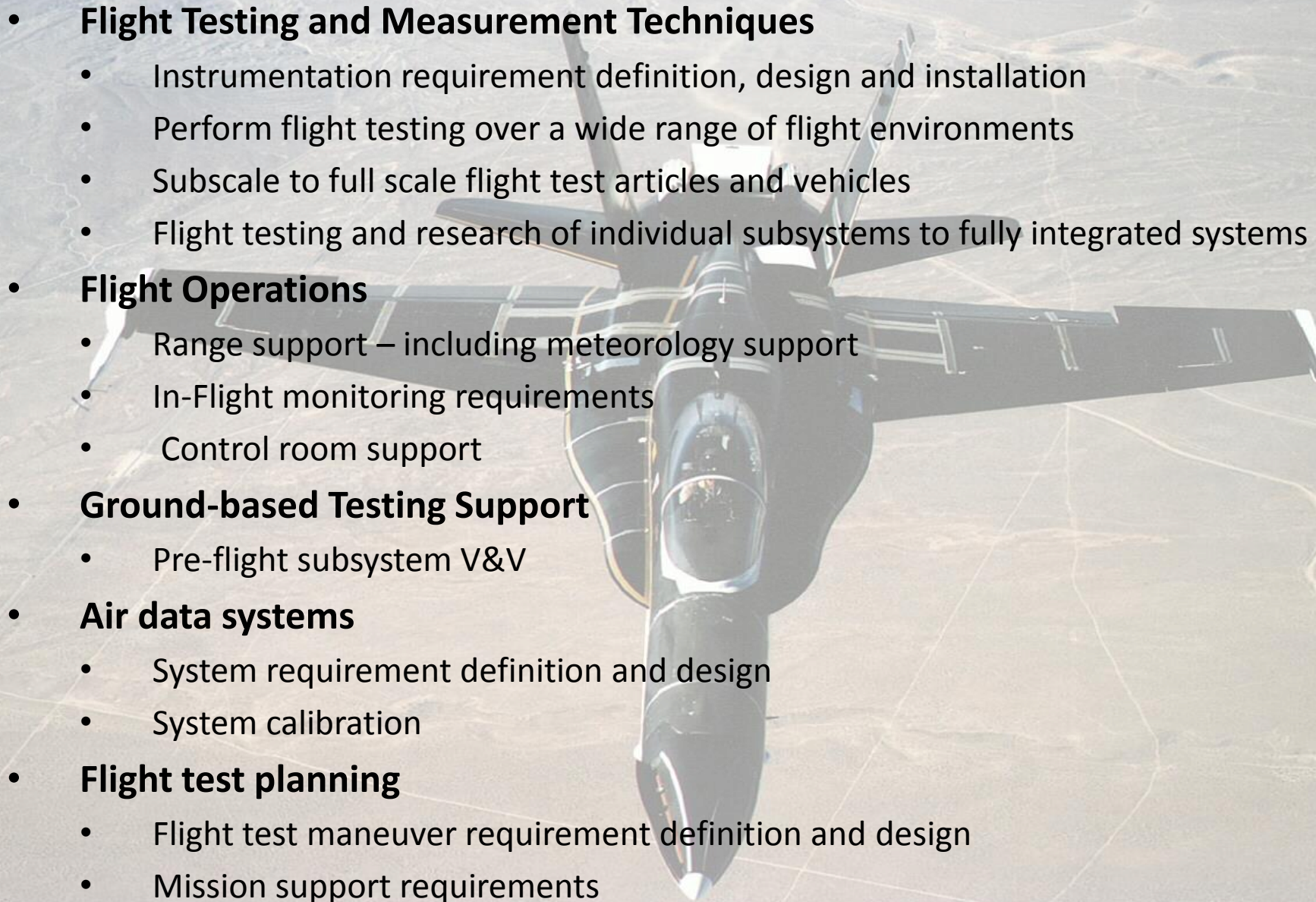


- **Trajectory Design and Optimization**
 - Optimized vehicle trajectories
 - Using simulations to design trajectories
- **Trajectory Reconstruction**
 - Reconstructed Best-Estimated Vehicle Trajectory (BET)
 - Reconstructed Best-Estimated Atmosphere (BEA)
- **Supporting Air Traffic Management**
 - Using autonomous aircraft research with trajectory research

