Welcome, Status, and Goals

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NASA GEO-CAPE Decadal Survey Mission

Science

This mission provides surface reflectance at high spectral, spatial and temporal resolutions from a geostationary orbit

These data will have the spatial & temporal resolution necessary for studying regional scale air quality issues and their impact on global atmospheric composition processes

The data will also be used to address key water quality, ocean chemistry, ecological science questions in the coastal ocean and its response to climate or environmental variability and change

Finally, there is synergy arising from knowledge of the impact of Aeolian inputs to coastal waters and improved atmospheric corrections for all surface retrievals

Architecture/structure:

Three instruments on one spacecraft in geostationary orbit: (1) UV-Vis-NIR spectrometer, (2) Event-imaging spectrometer, (3) TIR correlation spectrometer

UV-Vis-NIR Science Measurement:
- N & S America from 45°S to 50°N
- 7 km nadir spatial resolution, hourly repeat
- land and shallow water

-**Event-Imaging Science Measurement:**
- Spectral range, near IR to UV
- 250 m spatial resolution, 300 km FOV
- steerable over land and shallow water

Thermal and near IR Correlation Science Measurement:
-CO observations

FY09 Objectives and Deliverables

- GEO-CAPE workshop report with science traceability matrix

- Refine Level 1 requirements (baseline and minimal)

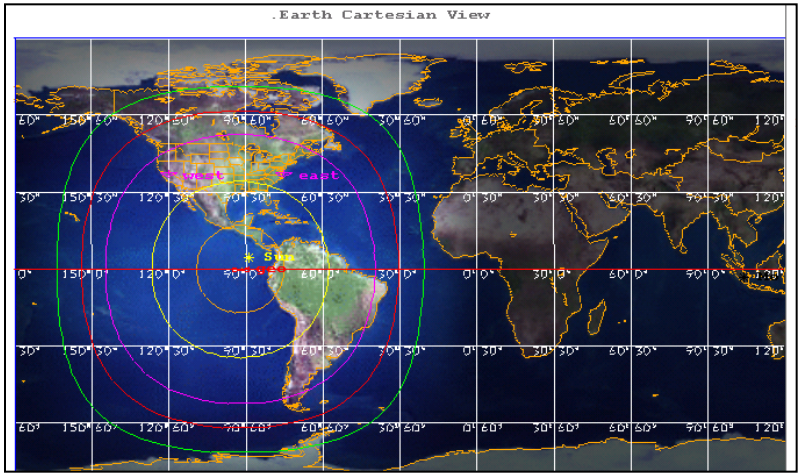
- Mission implementation schedule and other required products for transition to Phase A

- Fall 2009 2nd GEO-CAPE workshop

-Outline steps needed for transition to Phase A, June 2010 time frame.

Mission Implementation Challenges:

- Not yet identified



GEO-CAPE Status

- All Decadal Survey Tier-2 Missions, including GEO-CAPE, are in pre Phase-A and are funded at $2M each for FY2010
- Tier-2 Missions will not be considered for implementation until all Tier-1 Missions are under implementation
- Technical readiness and NASA budget are both constraints
  - *Launch dates recommended by the DS assumed increases to NASA budget, which have not yet happened in a sustained way*
  - *Current expectation for any Tier-2 launch is no earlier than… 2020?*
- Guidance is for all Tier-2 missions to continue pre Phase-A development and determine readiness for potential transition to Phase A
  - *Science requirements and mission concepts*
  - *Advanced technology development and maturation*

Mission Requirements for Pre-Phase A

Scope of Major Pre-Phase A Activities:

Headquarters

- Approve a Formulation Authorization Document
- Develop DRAFT Level 1 Requirements
- Conduct Acquisition Strategy Planning Meeting

Technical Activities:

