

The Top Flight Technologies' Simulation Environment and Fleet Management System is a full-life cycle solution set for UAV pilot and operator training, application-specific planning and operation, and remote fleet management operations. The system addresses the following key processes, roles, and responsibilities:

1. High-fidelity UAV physics and environmental models for accurate vehicle performance and mission operation.
2. UAV pilot and operator training through simulation.
3. Robust flight plan development for primary mission and contingency actions.
4. Simultaneous operation of multiple UAVs in real and simulated environments.
5. Real-time flight data monitoring and post mission analysis.
6. Fleet management data analytics dashboard for detailed analysis of fleet operations.

Top Flight Simulation Environment

This platform enables UAV pilots and operators to learn the essentials of operating UAVs in current and future operating environments. Key Features include:

1. UAV pilots and operators train using actual hardware, software, and avionics systems used on real autonomous flight systems and reduces time to achieve required level of proficiency for safe operation
2. Simultaneous simulation of multiple UAVs in high-fidelity photo-realistic environments teach pilots and operators how to safely operate in real-world highly congested settings.
3. Real-world location models of infrastructure, terrain, and dynamic weather conditions allow for training in the environment where missions will be performed
4. UAV models are developed using as-built physical and aerodynamic properties of flight vehicles. This enables operators to train with realistic flight characteristics prior to operating a real vehicle.



Figure 1 – Top Flight Technologies Airborg™ 10K UAV Simulator

Top Flight Technologies® Fleet Management System

The Fleet Management System (FMS) is designed for fleet-operator businesses, providing them the tools for easy setup, operation, and remote monitoring of UAV fleets operating simultaneously over diverse locations. Top Flight's FMS allows business units to focus on operations, rather than the details of piloting individual UAVs. Key Features include:

1. Allows one operator to remotely manage multiple UAVs simultaneously from a remote location providing the capability to operate the fleet with fewer operators and reducing the cost of training and operation.
2. Provides an interface for fleet managers to easily develop verified and validated missions and flight routes with an emphasis on safety, reliability, accuracy, and repeatability.
3. Allows for post-flight review of data from high-level mission objectives to detailed subsystem analysis and maintains historical records for the entire fleet.
4. Provides a configurable dashboard interface for fleetwide statistics and operational oversight.

Top Flight Technologies Fleet Management System					
Vehicle	Mission	Flight Plan	State	Command	Action
1	One-way delivery	Route 1	Idle	Load Mission	UPDATE
2	Round-trip delivery	Route 2	Idle	Start Mission	UPDATE
3	Round-trip delivery	Route 1	Idle	Return	UPDATE
4	One-way delivery	Route 4	Idle	Pause Mission	UPDATE
5	One-way delivery	Route 2	Idle	Return	UPDATE
6	Round-trip delivery	Route 1	Idle	Start Mission	UPDATE
7	One-way delivery	Route 1	Idle	Load Mission	UPDATE
8	Round-trip delivery	Route 3	Idle	Load Mission	UPDATE
9	One-way delivery	Route 1	Idle	Load Mission	UPDATE
10	Round-trip delivery	Route 4	Idle	Start Mission	UPDATE



Figure 2 – Top Flight Technologies Fleet Management System

Top Flight Technologies® Model-based Design Approach & Benefits

Top Flight's model-based design approach accelerates the systems engineering life-cycle process (Figure 3) by enabling continuous feedback throughout the entire design process. Key benefits include:

- **Reducing Design Time and Cost**
 - Enabling rapid systems engineering trade studies in response to design iterations and changing requirements.
 - Reducing costly hardware development iterations and costly flight testing of early prototype/subscale vehicle designs.
- **Getting it Right the First Time**
 - Capturing errors early helps eliminate redesign in later stages of development.
 - Designing and testing interfaces prior to production reduces costly integration time.
 - Automating regression testing of design iterations exposes masked integration issues.
 - Evaluating corner-cases that are hard to replicate on the physical system.
 - Easily visualize and communicate system design and performance to engineers, management, and potential customers.

