The primary objective of the NASA Airborne Science Program (ASP), managed under the Science Mission Directorate Earth Science Division, is to meet the needs of the NASA Earth Science community with respect to in situ atmosphere or remotely sensed sub-orbital measurements. Program objectives are driven primarily by Research and Analysis (R&A) Program-funded projects that use airborne instruments in support of satellite calibration, algorithm or model validation, or multi-instrument, multi-vehicle missions to understand fundamental earth system processes. Prior to launch, many flight project develop airborne instruments that simulate intended measurements from orbit.

This analysis of Program stakeholder needs is conducted approximately every 5 years and is the third internal ASP report to assess changing needs within the NASA science community. The intent of this report is to summarize the NASA Programs, Missions, and Projects for which there are clear requirements for airborne platforms, as well as documenting stated needs, or interest, from future stakeholders.

Requirements for airborne observations originate from the following NASA Earth Science activities:

- NASA Earth observing satellite missions,
- Earth Science R&A data collections and field studies,
- Earth Science instrument / technology development

Data for this report have been collected through several means over the past 2 years and validated where possible by Program Managers and Program Scientists at NASA HQ.

Sources of information include but are not limited to:

- Interviews with Program Scientists through the annual ASP 5-yr planning exercise
- A survey completed by principal investigators at the NASA Centers,
- Reviews of science mission planning documents,
- Requests for NASA ESD flight hours in the NASA Science Operations Flight Request System (SOFRS)
- Participation in science team meetings and community workshops
- Requests and early planning for Designated Observables and Targeted Observable missions, as defined by the NRC 2017 Decadal Survey.

The fleet of available aircraft spans several orders of magnitude in terms of available payload mass, provides measurements from the surface to 70,000ft, and has flight ranges that exceed 5000 nautical miles. This owes to the variety of different vantage points required, payload mass, range, duration and cost. The following table indicates the characteristics of the NASA aircraft in altitude, endurance, range, and payload capability.
## Airborne Science Aircraft and their characteristics

