

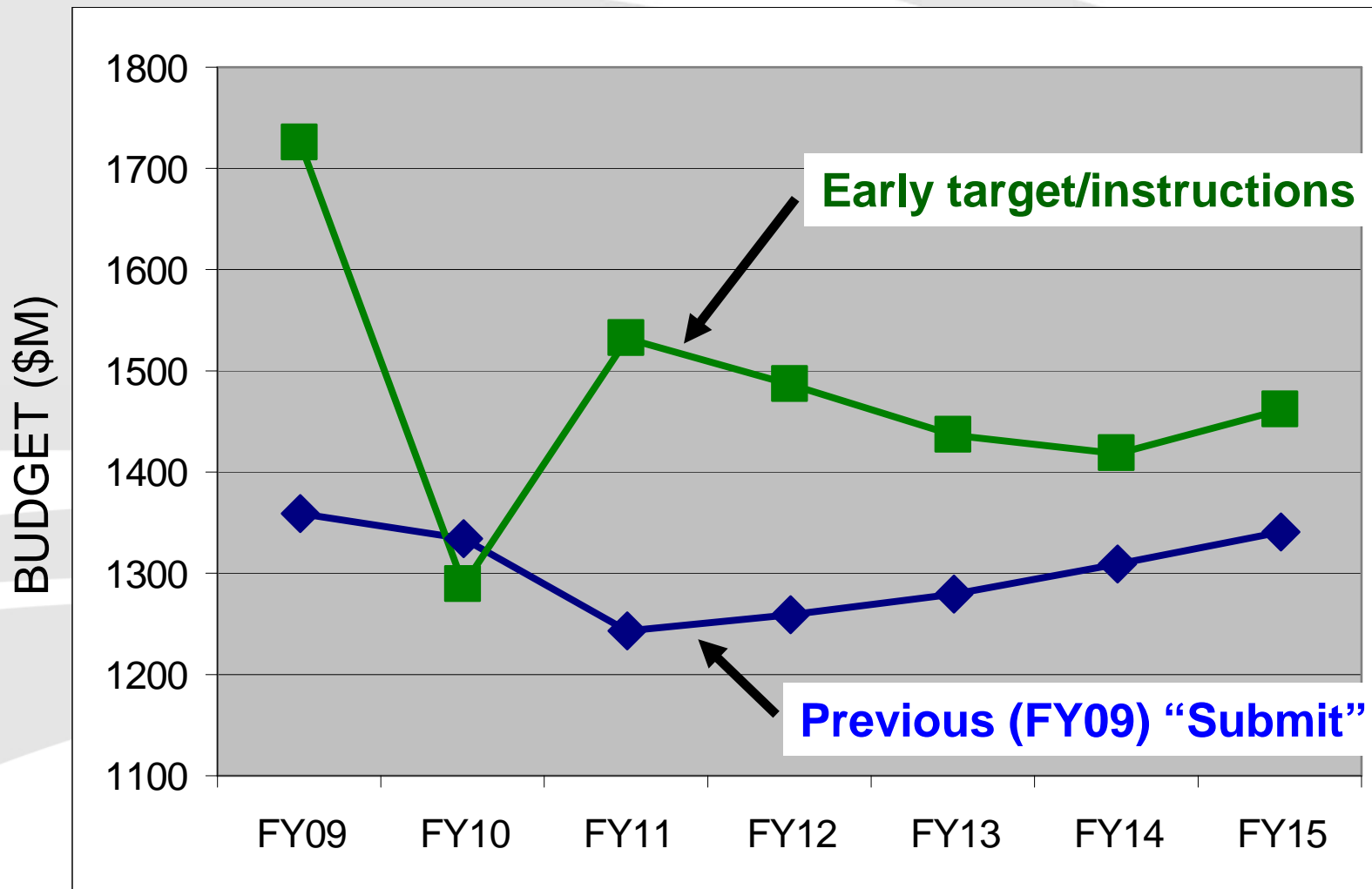
National Aeronautics and Space Administration



