





2008 Activities

- **New instrument development**
 - **ATOMMS**
 - **HIWRAP**
 - **TWILITE**
 - **NOVICE (Collection of new instruments)**
- **Ground and flight tests for superpod upgrade**
- **Shuttle entry boundary layer experiment (HYTHIRM)**
- **Private industry deployments**
- **DoD instrument development and deployments**



Upgrades

- **The superpod upgrade is the priority project for the coming 22 months**
 - **Requires gross weight increase**
 - **Facilitated by prior landing gear upgrade**
 - **Dependant upon adequate flutter margins for the new configuration(s). Preliminary analysis good**
- **Project Team established and began work in December 2007**



Upgrade Schedule

- * Underway now
- * Fall 2008: Structural and flutter analysis complete.
- Provides verification of superpod compatibility
- * Jan – Jun 2009: Superpod fabrication and installation
- * Jul 2009: Flight tests
- * Oct-Nov 2009: Integrate superpod electrical and data during phase maintenance (Some integration in 2008 Phase?)
- * Dec 2009: TC4 Instrument integration
- * Jan 2010: Deploy
- * Note: Project includes two other elements; Landing gear analysis and performance analysis. The schedules for these elements are enveloped by structural and superpod schedules



Airborne Science Annual Review

Wallops Flight Facility
Presentation

Anthony R. Guillory
GSFC/WFF

NASA HQ
February 6, 2007



FY07 Catalog Aircraft



- **NASA**
 - P-3 (core)
 - LaRC B-200
 - GRC S-3
- **Commercial**
 - Twin Otter
 - J-31
 - Caravan
 - A-200
- **Other Government**
 - DOE B-200
 - NRL P-3



P-3 Accomplishments FY07



| <u>Mission</u> | <u>Dates</u> | <u>Flt Hrs</u> | <u>Sorties</u> |
|----------------|----------------|----------------|----------------|
| Arctic 2007 | May 2007 | 48.8 | 17 |
| CLASIC | June-July 2007 | 59.0 | 14 |
| GISMO | September 2007 | 105.6 | 17 |