<table>
<thead>
<tr>
<th>Platform Name</th>
<th>Center</th>
<th>Payload Accommodations</th>
<th>Duration (Hours)</th>
<th>Useful Payload (lbs)</th>
<th>Max Altitude (ft)</th>
<th>Airspeed (knots)</th>
<th>Range (Nmi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASP Supported Aircraft</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC-8</td>
<td>NASA-AFRC</td>
<td>4 nadir ports, 1 zenith port, 14 additional view ports</td>
<td>12</td>
<td>50,000</td>
<td>41,000</td>
<td>450</td>
<td>5,400</td>
</tr>
<tr>
<td>ER-2 (2)</td>
<td>NASA-AFRC</td>
<td>Q-bay (2 nadir ports), nose (1 nadir port), wing pods (4 nadir, 3 zenith ports), centerline pod (1 nadir port)</td>
<td>12</td>
<td>2,900</td>
<td>&gt;70,000</td>
<td>410</td>
<td>5,000</td>
</tr>
<tr>
<td>G-III/C-20A</td>
<td>NASA-AFRC</td>
<td>UAVSAR pod</td>
<td>7</td>
<td>2,610</td>
<td>45,000</td>
<td>460</td>
<td>3,000</td>
</tr>
<tr>
<td>G-III</td>
<td>NASA-JSC</td>
<td>UAVSAR pod, Sonobuoy launch tube</td>
<td>7</td>
<td>2,610</td>
<td>45,000</td>
<td>460</td>
<td>3,000</td>
</tr>
<tr>
<td>G-III</td>
<td>NASA-LaRC</td>
<td>2 nadir ports</td>
<td>7</td>
<td>2,610</td>
<td>45,000</td>
<td>460</td>
<td>3,000</td>
</tr>
<tr>
<td>GV</td>
<td>NASA-JSC</td>
<td>2 nadir ports</td>
<td>12</td>
<td>8,000</td>
<td>51,000</td>
<td>500</td>
<td>5,500</td>
</tr>
<tr>
<td>P-3</td>
<td>NASA-WFF</td>
<td>1 large and 3 small zenith ports, 3 fuselage nadir ports, 4 P-3 aircraft window ports, 3 DC-8 aircraft window ports, nose radome, aft tailcone, 10 wing mounting points, droopsonde capable</td>
<td>14</td>
<td>14,700</td>
<td>32,000</td>
<td>400</td>
<td>3,800</td>
</tr>
<tr>
<td>WB-57</td>
<td>NASA-JSC</td>
<td>Nose cone, 12 ft of pallets for either 3 ft or 6 ft pallets, 2 Spearpods, 2 Superpods, 14 Wing Hatch Panels</td>
<td>6.5</td>
<td>8,800</td>
<td>&gt;60,000</td>
<td>410</td>
<td>2,500</td>
</tr>
<tr>
<td>Other NASA Aircraft</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B-200 (UC-12B)</td>
<td>NASA-LaRC</td>
<td>2 nadir ports, 1 nose port, aft pressure dome with droopsonde tube, cargo door</td>
<td>6.2</td>
<td>4,100</td>
<td>31,000</td>
<td>260</td>
<td>1,250</td>
</tr>
<tr>
<td>B-200</td>
<td>NASA-AFRC</td>
<td>2 nadir ports</td>
<td>6</td>
<td>1,850</td>
<td>30,000</td>
<td>272</td>
<td>1,490</td>
</tr>
<tr>
<td>B-200</td>
<td>NASA-LaRC</td>
<td>2 nadir ports, wing tip pylons, zenith site for aerosol inlet, lateral ports</td>
<td>6.2</td>
<td>4,100</td>
<td>35,000</td>
<td>275</td>
<td>1,250</td>
</tr>
<tr>
<td>C-130</td>
<td>NASA-WFF</td>
<td>3 nadir ports, 1 zenith port, 2 rectangular windows, wing mount for instrument canisters, droopsonde capable, cargo carrying capable</td>
<td>10</td>
<td>36,500</td>
<td>33,000</td>
<td>290</td>
<td>3,200</td>
</tr>
<tr>
<td>Cessna 206H</td>
<td>NASA-WFF</td>
<td>Wing pod, belly pod, modified rear window for zenith ports</td>
<td>5.7</td>
<td>1,175</td>
<td>15,700</td>
<td>150</td>
<td>700</td>
</tr>
<tr>
<td>Dragon Eye (UAS)</td>
<td>NASA-ARC</td>
<td>In situ sampling ports</td>
<td>1</td>
<td>1</td>
<td>&gt;500</td>
<td>34</td>
<td>3</td>
</tr>
<tr>
<td>HU-25A Guardian</td>
<td>NASA-LaRC</td>
<td>1 nadir port, wing hard points, crown probes</td>
<td>6</td>
<td>3,000</td>
<td>42,000</td>
<td>430</td>
<td>2,075</td>
</tr>
<tr>
<td>Matrice 600 (UAS)</td>
<td>NASA-ARC</td>
<td>Imager gimbal</td>
<td>1</td>
<td>6</td>
<td>8,000</td>
<td>35</td>
<td>3</td>
</tr>
<tr>
<td>SIERRA-B (UAS)</td>
<td>NASA-ARC</td>
<td>Interchangeable nose pod for remote sensing and sampling, 1 nadir port</td>
<td>10</td>
<td>100</td>
<td>12,000</td>
<td>60</td>
<td>600</td>
</tr>
<tr>
<td>WB-57 (2)</td>
<td>NASA-JSC</td>
<td>Nose cone, 12 ft of pallets for either 3 ft or 6 ft pallets, 2 Spearpods, 2 Superpods, 14 Wing Hatch Panels</td>
<td>6.5</td>
<td>8,800</td>
<td>60,000+</td>
<td>410</td>
<td>2,500</td>
</tr>
</tbody>
</table>
The chart above, based upon aircraft support requested in recent solicitations, provides a useful way to represent the broad set of science needs across Earth Science disciplines. It also reflects what aircraft are currently available and able to carry a given mass of payload while also demonstrating a sustained need for high altitude, medium altitude, and low altitude flight.

