



Sense and Avoid for Small Unmanned Aircraft

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MSR

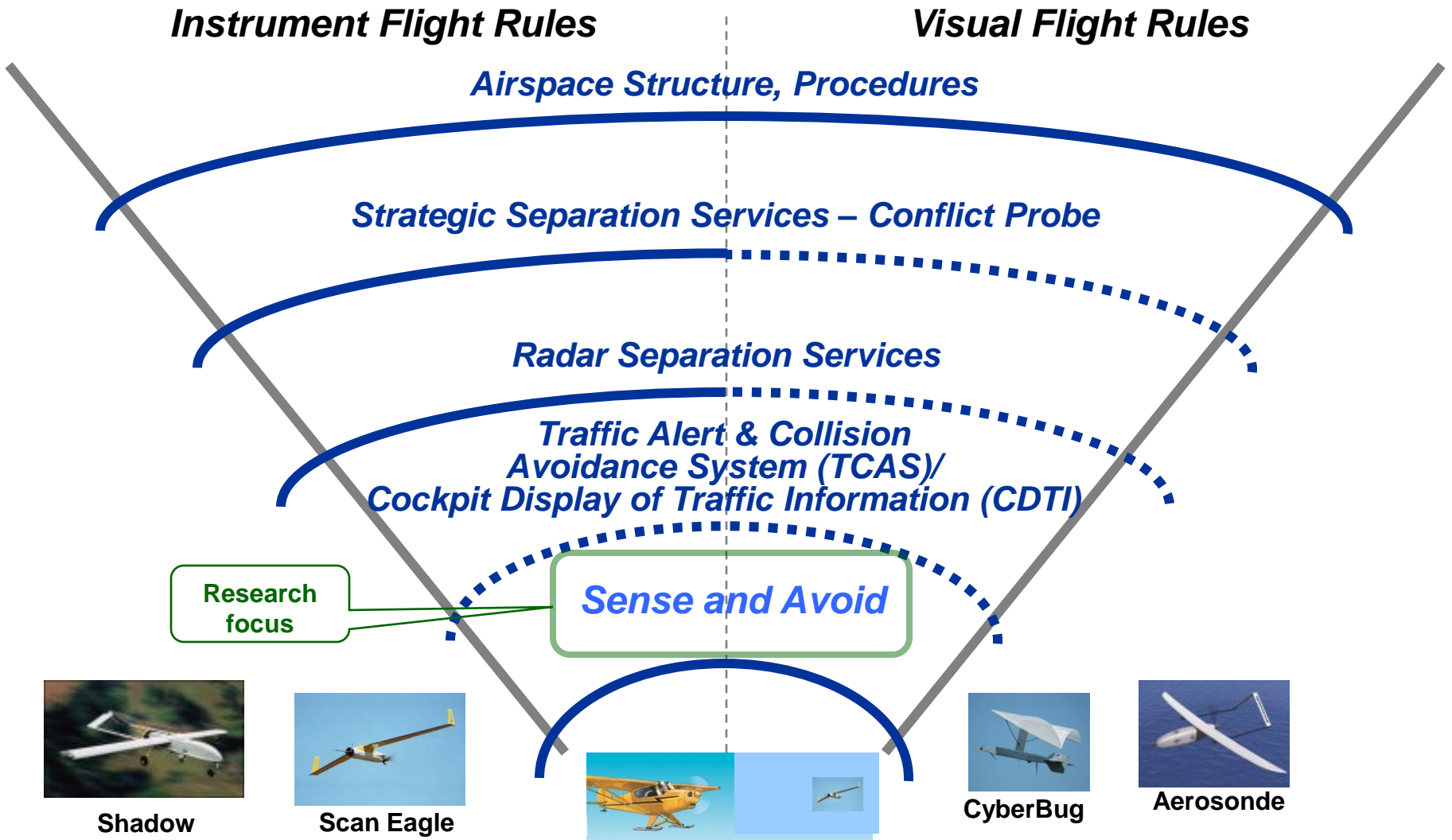
Problem

- ***Can small autonomous craft reliably detect and avoid collision with objects in its path of interest, both stationary and moving, that do not announce their position?***
 - Many research efforts focus on one or more components of the research question, but few broadly address the combination