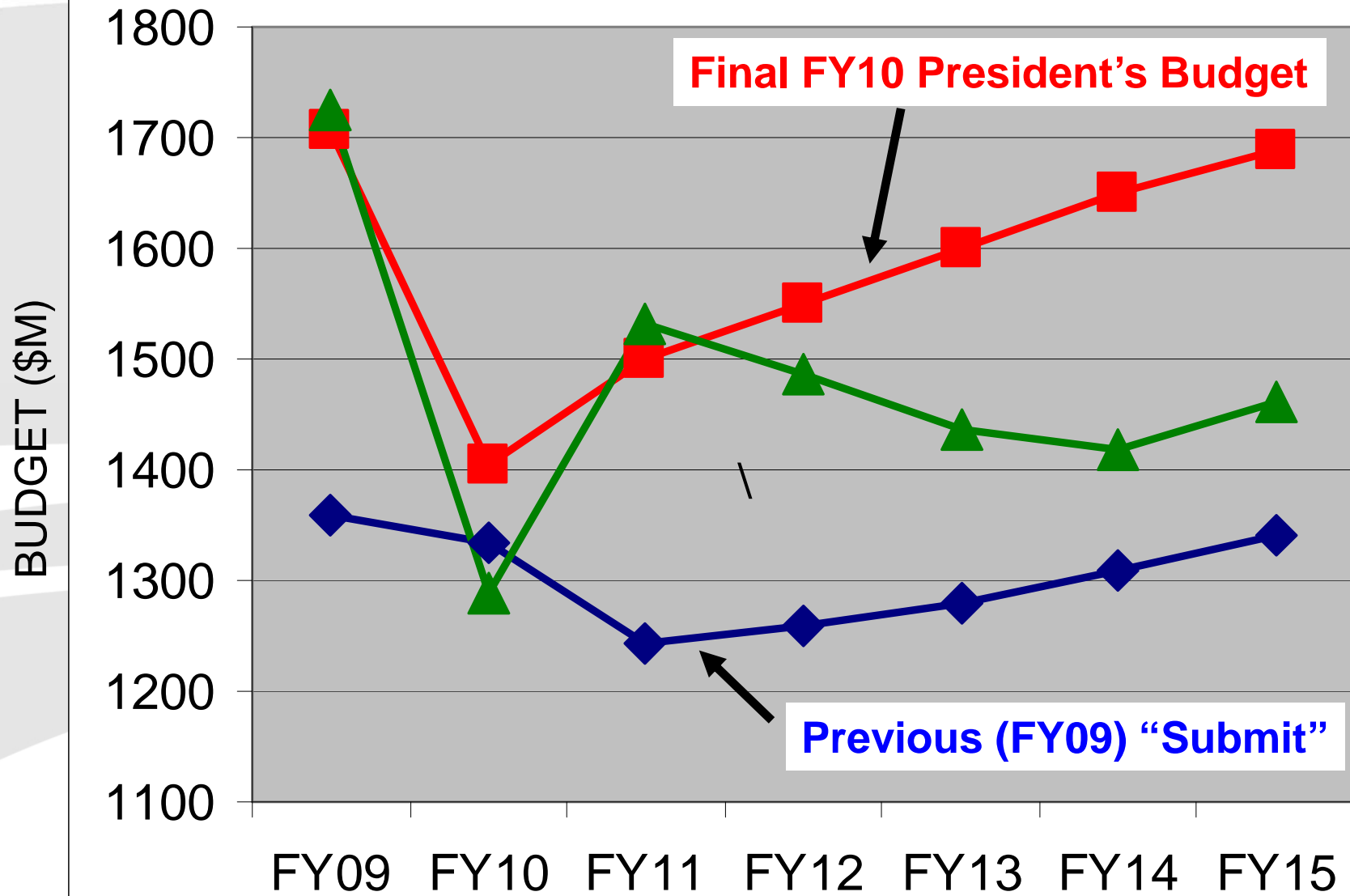
Scatterometry and Climate: the 100K-foot View of Surface Winds

Michael H. Freilich
19 August 2009

ESD BUDGET MARKS: ORIGINAL



ESD BUDGET MARKS: "FINAL"