The series of tables below summarize how aircraft are being used or planned for use in support of NASA Earth Science Division satellite programs, including the types of instruments, current examples of airborne instruments, as well as the class of aircraft that is required. For future missions the aircraft represent various general capabilities such as heavy lift, high or low altitude, and are also based on past trends in given communities. Calibration and Validation refers to the under-flight of satellites with well calibrated airborne instruments so as to assess the quality of the space instrument as it degrades over time, and to provide high resolution data that can be used to validate that data products produced by space mission processing algorithms yield scientifically and socially useful data products. These algorithms and how they process the data are based on assumptions made by satellite simulation through airborne observations.

Airborne Science support for NASA Earth Science Space Missions in Extended and Primary Operations (active missions) is summarized in the table on the following page. The supporting aircraft have the capability to carry the supporting instrument and perform the supporting activities.
Airborne Science support for NASA Earth Science Space Missions in Extended and Primary Operations (active missions).

<table>
<thead>
<tr>
<th>Mission</th>
<th>POC</th>
<th>Satellite Instruments</th>
<th>Supporting/related aircraft instruments</th>
<th>Airborne Science supporting activities</th>
<th>Supporting Aircraft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aura</td>
<td>Jucks</td>
<td>MLS, HIRDLS, OMI, TES</td>
<td>ASMLE; Discover-AQ, KORUS-AQ packages</td>
<td>Data product validation</td>
<td>ER-2, P-3, DC-8</td>
</tr>
<tr>
<td>Calipso Cloudsat</td>
<td>Considine</td>
<td>CALIOP, IIR, WFC, CPR</td>
<td>HSRL, HSRL2, AMPR, CRS, CPL</td>
<td>Cal/val</td>
<td>B-200, UC-12, ER-2</td>
</tr>
<tr>
<td>Aqua / Terra</td>
<td>Jucks</td>
<td>MODIS, AMSR-E, ASTER, MISR, CERES</td>
<td>MAS, eMAS, MASTER, AVIRIS</td>
<td>Data product Validation</td>
<td>ER-2, Twin Otter</td>
</tr>
<tr>
<td>GPM / Aeolus</td>
<td>McCarty</td>
<td>Microwave Imager, Doppler Precipitation Radar (DPR)</td>
<td>AMPR, COSMIR, HIWRAP</td>
<td>Instrument calibration &amp; Data product validation</td>
<td>ER-2, DC-8, Citation</td>
</tr>
<tr>
<td>Suomi-NPP</td>
<td>Lorenzoni</td>
<td>VIIRS, CrIS, ATMS, OMPS</td>
<td>NAST, S-HIS, eMAS, MASTER, AVIRIS</td>
<td>Instrument calibration &amp; Data Product validation</td>
<td>P-3, Twin Otter, ER-2</td>
</tr>
<tr>
<td>SMAP</td>
<td>Entin</td>
<td>L-band radar, L-band radiometer</td>
<td>UAVSAR, PALS, SLAP</td>
<td>Instrument calibration &amp; Data Product validation</td>
<td>G-III, P-3, B-200, DC-3</td>
</tr>
<tr>
<td>ICESat-2</td>
<td>Markus</td>
<td>5-beam laser mapper</td>
<td>LVIS, Ice Bridge suite</td>
<td>Instrument calibration &amp; Data Product validation</td>
<td>G-V, P-3, DC-8</td>
</tr>
<tr>
<td>Landsat 9</td>
<td>Margolis</td>
<td>Multi-spectral imager</td>
<td>AVIRIS-NG, AVIRIS classical, MASTER</td>
<td>Data Product validation</td>
<td>ER-2, B-200</td>
</tr>
<tr>
<td>ECOSTRESS (ISS)</td>
<td>Turner</td>
<td>High resolution multispectral thermal imaging spectrometer</td>
<td>HYTES, AVIRIS-ng</td>
<td>Data Product validation</td>
<td>B-200, ER-2, G-V</td>
</tr>
<tr>
<td>GEDI (ISS)</td>
<td>Margolis</td>
<td>Lidar</td>
<td>LVIS, G-LiHT</td>
<td>Data product validation</td>
<td>B-200, G-V, various</td>
</tr>
</tbody>
</table>
The tables below represent currently planned needs for aircraft support to missions in various stages of formulation and development:

### Summary of Missions in Implementation and Pre-formulation Phases (Future)

<table>
<thead>
<tr>
<th>Mission / (launch date) / POC</th>
<th>POC</th>
<th>Spacecraft Instruments</th>
<th>Supporting/related aircraft instruments</th>
<th>Airborne Science supporting activities</th>
<th>Representative Supporting Aircraft</th>
</tr>
</thead>
<tbody>
<tr>
<td>NISAR (2024)</td>
<td>Bawden</td>
<td>L-band SAR, S-band SAR</td>
<td>UAVSAR, ASAR</td>
<td>Algorithm development, Instrument calibration &amp; Data product validation</td>
<td>G-III</td>
</tr>
<tr>
<td>PACE (2024)</td>
<td>Lorenzoni</td>
<td>Ocean Color Instrument (OCI); Polarimeter</td>
<td>OCI simulator, PRISM, HSRL</td>
<td>Algorithm development, Instrument calibration &amp; Data Product validation</td>
<td>B-200, ER-2, G-III (PRISM)</td>
</tr>
<tr>
<td>SWOT (2022)</td>
<td>Shiffer</td>
<td>Ka-band radar, C-band radar</td>
<td>AirSWOT, MASS, DopplerScatt</td>
<td>Algorithm development, Instrument calibration &amp; Data Product validation</td>
<td>G-V, B-200</td>
</tr>
<tr>
<td>TEMPO (2023)</td>
<td>Lefer</td>
<td>Geostationary ultraviolet visible spectrometer</td>
<td>GEO-TASO, GCAS</td>
<td>Instrument calibration &amp; Data Product validation</td>
<td>UC-12, B-200</td>
</tr>
<tr>
<td>MAIA (2024)</td>
<td>ESTO, Maring</td>
<td>Air pollution particulate using twin camera radiometer and polarimeter</td>
<td>Air quality package</td>
<td>Instrument calibration &amp; Data Product validation</td>
<td>ER-2, DC-8</td>
</tr>
<tr>
<td>TROPICS (2022)</td>
<td>ESTO</td>
<td>Microwave radiometers (3)</td>
<td>AMPR, HAMSR</td>
<td>Data product validation</td>
<td>DC-8, ER-2</td>
</tr>
<tr>
<td>GEOCARB (2024)</td>
<td>Jucks</td>
<td>Spectrometer</td>
<td>Picarro, CO₂/CH₄</td>
<td>Data product validation</td>
<td>Alphajet, profiling UAS</td>
</tr>
<tr>
<td>GLIMR (2026)</td>
<td>ESTO/Entin, Lorenzoni</td>
<td>Hyperspectral imager</td>
<td>AVIRIS-ng, HyTES, PRISM</td>
<td>Instrument calibration &amp; Data Product validation</td>
<td>G-III, G-V, B-200</td>
</tr>
</tbody>
</table>