Major Missions in FY08

ARCTAS

AK, Canada

April & July 2008

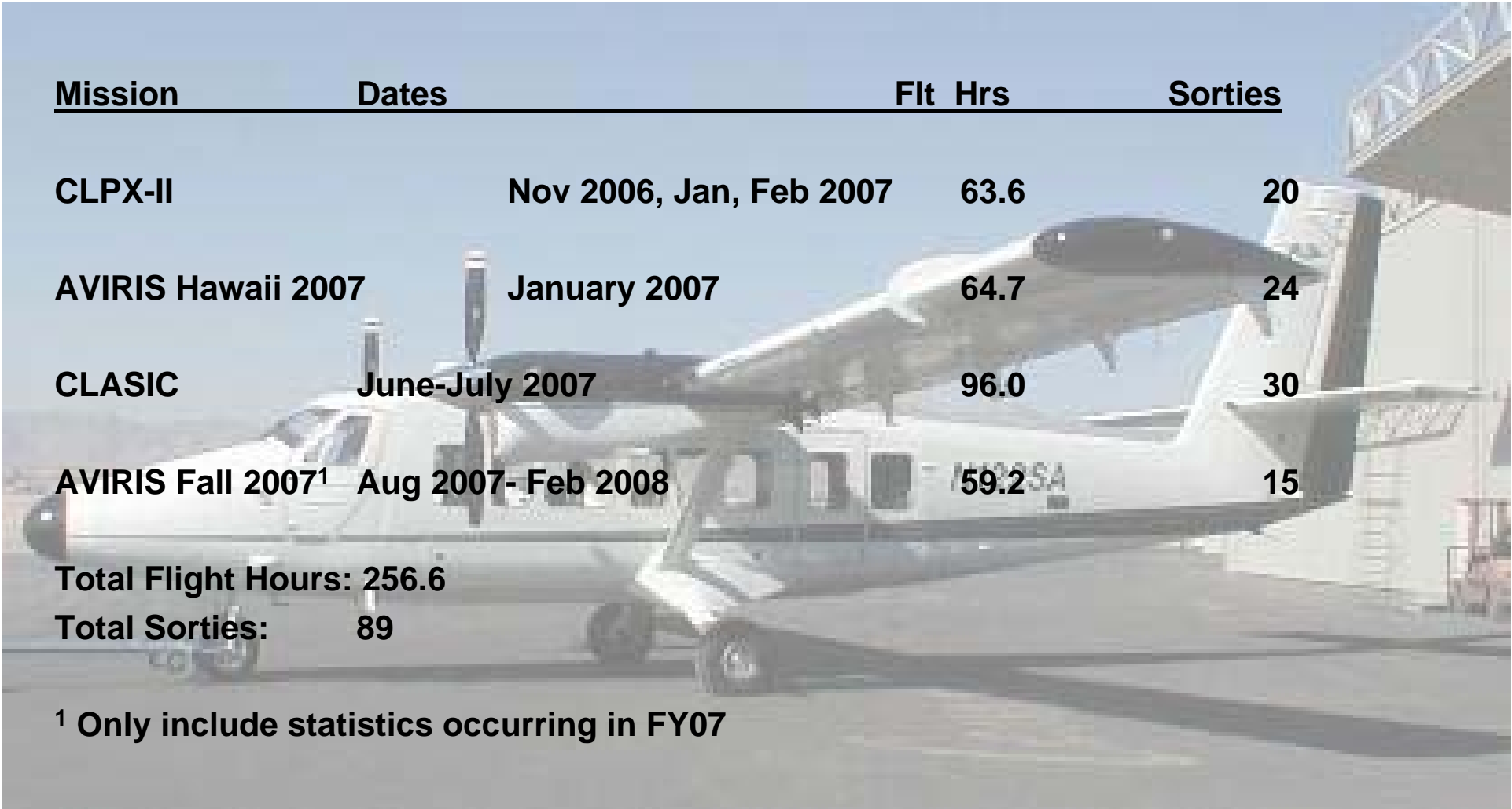
High Winds

WFF, FL





Twin Otter in FY07



| <u>Mission</u> | <u>Dates</u> | <u>Flt Hrs</u> | <u>Sorties</u> |
|----------------------------------|-------------------------|----------------|----------------|
| CLPX-II | Nov 2006, Jan, Feb 2007 | 63.6 | 20 |
| AVIRIS Hawaii 2007 | January 2007 | 64.7 | 24 |
| CLASIC | June-July 2007 | 96.0 | 30 |
| AVIRIS Fall 2007 ¹ | Aug 2007- Feb 2008 | 59.2 | 15 |
| Total Flight Hours: 256.6 | | | |
| Total Sorties: 89 | | | |

¹ Only include statistics occurring in FY07



Twin Otter in FY08



| <u>Mission</u> | <u>Dates</u> |
|----------------|-----------------------------|
| CLPX-II | November 2007, Feb/Mar 2008 |
| AVIRIS | Spring or Fall possibly |





Sky Research Caravan



| <u>Mission</u> | <u>Flt Hrs</u> | <u>Sorties</u> |
|------------------------------------|----------------|----------------|
| Western States Fire Mission | | |
| Instrument Checkout | 5.0 | 2 |