Objectives/Principles for Augmentation Funds



- Complete and launch the 5 “Foundational” Earth Science missions now under development
 - Glory, Aquarius, NPP, LDCM (w/TIRS), GPM Core
- Develop Decadal Survey missions, as possible
 - Venture-class
 - SMAP, ICESAT-II
 - DESDynI, CLARREO
 - Tier-II mission studies
 - Focused technology development
- Preserve overall program balance (R&A, Applied Sciences, Technology)
 - *Ice Bridge (aircraft campaigns to extend ICESAT-1 data set to ICESAT-II)*
 - Airborne Infrastructure and instruments
 - Supercomputing
 - Technology
 - Regional impacts/applications
 - Climate Modeling
 - Education and Public Outreach

QuikSCAT and Scatterometry in NASA



NASA has flown 3 scatterometers in the post-Seasat era

- NSCAT (1996-1997); **QuikSCAT (1999-)**; Seawinds/ADEOS-II (2002-2003)

The 10-year QuikSCAT global vector wind and backscatter cross-section data sets are among the longest, consistently processed, NASA measurement series(!)

- Manifest utility for “operational” forecasting (ice as well as weather) has contributed greatly to interagency cooperation
- Latest Senior Review recommended QuikSCAT extended mission for 4 more years
- QuikSCAT measurements are being used by the non-NASA/non-NOAA scientific communities

The decade-long global QuikSCAT time series have clear potential for “climate” studies

- Seasonal and annual statistics
- Interannual variability
- Overlap with many other missions (ERS-2, Metop, Envisat, Terra, Aqua, T/P, Jason-1, DMSPs, GRACE, POESs, Windsat, ...)
- ***Converting the “climate potential” into substantive scientific advances will send a strong message regarding the utility of the data and the interest of the expert scientific community – ROSES09 call provides a near-term solicitation for such work***

Scatterometry in NASA and the US



Earth Science and Applications Decadal Survey assigns follow-on scatterometers to NOAA

- Near-term replacement for QuikSCAT
- Longer-term advanced instrument/mission (XOVWM)
- NASA/ESD has encouraged JPL to work reimbursably to support NOAA studies – DFS
- NASA supports NOAA's efforts to establish agreements with JAXA to fly a DFS instrument on GCOM-W2 (2012 launch)

NASA supports a strong, active International Ocean Vector Winds Science Team

- NASA focus on, and funding for, Earth system science involving ocean vector wind measurements will continue even after the demise of QuikSCAT

NASA – with and separately from NOAA – is working to ensure rapid, open access to future international scatterometer missions

- China's HY series of ocean satellites
- India's (ISRO) planned Oceansat-2
- ...

Substantial scientific advances by the scatterometer science/research community will be key to advancing domestic programs for DFS and XOVWM-type scatterometer instruments, and for helping to gain mutually beneficial access to, and produce analyses of, international partner data sets

NEW MISSION CLASSES (ESD)



“Foundational”

- Glory (1/2010)
- Aquarius (5/2010)
- NPP (1-6/2010)
- LDCM (12/2012) (w/o TIRS)
- GPM (7/2013, *11/2015*)

“Decadal Survey”

- **Venture-Class (2009, 2011, ...)**
- SMAP (3/2014)
- ICESAT-II (2015)
- CLARREO
- DESDynI (SAR, LIDAR)
- **Tier-2 (5 missions)**
- **Tier-3 (6 missions)**

NEW MISSION CLASSES (ESD+unplanned)



“Foundational”

- Glory (1/2010)
- Aquarius (5/2010)
- NPP (1-6/2010)
- LDCM (12/2012) (w/o TIRS)
- GPM (7/2013, *11/2015*)

“Decadal Survey”

- **Venture-Class (2009, 2011, ...)**
- SMAP (3/2014)
- ICESAT-II (2015)
- CLARREO
- DESDynI (SAR, LIDAR)
- **Tier-2 (5 missions)**
- **Tier-3 (6 missions)**

“National Needs”

- Carbon Recovery (vice-OCO)
- TIRS (LDCM or free-flyer)
- DSCOV
- SAGE-III
- GIFTS

NEW MISSION CLASSES (ESD and ???)