### Airborne Support to Designated Observables Missions

<table>
<thead>
<tr>
<th>Mission</th>
<th>POC</th>
<th>Spacecraft measurement or Instruments</th>
<th>Supporting/related aircraft instruments</th>
<th>Airborne Science supporting activities</th>
<th>Possible Aircraft</th>
</tr>
</thead>
<tbody>
<tr>
<td>AOS</td>
<td>Maring</td>
<td>Lidar, radar, polarimeter, radiometer</td>
<td>Polarmeter, radiometer, lidar, radar</td>
<td>Algorithm development, Instrument calibration &amp; Data product validation; Suborbital component currently being defined.</td>
<td>ER-2, DC-8</td>
</tr>
<tr>
<td>SBG</td>
<td>Turner</td>
<td>Hyperspectral visible, short-wave and thermal IR spectrometer (or) spectrometers</td>
<td>PRISM, HYTES, AVIRIS-ng, MASTERS</td>
<td>Precursor data collection; Instrument calibration; Data Product validation</td>
<td>ER-2, G-V, G-III; commercial B-200</td>
</tr>
<tr>
<td>SDC</td>
<td>Bawden</td>
<td>Interferometric SAR</td>
<td>UAVSAR in multiple frequencies</td>
<td>Instrument calibration &amp; Data Product validation</td>
<td>G-III, G-V</td>
</tr>
</tbody>
</table>
Upcoming field campaigns and process studies are summarized in the table below. For most of these missions the aircraft have been specified or indicated. This demonstrates a current and sustained need for the currently available aircraft while also showing sustained support for Commercial Aviation Services (CAS), especially for single instrument projects.