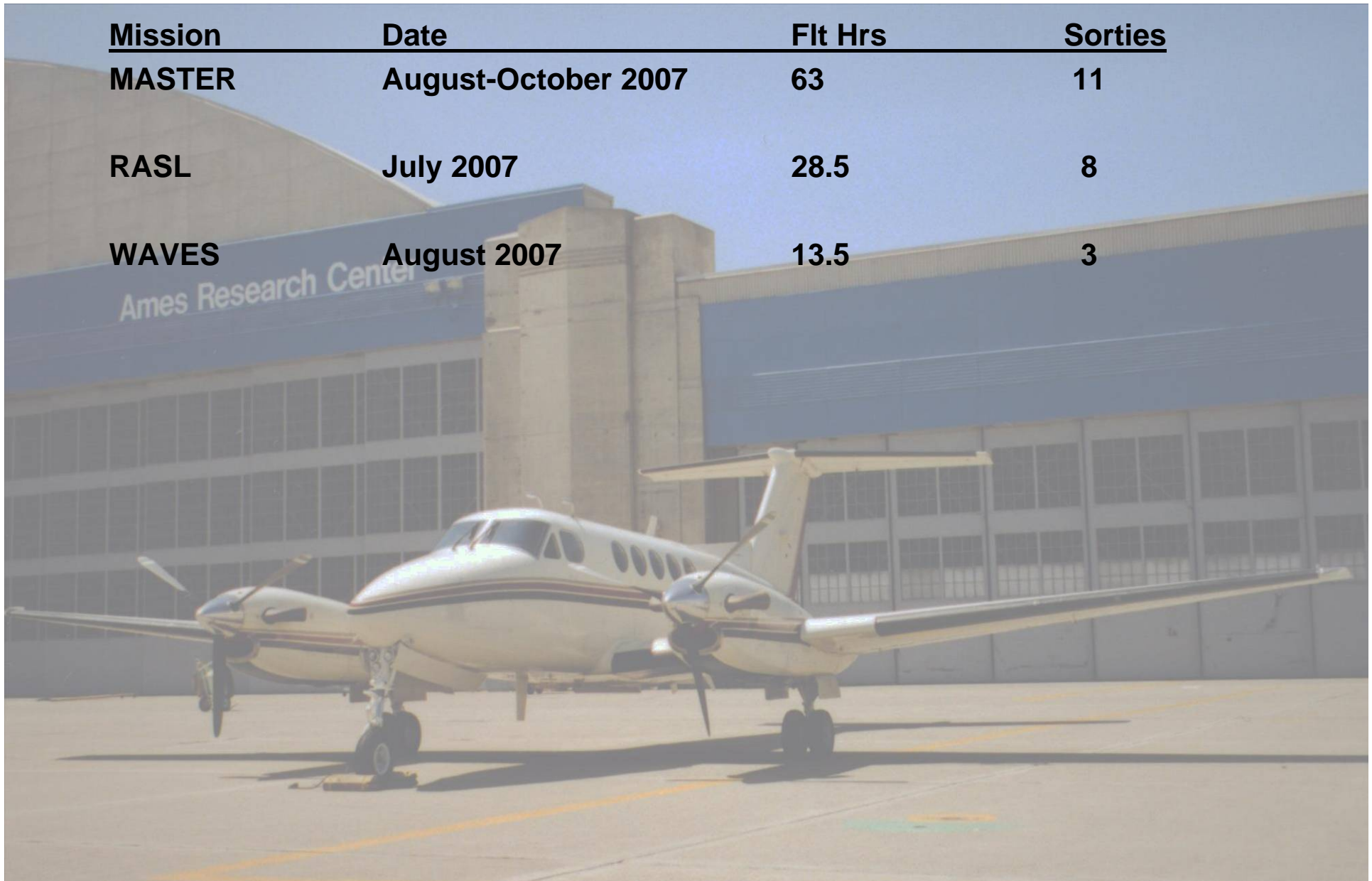




DOE B-200 / Dynamic Aviation A-200



| <u>Mission</u> | <u>Date</u> | <u>Flt Hrs</u> | <u>Sorties</u> |
|----------------|---------------------|----------------|----------------|
| MASTER | August-October 2007 | 63 | 11 |
| RASL | July 2007 | 28.5 | 8 |
| WAVES | August 2007 | 13.5 | 3 |



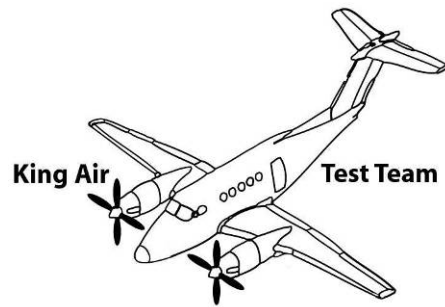


LaRC B-200



Research Activity

Flight Statistics



| Breakdown by Deployment/Event | Research Flight hours | Research Sorties |
|------------------------------------|-----------------------|------------------|
| CALIPSO Validation - US East Coast | 4.1 | 2 |
| San Joaquin Valley EPA | 45 | 16 |
| CALIPSO Validation - US East Coast | 6.6 | 3 |
| CHAPS/CL w/CALIPSO | 71 | 22 |
| CALIPSO Validation - US East Coast | 40.7 | 12 |