“Foundational”

- Glory (1/2010)
- Aquarius (5/2010)
- NPP (1-6/2010)
- LDCM (12/2012) (w/o TIRS)
- GPM (7/2013, 11/2015)

“Decadal Survey”

- **Venture-Class (2009, 2011, ...)**
- SMAP (3/2014)
- ICESAT-II (2015)
- CLARREO
- DESDynI (SAR, LIDAR)
- **Tier-2 (5 missions)**
- **Tier-3 (6 missions)**

“National Needs”

- Carbon Recovery (vice-OCO)
- TIRS (LDCM or free-flyer)
- DSCOV
- SAGE-III
- GIFTS

“Climate/Operational”

- *Vector Winds (vice QuikSCAT)*
- Space Weather (vice ACE)
- Ocean color, Aerosols (vice MODIS)
- *Nadir Altimetry (vice OSTM/Jason-2)*
- GPSRO
- *Broad-band Radiation Bud.(CERES)*
- “R 2 O” infusion ...

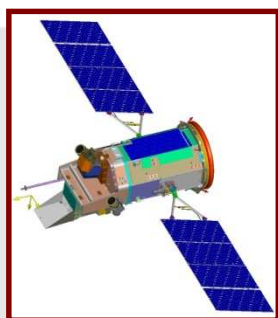
NASA Operating Missions



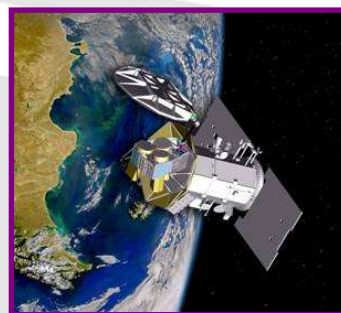
Missions in Formulation and Implementation



OCO
2/2009
Atmos CO₂



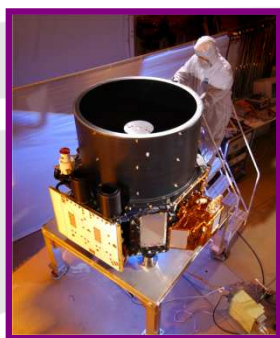
GLORY
4-11/2010
Aerosols, Solar Irrad



AQUARIUS
5/2010
Ocean Salinity



NPP
1-6/2011
EOS Cont.