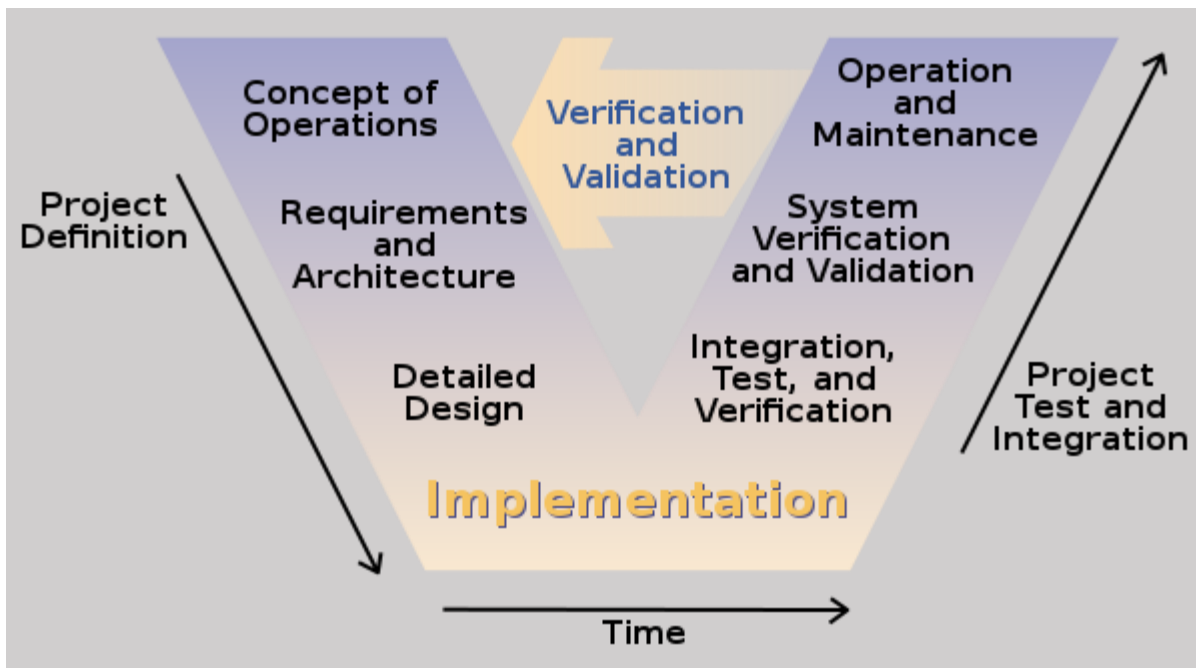


Figure 3 - Typical System Development Lifecycle, [Clarus Concept of Operations](#), Publication No. FHWA-JPO-05-072,

Federal Highway Administration (FHWA), 2005

Supporting Iterative Vehicle Design, Pilot Training, Mission Design, Fleet Management and Post-Flight Analytics in a continuously updated environment.

Vehicle design engineers use Industry Tools (1) in conjunction with the Top Flight's Physics-based Simulation Environment (2) to rapidly iterate a vehicle design and its flight performance. Pilots and operators (3) use the the Top Flight Simulation Environment (2) for training, mission-based planning, evaluation and post-flight analytics for a single mission or fleet of vehicles. The Top Flight Simulation Environment is continuously fine-tuned with comprehensively logged flight data (4).

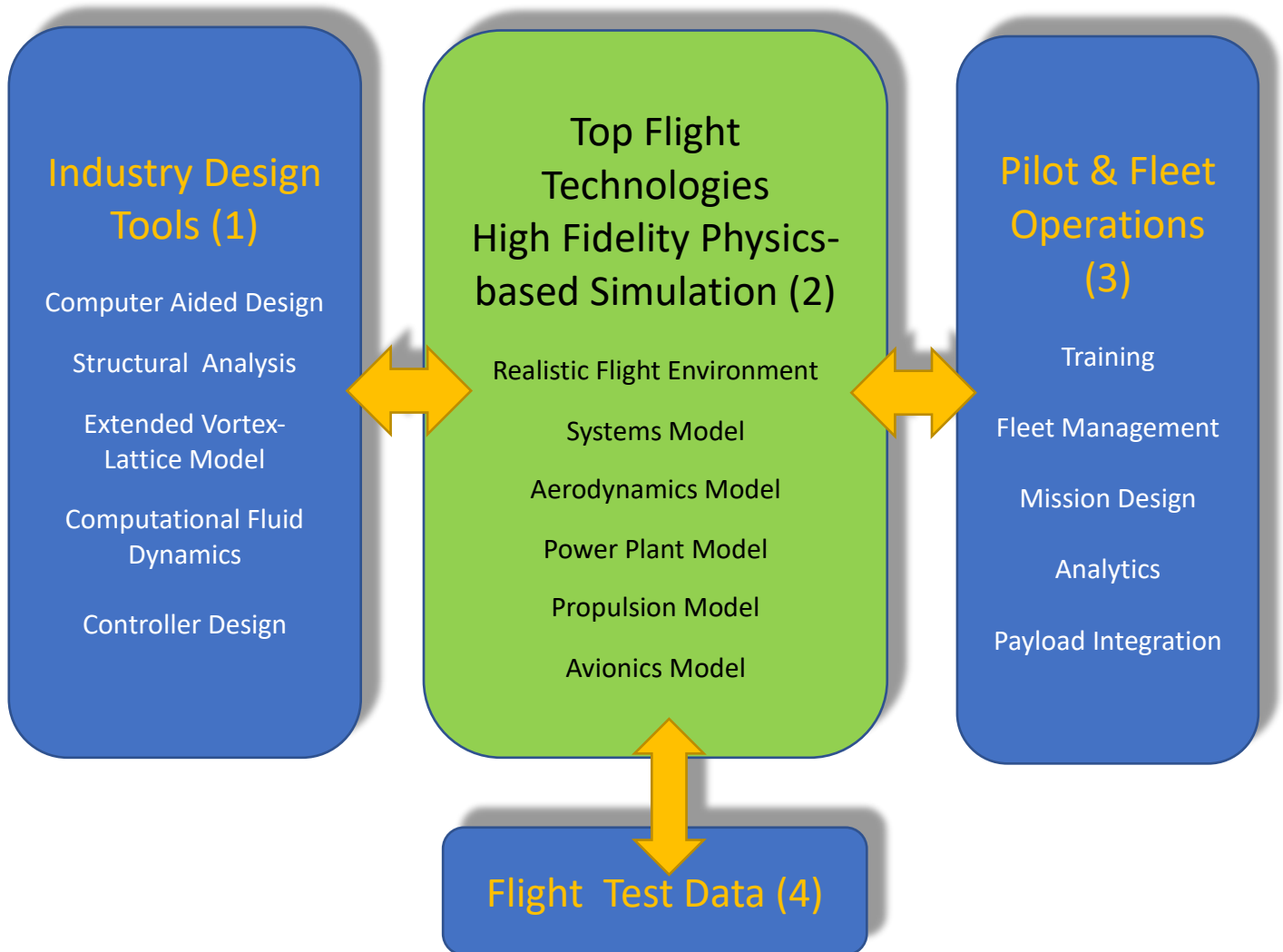


Figure 4 - Top Flight Simulation & Operating Environment