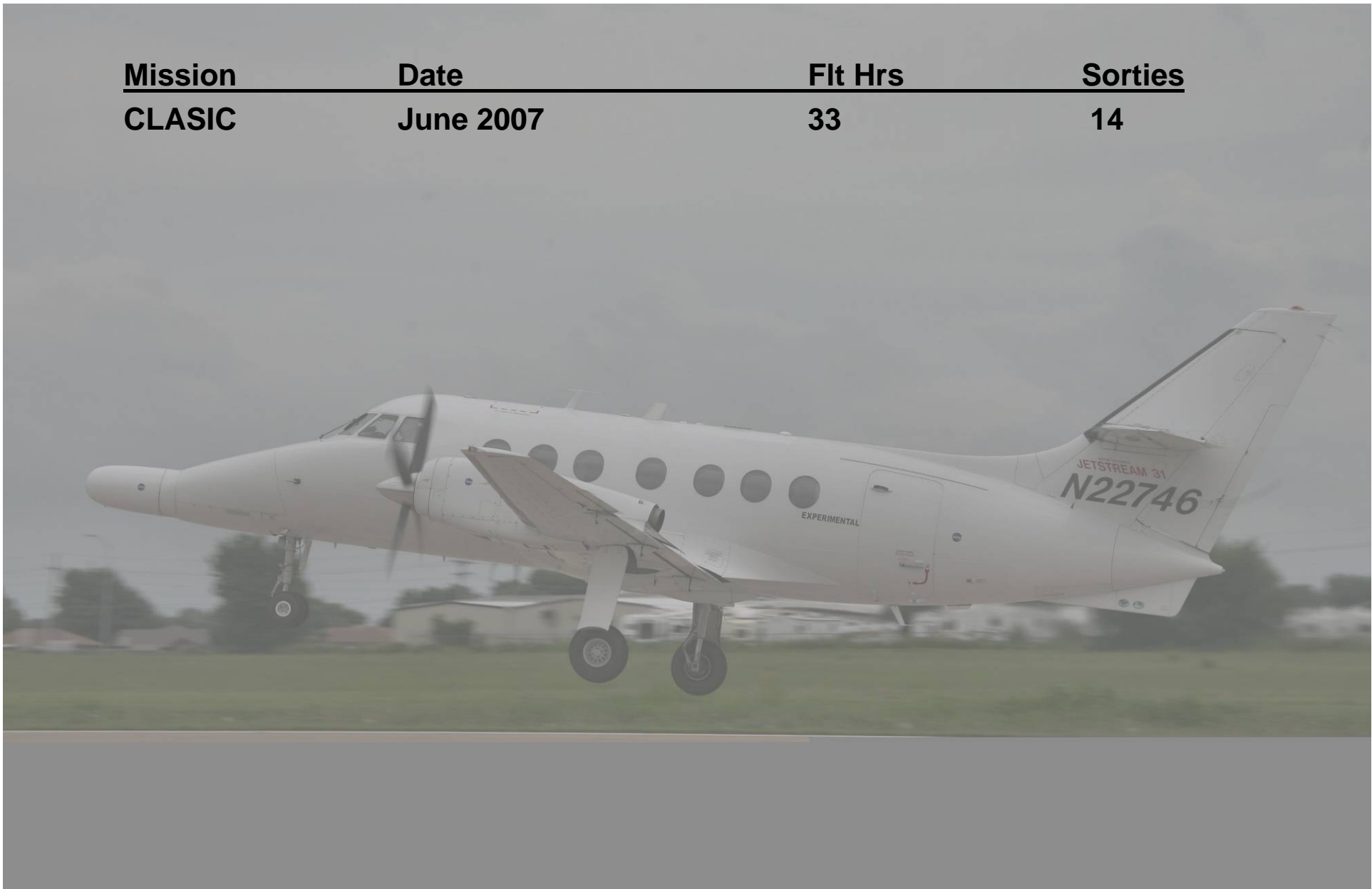
Total: 177.5 hours, 57 sorties



J-31



| <u>Mission</u> | <u>Date</u> | <u>Flt Hrs</u> | <u>Sorties</u> |
|----------------|-------------|----------------|----------------|
| CLASIC | June 2007 | 33 | 14 |





Aerosonde in FY07



- **NASA/NOAA Hurricane Demonstration 2007**
 - Based out of Key West, FL with secondary base at WFF
 - FAA granted COA in late 2006 for flights out of Key West
 - Hurricanes did not cooperate for flights out of Key West
 - Flew 17.5 hour mission, flying at 300-500 feet, into Hurricane Noel on November 2nd (FY08) out of WFF

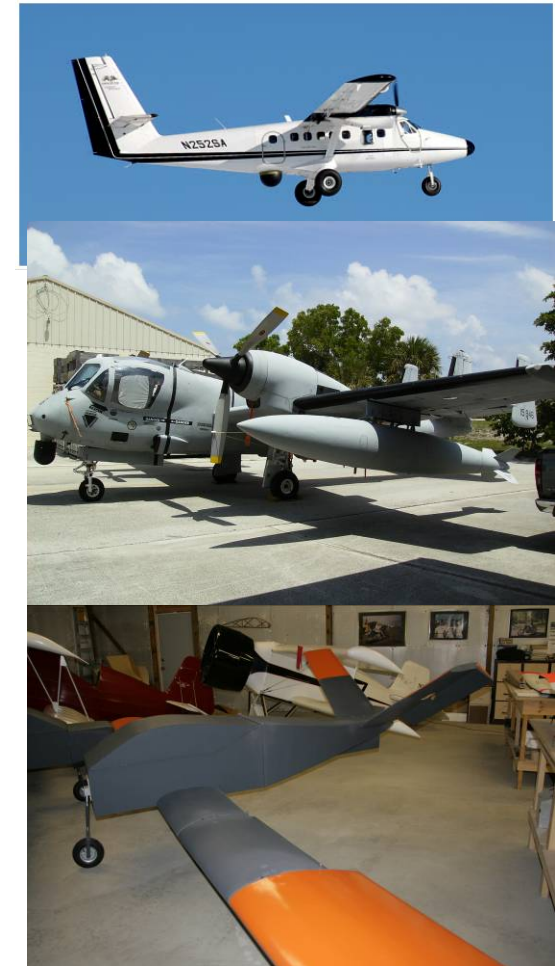




Blanket Purchase Agreements



- RFQ for BPA was released in February 2007
- No contract minimum
- \$750K per Delivery Order Cap, \$10M per BPA Cap
- Solicited Platform Categories:
 - Manned: Light
 - Manned: Medium
 - Manned: Heavy
 - UASs
 - Lighter-than-Air
- 13 vendors responded
 - Responses in all categories, except Lighter-than-Air
- 10 vendors were awarded BPAs yesterday!!
- Tasked on a Mission by Mission Basis





Aircraft Catalog

Blanket Purchase Agreement Vendors



| Vendor | Aircraft | Category |
|---------------------------------------|------------------|----------|
| <i>Airtec</i> | B-200 | Medium |
| | Beechcraft Baron | Medium |
| <i>Battele</i> | Gulfstream 1 | Medium |
| <i>Dynamic Aviation</i> | Beechcraft A-100 | Medium |
| | Beechcraft A-200 | Medium |
| | Beechcraft A-90 | Medium |
| <i>Foldesi & Associates</i> | Learjet 24 | Medium |
| | SAAB 340 | Medium |
| <i>L-3/BAI</i> | Viking 100 | UAS |
| | Viking 300 | UAS |
| | Viking 400 | UAS |
| <i>Mohawk Technologies</i> | OV-1 | Medium |
| <i>Orbital Sciences</i> | L-1011 | Heavy |
| <i>Thesis</i> | Super Ferret | UAS |
| | Tarzan TD-1c | UAS |
| <i>Twin Otter International</i> | Twin Otter | Medium |
| <i>University Research Foundation</i> | Cessna 402B | Light |
| | Piper Arrow | Light |
| | Piper Aztec | Light |



Summary



Aircraft Utilized in FY07

- **NASA**
 - P-3
 - LaRC B-200
- **Commercial**
 - Twin Otter
 - J-31
 - Caravan
 - A-200
 - Aerosonde
- **Other Government**
 - DOE B-200

BPA Awarded

Provides access to 10 commercial companies with over 19 different types of aircraft.