### Upcoming Field Campaigns

<table>
<thead>
<tr>
<th>Mission/POC</th>
<th>Objective</th>
<th>Location</th>
<th>Date</th>
<th>Aircraft Instrumentation</th>
<th>Aircraft</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCLIP / Maring, Jucks</td>
<td>Air pollution monitoring</td>
<td>Korea</td>
<td>2022</td>
<td>Similar to Korus-AQ package</td>
<td>WB-57</td>
</tr>
<tr>
<td>ABoVE / Margolis</td>
<td>Boreal land composition changes</td>
<td>Alaska, Canada</td>
<td>2022-23</td>
<td>UAVSAR, AVIRIS-ng, LVIS</td>
<td>G-III, B-200, G-V</td>
</tr>
<tr>
<td>SnowEx / Entin</td>
<td>Snow-water equivalent under various conditions</td>
<td>Colorado, Alaska</td>
<td>2022</td>
<td>UAVSAR</td>
<td>G-III</td>
</tr>
<tr>
<td>CPEX-CV / McCarty/Margolis</td>
<td>Microphysics and deep convection</td>
<td>Cape Verde, Africa</td>
<td>2022</td>
<td>DAWN, APR-3, HALO, dropsondes</td>
<td>DC-8</td>
</tr>
<tr>
<td>BioScape / Turner</td>
<td>Vegetation biodiversity</td>
<td>South Africa</td>
<td>2024</td>
<td>HyTES, AVIRIS-ng, PRISM, LVIS</td>
<td>G-III (L), GV</td>
</tr>
<tr>
<td>Terrestrial ecology and earth surface topography / Bawden/Margolis</td>
<td>L-band SAR for solid earth and vegetation measurements</td>
<td>North America</td>
<td>Ongoing</td>
<td>UAVSAR</td>
<td>G-III</td>
</tr>
<tr>
<td>STAQS / Lefer</td>
<td>Air quality measurements</td>
<td>CA, New York</td>
<td>2023</td>
<td>GCAS, HSRL-2 AVIRIS-NG, HALO</td>
<td>GV, G-III</td>
</tr>
<tr>
<td>ARCSIX / Maring</td>
<td>Radiation and chemistry</td>
<td>Arctic</td>
<td>2024</td>
<td>Spectrometer, radiometer, aerosol counter, LVIS</td>
<td>GV, P-3</td>
</tr>
<tr>
<td>Asia-AQ / Lefer</td>
<td>Air quality measurements</td>
<td>4 Sites in SE Asia</td>
<td>2024</td>
<td>Similar to Korus-AQ package for air pollution</td>
<td>GV, DC-8</td>
</tr>
<tr>
<td>Africa-AQ / Lefer</td>
<td>Air pollution monitoring</td>
<td>Africa</td>
<td>TBD</td>
<td>Similar to Asia-AQ package</td>
<td>GV, DC-8</td>
</tr>
<tr>
<td>BLUEFLUX / Hibbard</td>
<td>Carbon Monitoring</td>
<td>Florida</td>
<td>2022, 2023, 2024</td>
<td>Picarro</td>
<td>B-200</td>
</tr>
<tr>
<td>AEROMMA / Lefer</td>
<td>Air Quality</td>
<td>CA, NYC, OH</td>
<td>2023</td>
<td>Payload similar to FIREX-AQ</td>
<td>DC-8</td>
</tr>
<tr>
<td>PACE PAX / Lorenzoni</td>
<td>PACE cal/val</td>
<td>California coast</td>
<td>Fall 2024</td>
<td>eMAS; PRISM, AirHARP, SPEX Airborne, HSRL-2, RSP</td>
<td>ER-2</td>
</tr>
<tr>
<td>Arctic COLORS / Lorenzoni</td>
<td>Coastal impacts of climate change</td>
<td>Alaska</td>
<td>TBD</td>
<td>Imagery, aerosols (like SABOR); PRISM</td>
<td>Low-to-mid altitude with moderate payload, UAS measurements</td>
</tr>
</tbody>
</table>
The Earth Venture Suborbital series of missions have pushed the boundaries of knowledge in many science disciplines by flying a series of multi-year flights using a variety of platforms to improve process models and forecasts. Data from more than a decade of proposals shows sustained needs for the current fleet, while also emphasizing that both the “B-200” and “Other” categories (consisting largely of CAS) are needed at approximately the same magnitude. Some trends in science needs from the EVS-3 proposals include continued scientific interest in polar regions (Arctic, Greenland, Alaska, Antarctic), continued strong interest in weather and atmospheric composition and chemistry, and increased use of multi-platform campaigns; more than half of the mission concepts proposed call for multiple aircraft, some in stacked formation.
While CAS are often used for initial testing of new instrument concepts, many instrument teams continue to seek out the ER-2 for the ability to carry larger instruments above 95% of the atmosphere to simulate space-like observations. The table below provides a current snapshot of instruments scheduled for test flight. The Earth Science Technology Office (ESTO) Program is accelerating the pace of funding for the Instrument Incubator Program so this level of need is likely to continue and possibly grow.

### Instrument flight requests

<table>
<thead>
<tr>
<th>Instrument</th>
<th>PI</th>
<th>Aircraft</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAMLS / A-SMLS</td>
<td>Livesey</td>
<td>ER-2</td>
<td>2022</td>
</tr>
<tr>
<td>SHOW</td>
<td>Bourassa</td>
<td>ER-2</td>
<td>2022</td>
</tr>
<tr>
<td>AirMSPI-2</td>
<td>Diner</td>
<td>ER-2</td>
<td>2022</td>
</tr>
<tr>
<td>eMAS / PICARD validation</td>
<td>Jacobson</td>
<td>ER-2</td>
<td>2022</td>
</tr>
<tr>
<td>SoOpSAR</td>
<td>Yueh</td>
<td>TOIL</td>
<td>2022</td>
</tr>
<tr>
<td>GNSS RO/SF</td>
<td>JPL</td>
<td>B-200</td>
<td>2022</td>
</tr>
<tr>
<td>Air-MASTER</td>
<td>Sanchez-Barbetty</td>
<td>DC-8</td>
<td>2022</td>
</tr>
<tr>
<td>3D Cloud Scanner</td>
<td>Martins</td>
<td>ER-2</td>
<td>2022</td>
</tr>
<tr>
<td>Radar sounder</td>
<td>Cahill</td>
<td>P-3</td>
<td>2022</td>
</tr>
<tr>
<td>CHAPS Demonstrator</td>
<td>Schwartz</td>
<td>B-200</td>
<td>2022/23</td>
</tr>
<tr>
<td>Aerosol Wind Profiler</td>
<td>Marketon</td>
<td>G-III (LaRC)</td>
<td>2022</td>
</tr>
<tr>
<td>CoSSIR</td>
<td>Adams</td>
<td>ER-2</td>
<td>2022</td>
</tr>
<tr>
<td>KU Multi-channel snow radar</td>
<td>Paden</td>
<td>P-3</td>
<td>2022</td>
</tr>
</tbody>
</table>
CONCLUSIONS