ICESat-II
2015
Ice Topog



SMAP
2014
Soil Moist+Freeze/Thaw



GPM
7/2013, 11/2015
Global Precip



LDCM
12/2012
Land Imaging¹

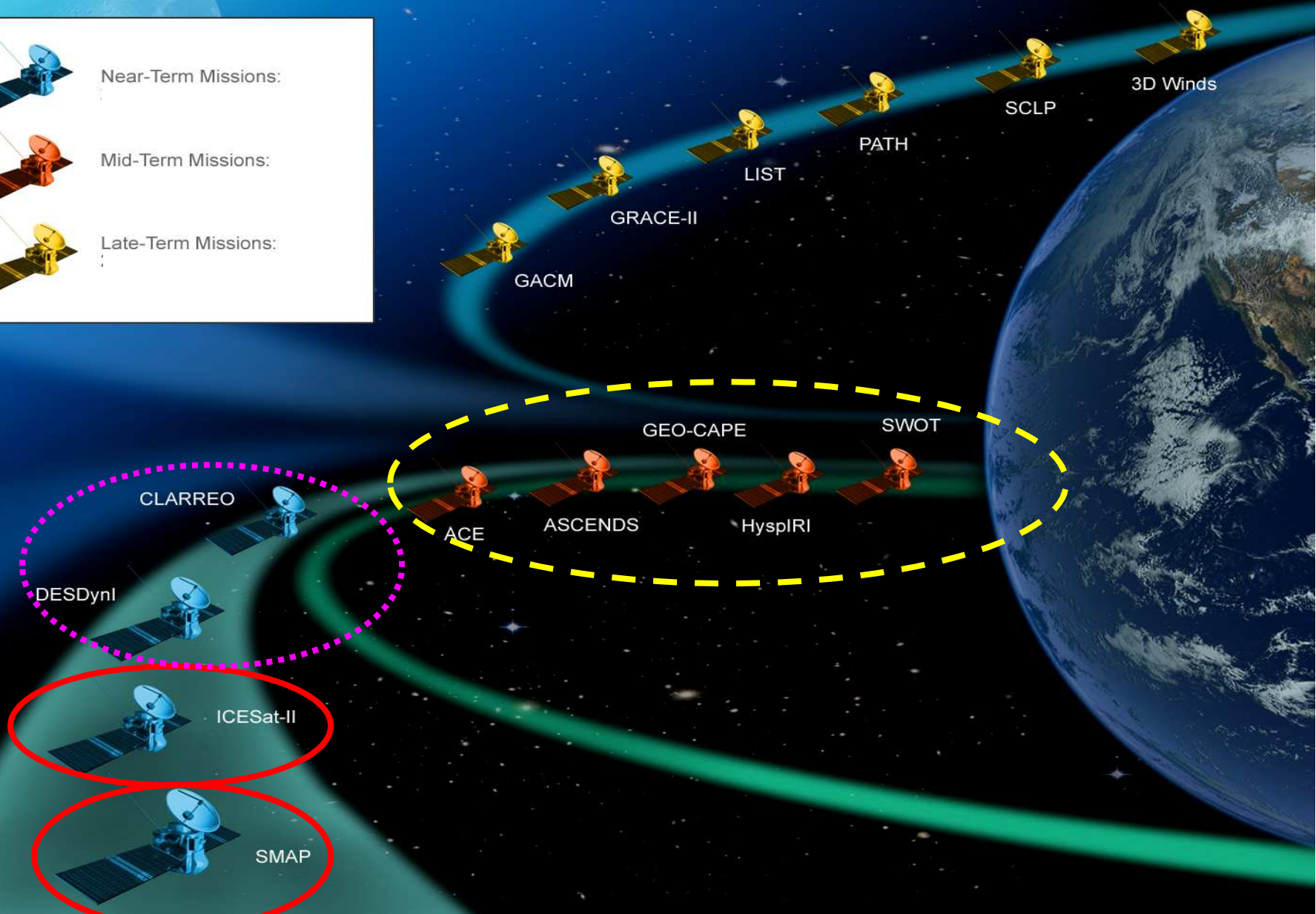
Decadal Survey Missions Next Generation



 Near-Term Missions:

 Mid-Term Missions:

 Late-Term Missions:



Venture Class



- Decadal Survey called for a regular line of competed, small, flexible missions to complement the identified 17 systematic missions
 - Replacement for former ESSP program
 - Science, innovation, education
 - Airborne and spaceborne specifically recommended
- ESD considers establishment *and sustained, successful implementation* of Venture-class to be a “Tier-1” priority from the Decadal Survey
- ESD Venture-class characteristics
 - Science-driven, involving sustained (> seasonal) data acquisition
 - *Technology development/demonstration is not sufficient justification*
 - Regular solicitations
 - *Annual desired, bi-annual minimum required*
 - Competitively selected
 - PI-led
 - Cost and schedule constrained
 - *~\$150M caps per solicitation*
 - *5-year development time-to-launch for space missions*

Venture Class – ESD Plans



- Alternate airborne and spaceborne solicitations
 - Airborne, instruments for flights of opportunity, airborne, small complete mission, ...
 - Airborne solicitations via ROSES NRA, spaceborne via SALMON AO
- First solicitation (airborne) imminent
 - Multiple complete investigations selected
 - Funding begins early CY10
- Cost/Schedule constraints will be enforced - absolutely
 - **Only** way to ensure availability for funding for **regular** solicitations
 - **Only** way to ensure programmatic flexibility/responsiveness
 - Cancellation for breaking cost/schedule constraints
 - *Venture-class is complementary to identified systematic missions; no single Venture-class mission is **essential** for overall ESD program*
- Single-step selection
- Bi-annual (every other year) solicitations planned owing to budget

Venture Class Solicitation



- Solicitation notice published in FedBizOps, 25 June 09
A--AMENDMENT 8: ESSP VENTURE-CLASS SCIENCE INVESTIGATIONS:
EARTH VENTURE-1
Solicitation Number: NNH09ZDA001N-EV1

6 Nov 2009 response date
- Solicitation in ROSES 2009 (NRA), cross-advertised in SALMON (AO)