“Sense and Avoid” Scope

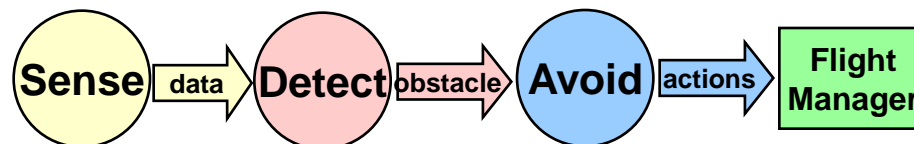
- Small Unmanned Aircraft System (UAS) missions as driver (remote sensing)
- Small payload limitation
- Uncontrolled Visual Flight Rules (VFR) Airspace operation, mixed with manned aircraft, without transponders
- Reactive timeframe for sensing and avoiding
- Fixed, moving, and virtual obstacles

Background



Objective

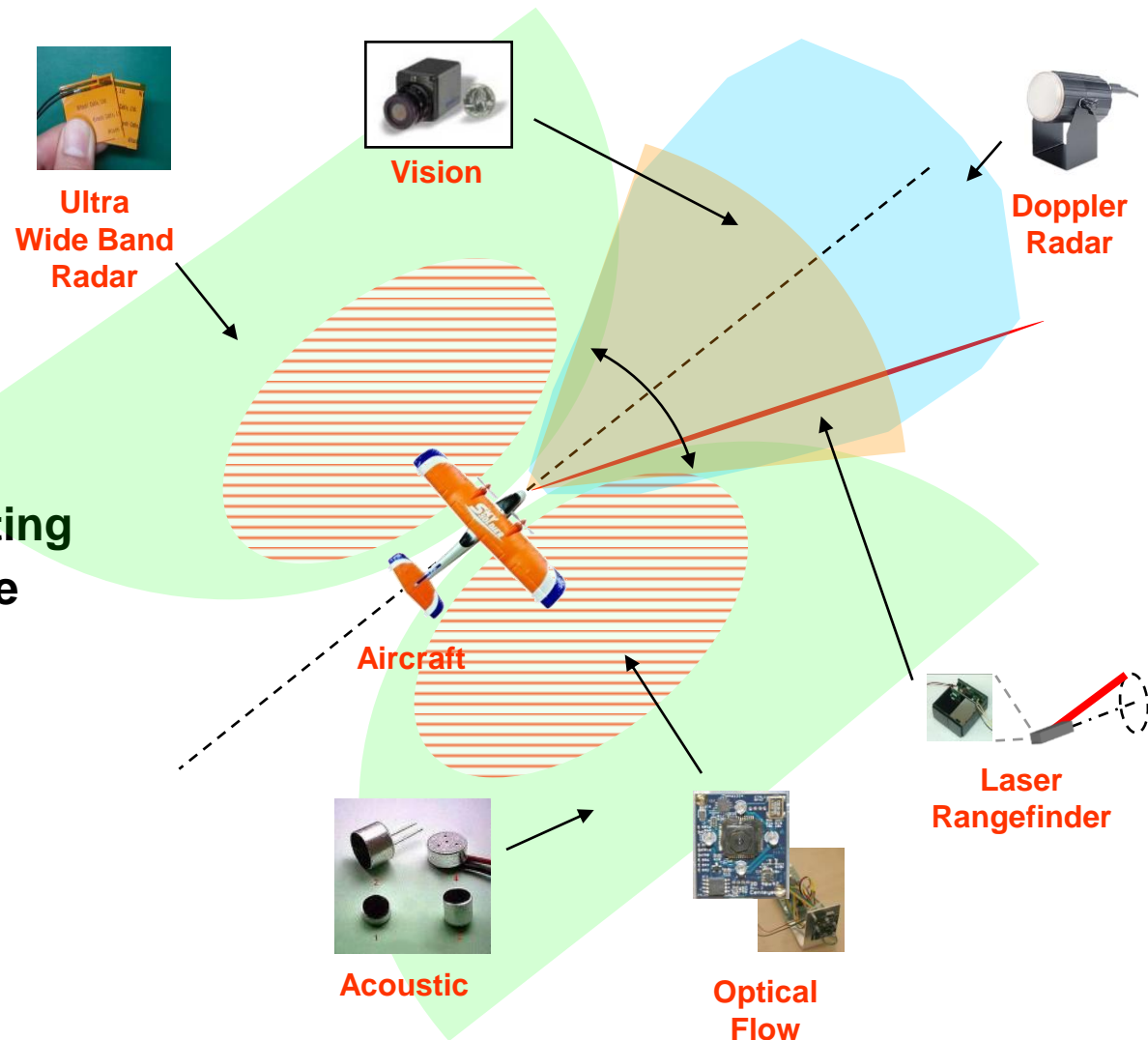
- Discover and refine the requirements for small UAS Sense and Avoid
- Map the breadth of Sense, Detect, and Avoid concepts and technology, and scope what is appropriate for small UAS
- Probe the depth by building, testing, and flying selected promising combinations



