Cross Cutting & Related Technologies: 
*Remotely Piloted Vehicles*

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Customers & Customer Requirements

Technology Needs Summary

- Extreme Duration, High Altitude Solar Electric UAV
  - >100 kg payload, 65-100k ft altitude (months on-station)
  - <$3M unit cost and <$500/hour operations cost

- Conventionally Powered, High Altitude UAV Science Testbed or Commercial Mission Prototype
  - >300 kg payload, 65k ft altitude, >48 Hours Endurance
  - >300 kg payload, 85k ft altitude, >24 Hours Endurance
  - <$5M unit cost and <$750/hour operations cost
UAV Technologies

- **Propulsion**
  - Conventional–spark piston engine
  - Turbomachinery
  - Engine cooling
  - Solar-electric
  - Photovoltaics
  - Propellers
  - Battery

- **Structures and materials**
  - Composites (including boron)

- **Actuators**

- **Digital electronics**
  - Miniature, high performance
  - EMI/arcing

- **Flight management**
  - Redundant flight control
  - Reliable flight control sensors

- **Heat rejection**
  - Exchangers

- **Energy storage**
  - Regenerative fuel cells/electrolyzers
  - Rechargeable batteries

- **Command, control, communications**
  - Reliable, efficient
  - Satcom
  - Payload interfaces

- **Operations**
  - Efficient, low cost

- **Computer models and simulations**

- **Integrated sensors**

Extreme operating conditions–low Reynold’s number, speed, temperatures and pressure
Extreme Duration and Altitude
Solar-Powered Technology

**ULDB Technology Roadmap**

**Centurion**
- Daytime Demonstrator 1998–2002
- Goal–100k ft

**Helios**
- Day/night Demonstrator 1999–2005
- Goal–65k ft, Moderate Payload, Months Endurance

**Pathfinder Plus**
- Daytime Demonstrator 1995–2000
- World Record Altitude–80,200 ft–6 August 1998
Cross-Cutting Technologies - UAVs & ULDBs

- Light-weight fuel cells
- Electric Motors
- High Altitude propellers
- Energy Storage
- Power Management
- Flight Control Systems
- Data Links
- Vehicle Systems
- Propulsion Systems
- Trajectory Tracking & Impact Prediction
- Weather predictions & Statistical Information
- Operations
- UAV/ULDB Test Ranges
- Second ULDB Technology Workshop
  November 12, 1998
• Operation in National/International airspace
• Over-the-Horizon (OTH) communications
• “See-Detect/Avoidance” capability
• Certification criteria for Vehicles & Operators
• Safe, economical & reliable operations in a global environment
UAV Test Ranges

- UAVs require large areas for long periods of time for testing
- The Pacific Missile Range Facility in Kauai has proved to be a nearly ideal location for such testing
  - Large military airbase with facilities
  - Unobstructed airspace with cooperative FAA participation
  - Logistics support and telecom infrastructure in “austere” location
  - Local people easily trained to augment test operations
  - High tech support for test missions
  - Ideal science collection environment in the islands