Approximate Mission Directorate funding for NASA Aircraft

- **Space Operations Mission Directorate (~\$75M)**
- **Science Mission Directorate (> \$1B capital investment)**
 - **(Earth Science ~ \$30M)**
 - **(Astrophysics ~ \$40M)**
- **Aeronautics Research Mission Directorate (~\$15M)**

******After Shuttle retirement SMD will
manage the bulk of the
aviation budget within the agency**

Not Validated with MDs, these are ROM values from PA&E



Internal & External Program Drivers

- NASA Science Plan
- National Research Council Decadal Survey
- NASA Advisory Committee, Earth Science Subcommittee
- Global Earth Observation System of Systems
- Climate Change Science Program
- Ocean Action Plan

**NOBEL Laureates with Airborne Science connections:
Sherry Rowland, Mario Molina, Paul Crutzen, George Smoot,
John Mather & IPCC**



ASP Requirements Report

- Science Requirement → Measurements → Platforms
- Six R&A Focus Areas
 - Atmospheric Composition
 - Carbon Cycle and Ecosystems
 - Climate Variability and Change
 - Earth Surface and Interior
 - Water and Energy Cycle
 - Weather



Example of Focus Area Suborbital Support Summary

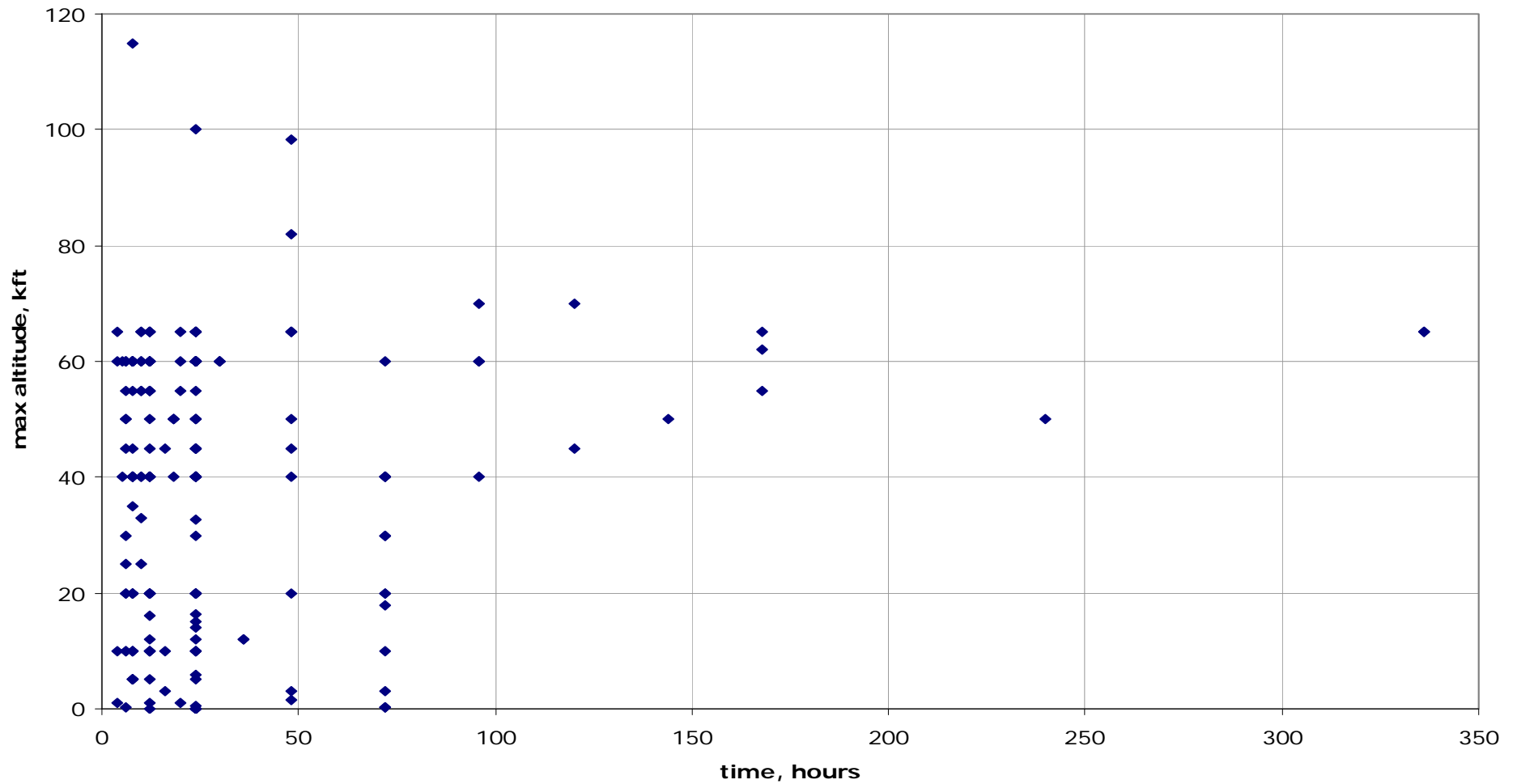
| Type | Timeframe | Suborbital Program support/remarks |
|--|--|---|
| Satellite Cal/Val missions AURA OCO GLORY AQUARIUS NPOESS Calipso/Cloudsat | 2006-2008 2008-2010 2009-2010 2009-2010 2011 2006 + | Pre- and post-launch Cal/val Cal/val Cal/val Cal/val Cal/val Cal/val |
| New Airborne Sensor development IIP – HSRL IIP – Harvard water Laser sounder for CO2 GOLD HSRL and DIAL Lidar | 2006-7 2006-7 2007-8 2006 2008 | Calipso validation Global measurement demo Airborne Ozone Lidar Ozone |
| Airborne Process studies TC-4 ARCTAS / POLARCAT Global Hawk / decadal survey proposal | 2007 (Costa Rica); 2010 (Guam) 2008 (Arctic) 2009 | Validates A-Train, plus process studies: trace species; Pollution chemistry in the Arctic Stratospheric chemistry |

