NASA Earth Science Division

Senior Review
Mission Extension Process

Stephen Volz

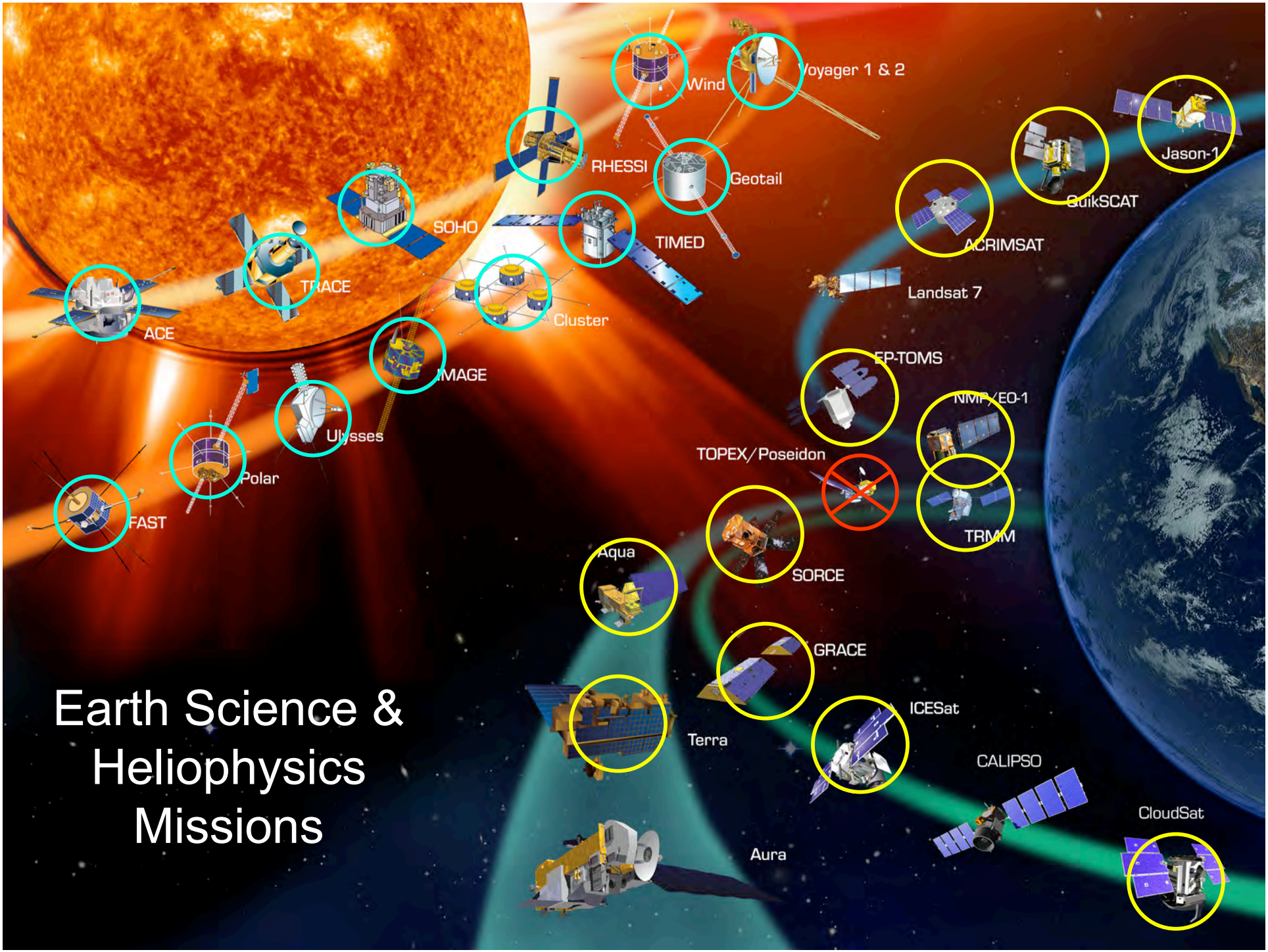
October 31, 2006

Outline