Across all Earth science stakeholders who were contacted during this survey, there exists a strong, continued need for NASA Science aircraft. New satellites under development have a variety of airborne instruments that are or will soon be used to develop new data products, and the Earth Venture Suborbital Program and Research and Analysis Programs represent a sustained need for the core aircraft.

The Program will continue to fly UAVSAR (or an updated SAR payload) for NISAR validation, indicating sustained need for business class jets such as the G-III and GV. Both SWOT and PACE will make use of airborne measurements for calibration and validation using a variety of active and passive optical instruments.

The Designated Observables satellite missions recommended by the National Academies have significant need for aircraft both for technology development and algorithm refinement for data products. AOS has a defined suborbital team to plan their use of aircraft and SBG has been building a long-term time series through the Western Diversity Time Series to refine imaging spectroscopy.

Missions in the technology incubator category, including STV and PBL, have expressed a need for instrument development using aircraft in addition to needing aircraft measurements for calibration, similar to OIB for ICESAT, or LVIS for GEDI.

With increased cadence of the instrument incubator program we see sustained need for ER-2 and CAS for instrument testing and maturation.

ER-2 continues to be important for technology development (Table, pg 8), process studies, and satellite support. Delays of several years for short instrument test flights are becoming more common because of maintenance delays. The Program should consider funding operations for 2 concurrent aircraft. This could be accomplished through contracts to LM or hiring additional mechanics and pilots at AFRC.

CAS continue to provide support for light aircraft with medium range requirements and this requirement is stable to growing, but largely reflects continued interest in AVIRIS-NG.

Following is a summary of the major survey and discussion input comments from our visits with NASA Center scientists.
Aircraft:

All currently ASP-supported aircraft are in routine use and continued use is projected and desired.

Gaps in the fleet include:

- Aircraft capable of supporting large instruments needing access to doors or large ports. Aircraft with suitable capability, used in the past, have included Twin Otter, DC-3/Basler, and Sherpa.
- Storm-penetrating aircraft for observing processes in severe storms, fire and volcanic plumes.
- Concerns were voiced about the availability of the ER-2 and G-V. Suggestions of having another GV dedicated to science and going back to 2 concurrently operational ER-2s.
- King Air 350ER or inexpensive aircraft with longer range and more schedule availability than LARC/AFRC B-200; although not a gap in the fleet, the cost of the currently un-supported B-200s is too expensive.

Aircraft accommodations or payload support needed:

- Strong need for dropsonde capability from long-range aircraft, e.g., G-V
- Aircraft modifications or aircraft with two nadir ports AND radar support
- Zenith port(s) on the G-V (or other)
- Forward and nadir cameras on ER-2 with real-time data downlink
- A new, advanced replacement for UAVSAR and its 3 frequency versions.

Other:

- Real-time data is desired for many instruments
- Suggestion to make AirSWOT a facility instrument
- Single-pass interferometry in demand – how to modify a/c to do this?
- Suggestion by JPL researchers to rotate P-3 and Sherpa to West Coast