Table 2.3 Summary of upcoming Atmospheric Composition and Chemistry missions



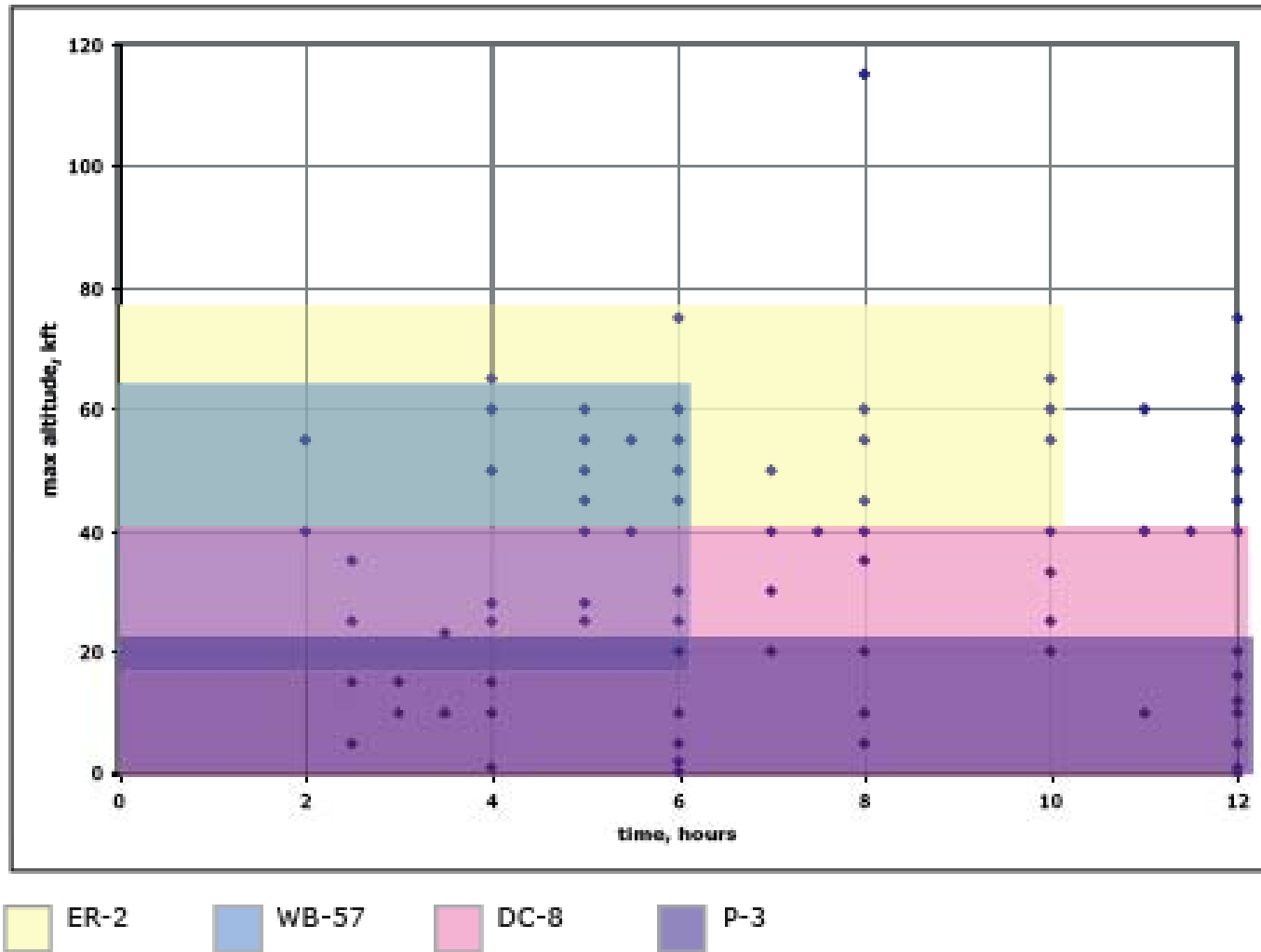
Required Science Measurement Objectives

Altitude vs. Endurance for all missions



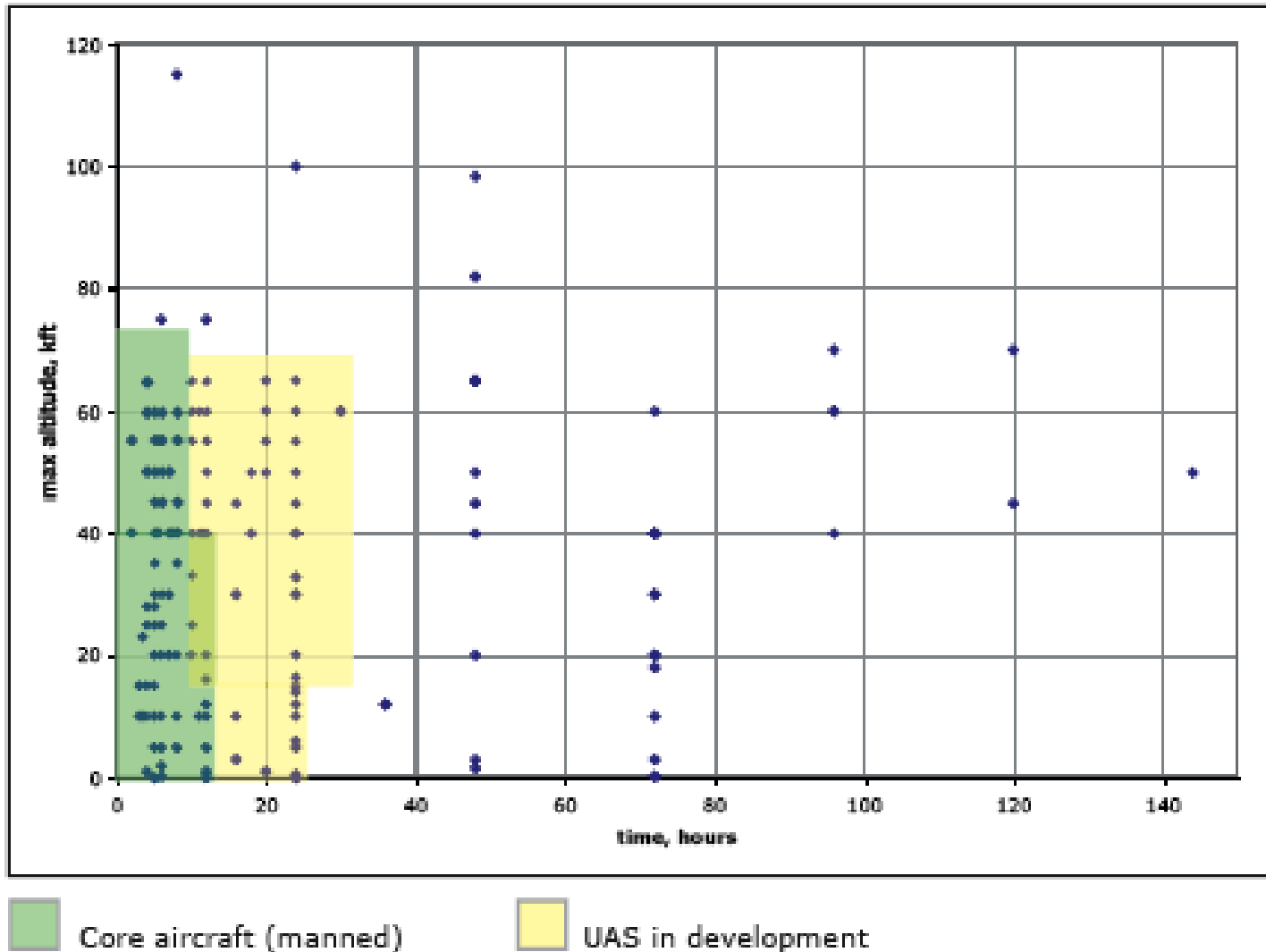


Core Aircraft Support of Required Measurements





Core and New Technology Aircraft Support of Required Measurements





Strategic Planning

- Engineering schedule and timeliness of development activity
 - 7 more FTE Engineers (As an ASP contribution to support Science integration) ~ 1.5M/yr
- UAS Airspace Access 1 FTE at FAA NASA detail
- Strategic Aircraft upgrade investments –
 - WB-57 Autopilot and Engines - \$10M multiple years FY 10-14
 - Extended fuel capability and Ejection Seats
 - P-3 Autopilot and major inspection \$3M over 09/10
 - Fuel heat system – ER-2, WB-57, Global Hawk ~\$1M
- High data rate SATCOM system, portable to multiple aircraft \$1M,
 - 2 units, + 1 WYE
- Long term DC-8 replacement - \$70 - \$150M????? FY 2015-2025



NRC Decadal Survey for Earth Science: (released 16 January 2007)

Space-based observations provide a global view of many Earth system processes; however, satellite observations have a number of limitations, including spatial and temporal resolution and the inability to observe certain parts of the Earth. Hence, they do not provide a picture of the Earth system that is sufficient for understanding key physical, chemical, and biological processes.