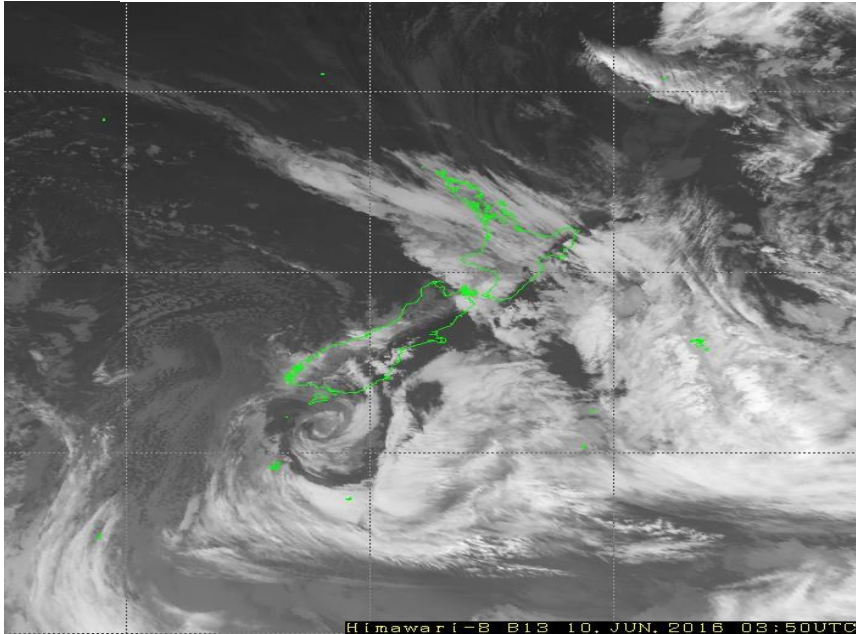
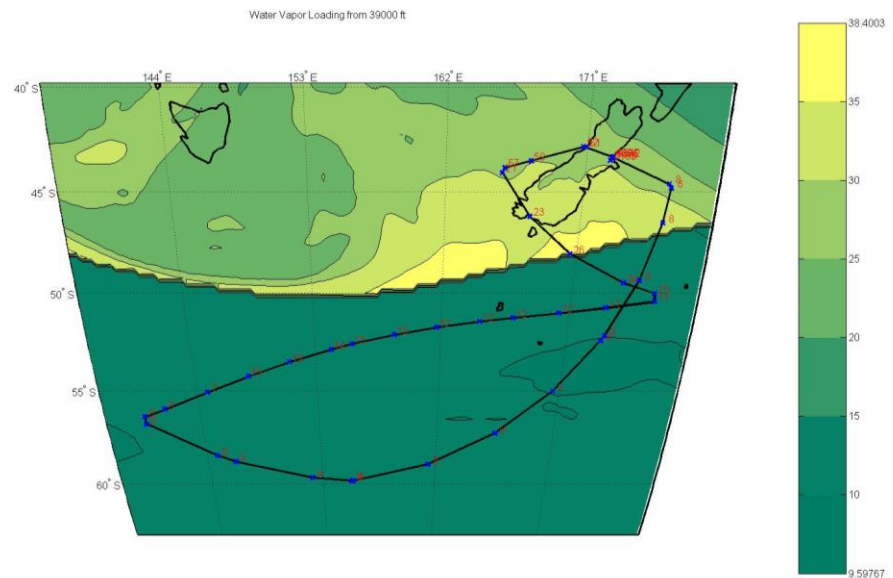


- Vehicle Performance
- Vehicle Dynamics
- Flying Handling Qualities
- System Identification
- Flight Performance
- Requirements, Certification and Model Validation



- **Flight Testing and Measurement Techniques**
 - Instrumentation requirement definition, design and installation
 - Perform flight testing over a wide range of flight environments
 - Subscale to full scale flight test articles and vehicles
 - Flight testing and research of individual subsystems to fully integrated systems
 - **Flight Operations**
 - Range support – including meteorology support
 - In-Flight monitoring requirements
 - Control room support
 - **Ground-based Testing Support**
 - Pre-flight subsystem V&V
 - **Air data systems**
 - System requirement definition and design
 - System calibration
 - **Flight test planning**
 - Flight test maneuver requirement definition and design
 - Mission support requirements
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- A top-down aerial view of an F-16 fighter jet in flight over a desert landscape. The aircraft is dark grey with white markings on the nose and wings. The terrain below is arid with some roads and fields.