- Develop and document preliminary mission concepts
- Conduct internal Reviews
- Conduct Mission Concept Review Project Planning, Costing and Scheduling
- Develop and document a DRAFT Integrated Baseline, including:
  - *High level WBS*
  - *Assessment of Technology Readiness Levels*
  - *Assessment of Infrastructure and Workforce needs*
  - *Identification of potential partnerships*
  - *Identification of conceptual acquisition strategies for proposed major procurements*

KDP Readiness

- Obtain KDP A Readiness products
- Approval through the governing PMC

Areas the Science Community must work:

- Development of DRAFT Level 1 Science Requirements
- Support development of preliminary mission concepts
- Support the assessment of Technical Readiness Levels
- Identify potential partnerships

Near-Term Direction: Guidelines

- Evaluate whether draft science requirements will be sufficiently defined to proceed with mission concept studies in FY10
- Strategic considerations for mission concepts
  - *Must address ALL science objectives given to the mission by the Decadal Survey; minimum success criterion*
  - *Cost and maturity will always be important constraints*
  - *Identifying relevance to, and synergy with, other missions including international is a key part of pre-Phase A*
  - *Programmatically, it would be wise for mission definition and development to be:*
    - Adaptable to a range of possible funding scenarios (up or down)
    - Part of a unified program/project implementation approach that meets Agency requirements while being flexible, repeatable, and expeditious

Near-Term Direction: Implications

- NASA "Integrated Design Study #5", the closest study to the notional baseline mission described in Decadal Survey, is considered expensive/complex enough that implementation will likely begin late in the 2nd Tier
- NASA HQ would welcome strong, quantifiable options for systematically implementing missions at lower cost and reduced risk
- Must be mindful that:
  - ***Fully accomplishing*** *the recommended DS mission* ***science and applications*** *is the overarching consideration*
  - *Perceived scope creep (with inevitable increase in mission cost/risk) is being viewed harshly*

=> Decadal Survey mission study teams have flexibility to develop viable implementation alternatives to the notional baseline missions, within clear ground rules

Consider A Phased Implementation? (1)

- Phased implementation, featuring separable payloads with a clear overall strategy for accomplishing all GEOCAPE objectives, may offer a timely, systematic, cost/risk effective approach
- Compelling science: harmonization with US and international geostationary missions to provide global observing capabilities at feasible timelines (i.e., soon enough to harmonize, yet within acceptable NASA budget profiles)
  - *ESA Sentinel 4, 2017 (AQ)*
  - *MEST/ME MP-GeoSat, 2017 (OC, AQ)*
  - *JAXA geostationary mission (AQ, OC?)*
  - *CNES OCAPI proposal (OC)*
- *Potential cost savings of shared instrument/algorithm development for common instruments on multiple contemporaneous international platforms*
- *Smaller and less complex payloads have more options for launch through shared or hosted opportunities (lower launch costs)*

Consider A Phased Implementation? (2)

- Future GOES platforms are particularly compelling shared platform options (synergistic observing capabilities, shared costs)
  - *European and Korean future mission studies have both concluded that AQ and OC sensors should be added to operational meteorological satellites*
- Early successes of simpler geostationary payloads can serve as risk reduction for later launches of more complex payloads
  - *Reduction of total cost is highly desirable, but risk reduction of later complex instruments/platforms also has real value*
  - *Provides a clear pathway for continued maturation of advanced instrumentation concepts*
- Presents a solution to conflicting observing requirements/strategies
  - *Combined atmosphere and ocean requirements for "fine" spatial / "frequent" temporal / "appropriate" spectral resolution with large area coverage present major technological challenges*
  - *Could separate the systematic vs episodic platform constraints*

Recommendation for FY 2010 Direction

- As soon as possible, provide NASA HQ "uniform" guidance on the range of GEO-CAPE implementation options
  - *Are draft science requirements firm enough to proceed to mission concept studies, or is significant science definition effort still required?*
    - Use GOCI data as soon as available to refine risk/capability assessment of geostationary and coastal waters remote sensing
  - *Determine whether additional investment is needed to refine cost/risk/ TRL estimates for the Integrated Design Study #5 (IDS#5) concept*
  - *Evaluate to what extent other mission concept study results may be consistently intercompared with IDS#5 and adjust for different ground rules as necessary*
    - PanFTS concept for full Geo-CAPE mission
    - GeoTrace, CWI, GOCI-2 (and other?) concepts relevant to partial Geo-CAPE mission
  - *Given SWG consensus on such a direction, develop complete concepts for both single-platform and phased implementation using common ground rules*