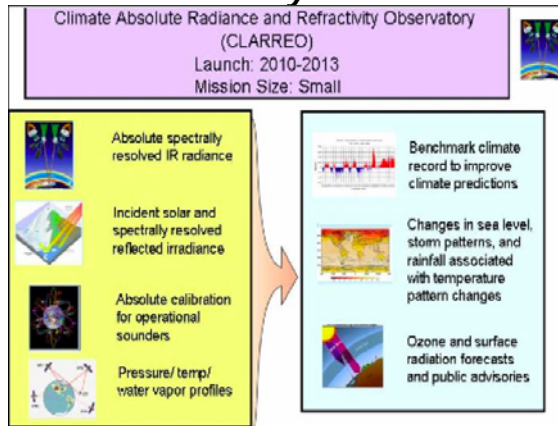
Recommendation: NASA should support Earth science research via suborbital platforms: *airborne programs*, which have suffered substantial diminution, should be restored, and *UAV technology* should be increasingly factored into the nation's strategic plan for Earth sciences.





Decadal Survey Risk Reduction (2010-2013)

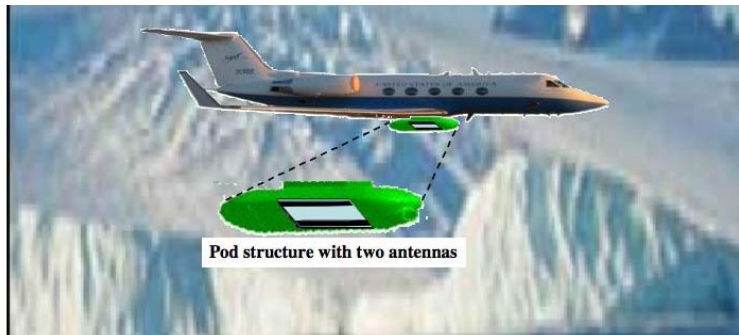
CLARREO (*Climate Absolute Radiance and Refractivity Observatory*)



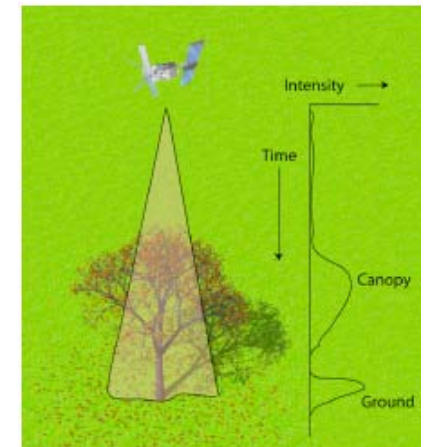
SMAP (*Soil Moisture Active-Passive*)



ICESat II



DESDynI (*Deformation, Ecosystem Structure and Dynamics of Ice*)





ASP Support for Near-Term Decadal Survey Missions (2008-2012)

Representative sensor development

Concept demos & algorithm development

Cal/Val

INFLAME

Radiation flux calibration

CLARREO

Provide benchmark spectral and broadband radiance capability in orbit that can serve both as its own climate data record and to calibrate less accurate space-borne instruments with wavelengths in the solar reflected and thermal infrared emission portions of the spectrum.

PALS, UAVSAR

Aircraft simulators

SMAP

SMAP will help characterize the relationship between soil moisture, its freeze/thaw state, and the associated environmental constraints to ecosystem processes including land-atmosphere carbon, water and energy exchange, and vegetation productivity.

UAVSAR, ATM

Airborne laser altimetry

ICESat II

ICESat (Ice, Cloud, and land Elevation Satellite) is the benchmark Earth Observing System mission for measuring ice sheet mass balance, cloud and aerosol heights, as well as land topography and vegetation characteristics.

LVIS, UAVSAR

Aircraft radar

DESDynI

Provide observations important for solid-Earth (surface deformation), ecosystems (terrestrial biomass structure) and climate (ice dynamics).



Airborne Science Program

- Requirements understood
 - Refocused program direction
- NASA unique strengths
 - high-altitude platforms
 - highly reconfigurable heavy-lift flying laboratories
 - Large, diverse catalog
- Critical to Earth science future
 - Decadal missions
 - Global Climate Change Missions
- Great value
 - Highly capable, motivated people
 - Unique suite of full service capabilities



Low Cost Low Altitude hovering Airborne UAS