- **Forecasts and courtesy briefings**
 - Winds, gusts, visibility, clouds, particulates, water vapor loading
- **Hazards**
 - Turbulence, icing, wind shear, T-storms, IFR conditions, mountain wave, lightning
- **Flight/project support**
 - Crew briefs, T-x briefings
 - Full-time in-flight weather monitoring
- **Best-Estimate-Atmosphere**
 - Trajectory analysis for atmospheric parameters
 - Airdata calibration
 - RVSM
- **Climatology**
 - Project planning studies
- **Real-time ground measurements**
 - Extensive weather station network
- **Mobile balloon launches**
 - Portable for project specific applications





Modeling and Simulation for Flight



- **Flight Simulation Development**

- Simulation architecture definition, design, and implementation
- Pilot-in-the-loop simulations
- Hardware-in-the-loop simulations
- Model validation using flight test data

- **Subsystem Modeling**

- Aerodynamic models
- Control models
- Structural models
- Mass property models
- Aero-servo-elastic models
- Propulsion models
- Atmospheric models
- Uncertainty models
- Tow line dynamic models



Facilities (Modeling and Simulation for Flight)



- **Simulation Systems Development Lab**
 - A small facility for maturing and testing simulation technology
- **Currently have simulations for all major projects**
- **Each simulation occupies their own room**
 - In general each can have full to partial cockpit
 - Can be run with all software or with hardware in the loop
- **Major Assets for Modeling and Simulation for Flight**
 - F-18 Simulation
 - F-15 Simulation
 - GIII Simulation
 - X-56 Simulation
 - Dreamchaser/HL-20/TGALS Simulation
 - Hybrid Wing Body Simulation
 - HEIST Simulation

F-15B 836



- A substantially instrumented research F-15B airplane with the capability to carry research on the centerline store.

GIII 804



- A substantially instrumented GIII airplane modified to support aerodynamic research.