Goals for this Workshop

- Assessment of the scientific direction and progress of the Science Working Group
  - *Report on progress from FY09 activities (Today)*
  - *Present status of science requirements definition (Today)*
  - *Review status/requirements for KDP-A and establish pathway to developing preliminary mission concepts (Wednesday)*
  - *Recommend and prioritize activities for FY10 (Thursday)*

- A Perspective and Semantics for GEO-CAPE
  - *GEO-CAPE ≠ Program*
  - *GEO-CAPE = Mission*
  - *A Satellite Mission Highly Coordinated and Integrated with Research & Analysis Programs*

Goals for this Workshop

- Speak openly
- Ask questions
- Remain focused and constructive
- Recommendations for improvement are always welcome!

Backup slides

Key Pre-Phase A Questions

- What science MUST this mission achieve?
  - *What specific measurements?*
  - *To what accuracy?*
  - *What are the required data products?*

Should be resolved ~ 12 months prior to Phase A review

- What mission parameters can achieve the science?
  - *What orbit (inclination/altitude)?*
  - *Which instruments?*
  - *What is the baseline mission duration?*
- How can NASA achieve these measurements?
  - *Are there other missions required/desired to achieve the science?*
  - *Who can NASA partner with to achieve this mission?*

Should be resolved ~ 6 months prior to Phase A review

DS Mission Concept Development

- All named Decadal Survey missions are Strategic, directed missions
  - *Mission management will be assigned to a Facility (almost always a NASA Center)*
  - *Venture Class missions and ESTO technology initiatives are competed and will be addressed later in this presentation*

- Elements of the missions will be competed, some hardware built in house and other procured or developed in partnership with industry. Possible competed elements should include but are not limited to:
  - *Science Definition Teams*
  - *Instruments*
  - *Spacecraft (through RFP or RSDO approach)*

- We wish to develop the DS missions as part of an integrated overall Earth Science Program
  - *The ESM Program Office will lead and coordinate appropriate inter-mission analyses and trade studies (subject of Day 2 of Symposium)*

Where do we want to be by October 1, 2009?

- Evaluation of formulation readiness for all missions under study
- Quantitative assessment of each mission's readiness to proceed to Phase A
  - *Technology readiness*
  - *Revised cost and schedule, possibly including independent cot and schedule assessment (depending on overall maturity and readiness)*
  - *KDP-A documentation completeness*
  - *Draft level 1 requirements status*
  - *Mission concept of operations*
- Mission maturation plan for FY10 and beyond
  - *Identification of highest priority activities*
- Decadal Survey *Program* assessment
  - *Cross cutting mission analyses*
  - *Coordinated activities: Launch vehicles*
  - *Constellation measurement requirements*
  - *Other Decadal Survey program needs: Venture class, ground systems, ground networks*

Presented May 22, 2008

GEO-CAPE Mission Study Issues

- Science Requirements
  - *Vertical resolution within the troposphere: Is BL sensitivity a satellite measurement science requirement (e.g., through multi-wavelength retrievals) or part of a broader integrated observing system?*
  - *Joint atmosphere/ocean retrievals in coastal zones*
- Observing strategy
  - *Combined atmosphere and ocean requirements for "fine" spatial / "frequent" temporal / "appropriate" spectral resolution with large area coverage present major technological challenges*
  - *Systematic vs episodic*
- Mission cost
  - *Advanced instrumentation concepts may offer reduced mass and improved capability, but at higher mission risk or later launch date*
  - *Potential for "hosted payloads" on other geostationary platforms may offer reduced cost*
  - *Common instrument development for contemporaneous international geostationary missions can reduce cost and improve science*