Activities

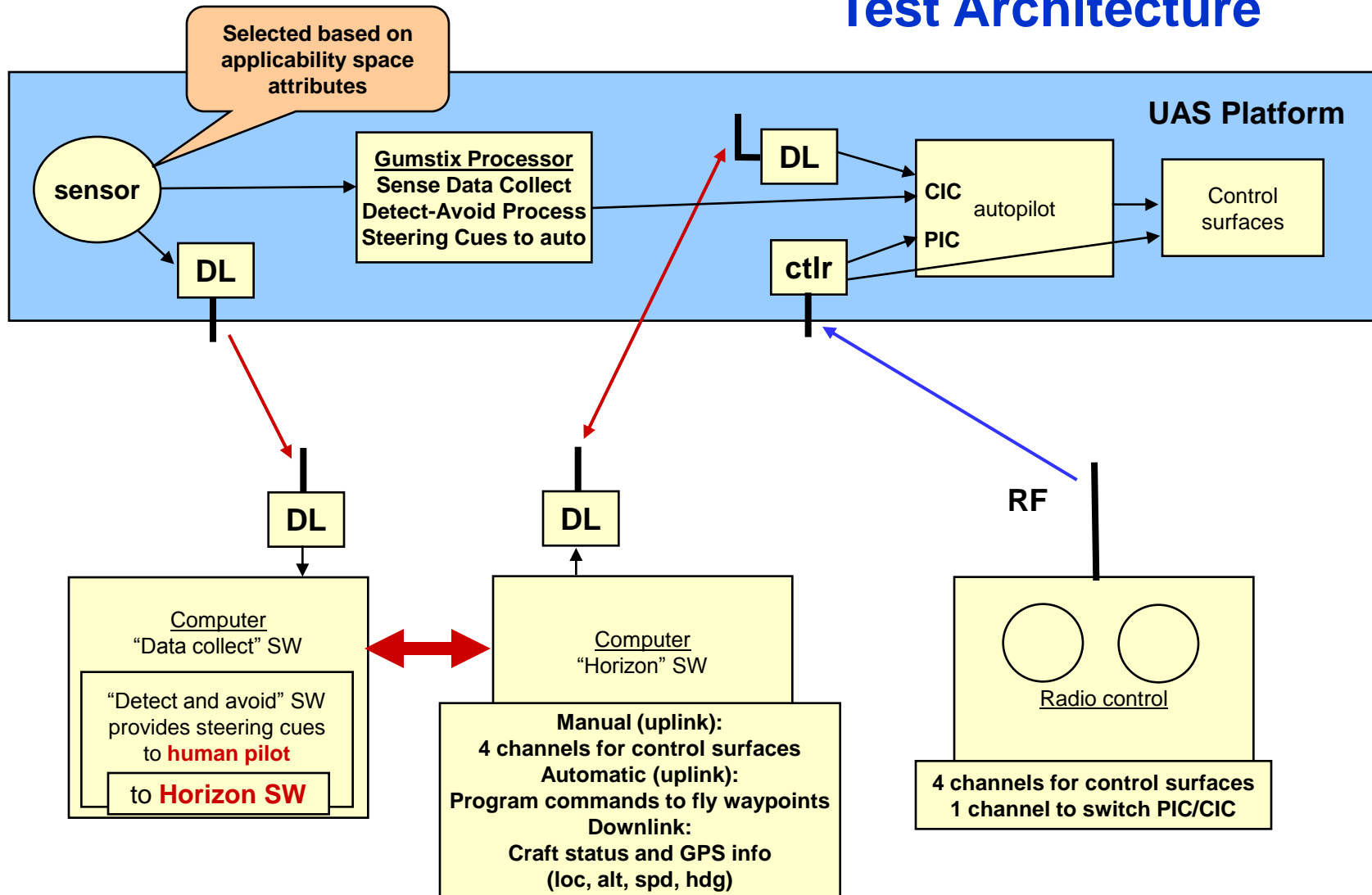
■ FY08 (3rd year) focus

- Complete sensor testing and evaluation (single and multi-sensor combinations)
- Compile the research findings (Big Picture mapping of sensor applicability)



Highlight

Test Architecture



Demonstration

Field Testing

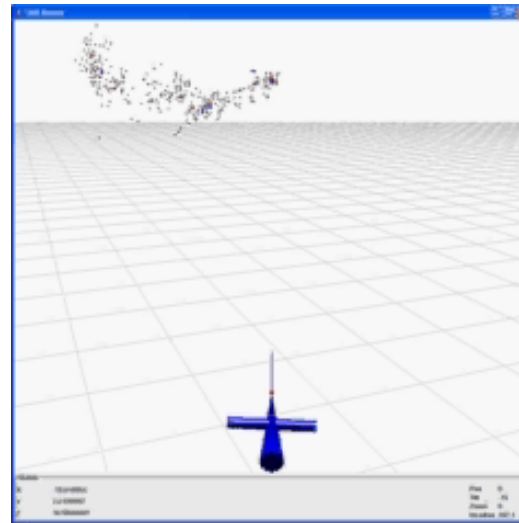


Fixed and rotary wing UAS flight tests

Field Analysis



Downlink of on-board video

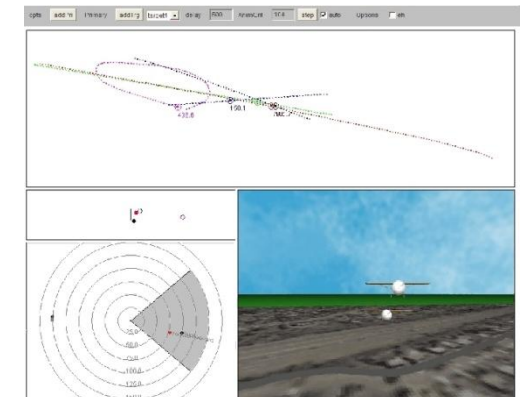


Real-time data visualization and analysis tools

Offline Analysis



3D data analysis



Simulation and data replay

■ Goals

- Enable UAS access to airspace by developing the capability for safe interaction of manned and unmanned aircraft
- Build corporate expertise with innovative UAS research and applied technology
- Leverage MITRE robotics experience and investment.

■ Actual Influence

- Developed industry sense of the difficulty with non-cooperative sense-and-avoid
- Provided rationale for difference between sense-and-avoid and pilot see-and-avoid
- Showed how one sensor is insufficient for all applications; a multi-sensor solution is required

Future Plans



- **Follow-on research for further sensor study**
- **Industry efforts for multi-sensor solutions**
- **Broader review of methods to fulfill sense-and-avoid requirement**
- **Enable eventual FAA testing of cooperative and non-cooperative solutions**