X-56

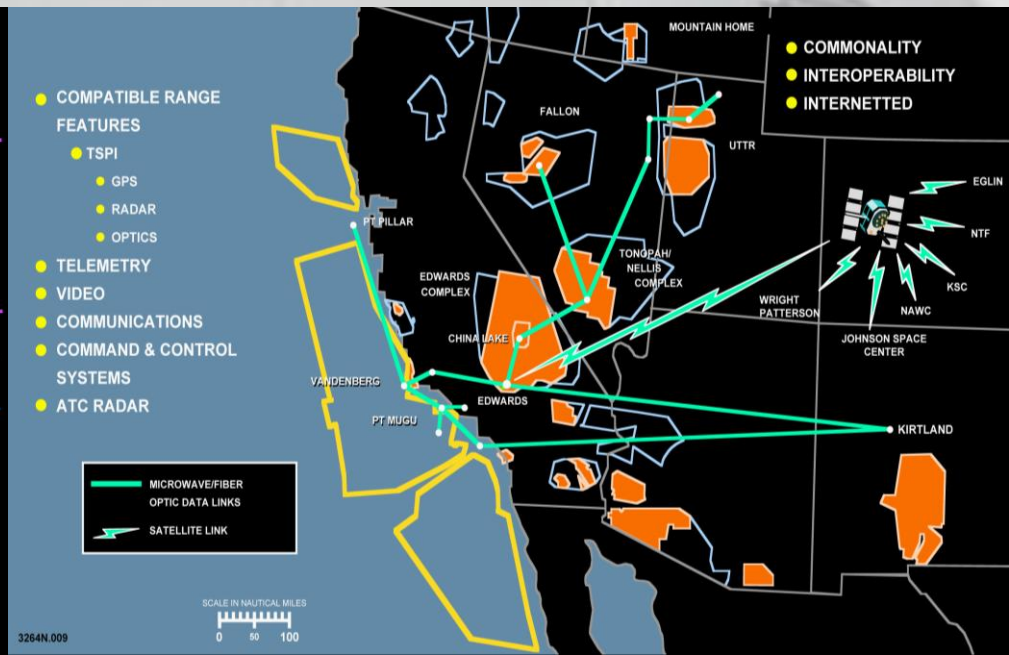
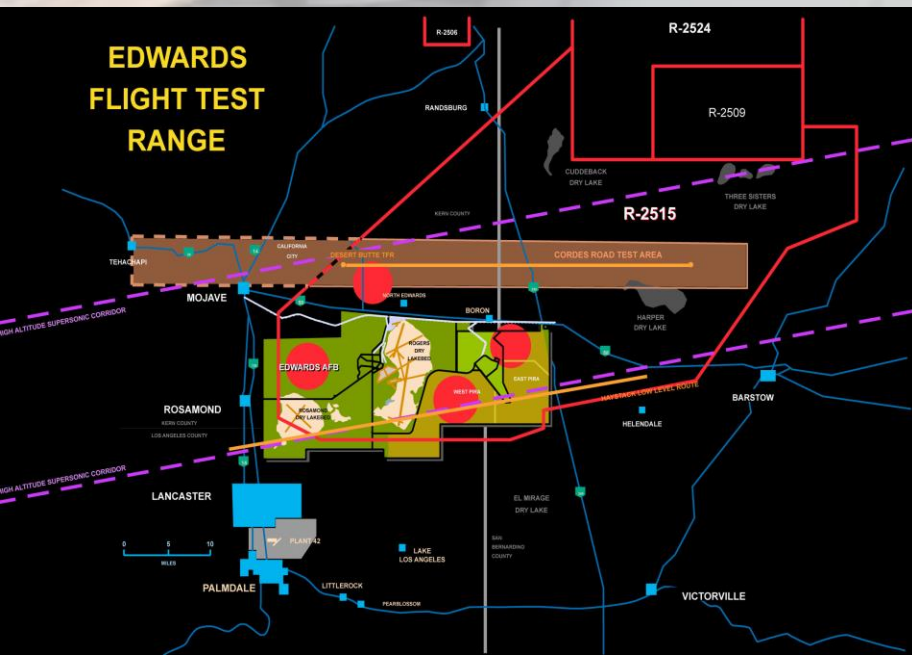


- An instrumented experimental unmanned airplane with replaceable wings.

- **Consolidated Information Technology Center (CITC)**
 - A facility dedicated to processing, storage, and access of flight and ground test data.
- **Dale Reed UAS Model Shop**
 - A facility for fabrication and model build-up of vehicles and small parts used for subscale flight research.



- **Dryden Aeronautical Test Range (DATR)**
 - Infrastructure for conducting flight tests including a tracking radar, data processing systems, and control rooms.
- **R2508 Restricted Airspace**
 - Restricted and controlled airspace available for flight test and flight research.
- **High-Altitude Supersonic Corridor**
 - High altitude restricted airspace corridor for conducting supersonic flights over land.
- **Black Mountain Supersonic Corridor**
 - Low altitude restricted airspace corridor for conducting supersonic flights over land.





Software Tools



- **Flight Performance and Analysis**
 - pEst
 - SIDPAC
 - Athena Vortex Lattice (AVL)
 - Digital datcom
 - MATLAB/SIMULINK
 - ODE (Omega Data Environment)
- **Trajectory Design and Analysis**
 - POST (Program to Optimize Simulated Trajectories)
- **Flight Mechanics Testing and Flight Operations**
 - IADS
 - FDAS (Flight Data Access System)

- Armstrong focus is on flight testing and flight research
 - Do have ability to conduct trajectory design and analysis
 - Capabilities in model development and implementing simulations
 - Capabilities in Flight prediction and analysis
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- An aerial, high-angle view of a large, modern aircraft hangar. The hangar is filled with various aircraft, including a large white commercial jet in the center, and other smaller planes and equipment. The floor is marked with yellow and blue circles. The hangar has a high ceiling with many lights and structural beams.