Instrument Incubator Program 2007 Awards vs. Decadal Survey Missions

2007 Instrument Incubator Awards versus Decadal Survey Missions	CLARREO	SMAP	ICESat-II	DESDynI	HyspIRI	ASCENDS	SWOT	GEO-CAPE	ACE	LIST	PATH	GRACE-II	SCLP	GACM	3D-Winds	CLARREO-NOAA	GPSRO	XOVWM
Abshire/GSFC - column CO2, lidar						■												
Diner/JPL - aerosols and clouds, polarimetric imager									■									
Durden/JPL - clouds and precipitation, profiling radar									■									
Folkner/JPL - time-varying gravity, laser frequency stabilization												■						
Fu/JPL - surface water and ocean topography, interferometric SAR							■											
Grund/Ball - tropospheric winds, Doppler lidar															■			
Hackwell/Aerospace - mineral and gas, TIR spectrometer					■													
Heaps/GSFC - column CO2, lidar						■												
Hook/JPL - mineral/water resources, hyperspectral TIR spectrometer					■													
Kavaya/LaRC - tropospheric winds, Doppler lidar															■			
Kopp/CU - radiation balance, UV-SWIR hyperspectral imager	■																	
Lambrigtsen/JPL - T, water vapor, precipitation; microwave sounder											■							
McClain/GSFC - ocean color, UV-SWIR radiometer									■									
Mlynczak/LaRC - radiation balance far-IR spectrometer	■																	
Neil/LaRC – CO from geostationary orbit, infrared correlation radiometer								■										
Papapolymerou/GT - snow-water equivalent, X-band phased array													■					
Revercomb/UWM - radiation balance, SI-traceable IR calibration	■																	
Sander/JPL - air pollution and coastal imaging, panchromatic FTS								■										
Stek/JPL - atmospheric composition, microwave limb sounder														■				
Weimer/Ball - vegetation canopy, steerable lidar				■														
Yu/GSFC - topography and vegetation structure, swath-mapping lidar										■								

■ IIP07 Awards

Earth Science Technology Office

Advanced Component Technology Program
2008 Awards vs. Decadal Survey Missions

2008 Advanced Component Technology Awards versus Decadal Survey Mission	CLARREO	SMAP	ICESat-II	DESDynI	HyspIRI	ASCENDS	SWOT	GEO-CAPE	ACE	LIST	PATH	GRACE-II	SCLP	GACM	3D-WINDS	CLARREO-NOAA	GPSRO	XOVWM
Dobbs/ITT - corrugated mirror telescope array for lidar			■	■		■			■	■				■	■			
Fang/JPL - large deployable reflector for Ka- and W-band									■									
Hoffman/JPL - thermal packaging for RF hybrids, radar				■			■											
Illing/Ball - polarization scrambler, spectroscopy					■			■	■					■				
Janz/GSFC - visible NIR blind GaN focal plane array, hyperspectral								■										
Krainak/GSFC - NIR optical receiver, lidar			■	■		■			■	■					■			
Marx/GSFC - hybrid doppler wind lidar transceiver															■			
McGill/GSFC - detector technology for cloud aerosol lidar									■						■			
Meehan/JPL - RF ASIC for digital beamforming, GNSS															■		■	
Mlynczak/LaRC - FIR detectors for Earth radiation	■																	
Phillips/LockMart - CO2 laser absorption spectroscopy						■												
Reising/Colo. St. Univ.- radiometer for wet-tropospheric correction							■											
Rider/JPL - analog to digital converter from UV to mid-IR					■			■	■					■				
Siqueira/Univ. Mass. - low power, high BW receiver, Ka-band							■											
Taylor/Composite Tech. Dev. - large aperture, deployable reflector		■					■				■		■					■
Thomson/JPL - deployable Ka-band reflect array							■											

Earth Science Technology Office