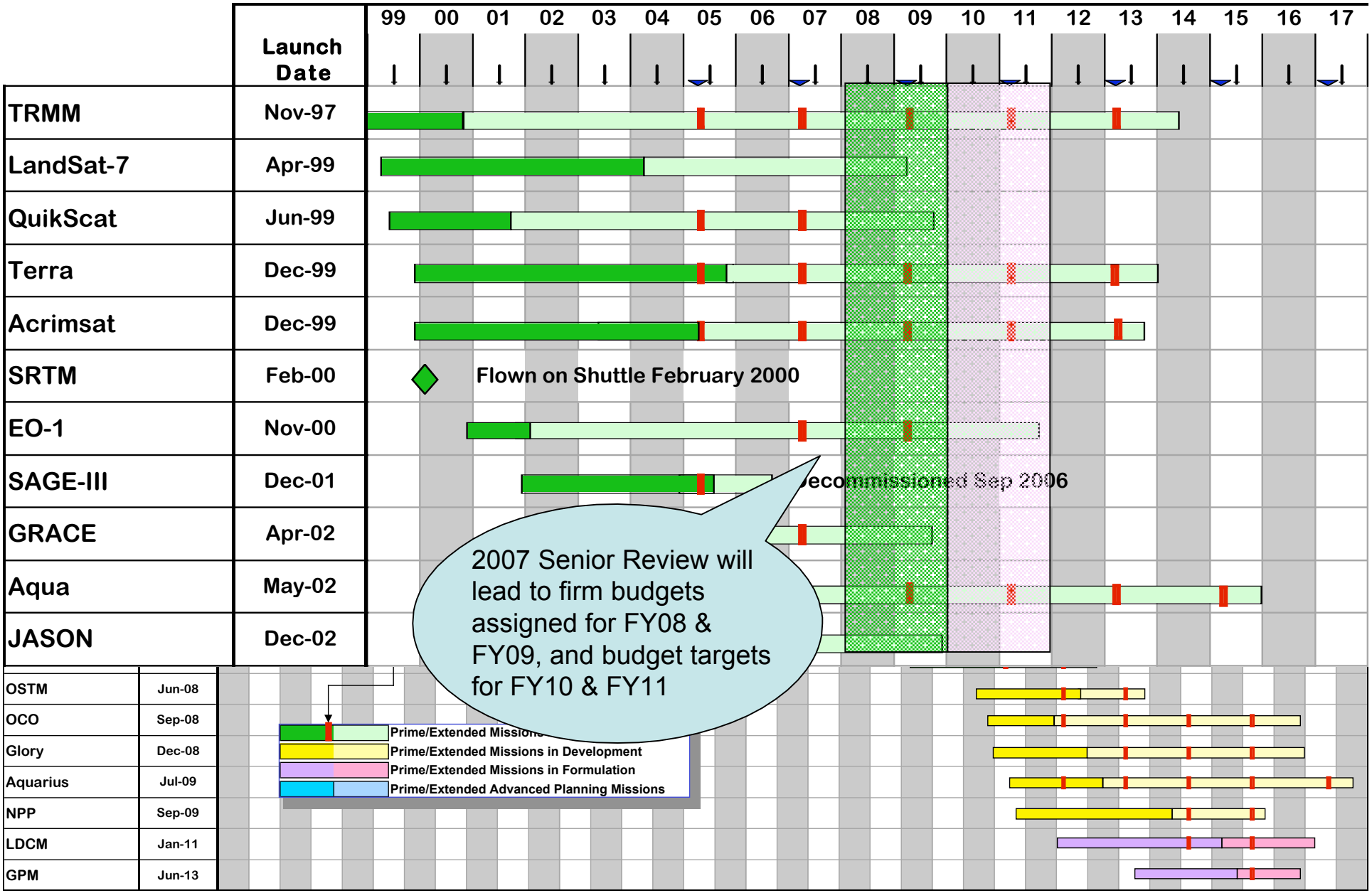
- NASA Earth Science Division Mission Overview
- 2005 Senior Review Results
- Plans for the 2007 Senior Review

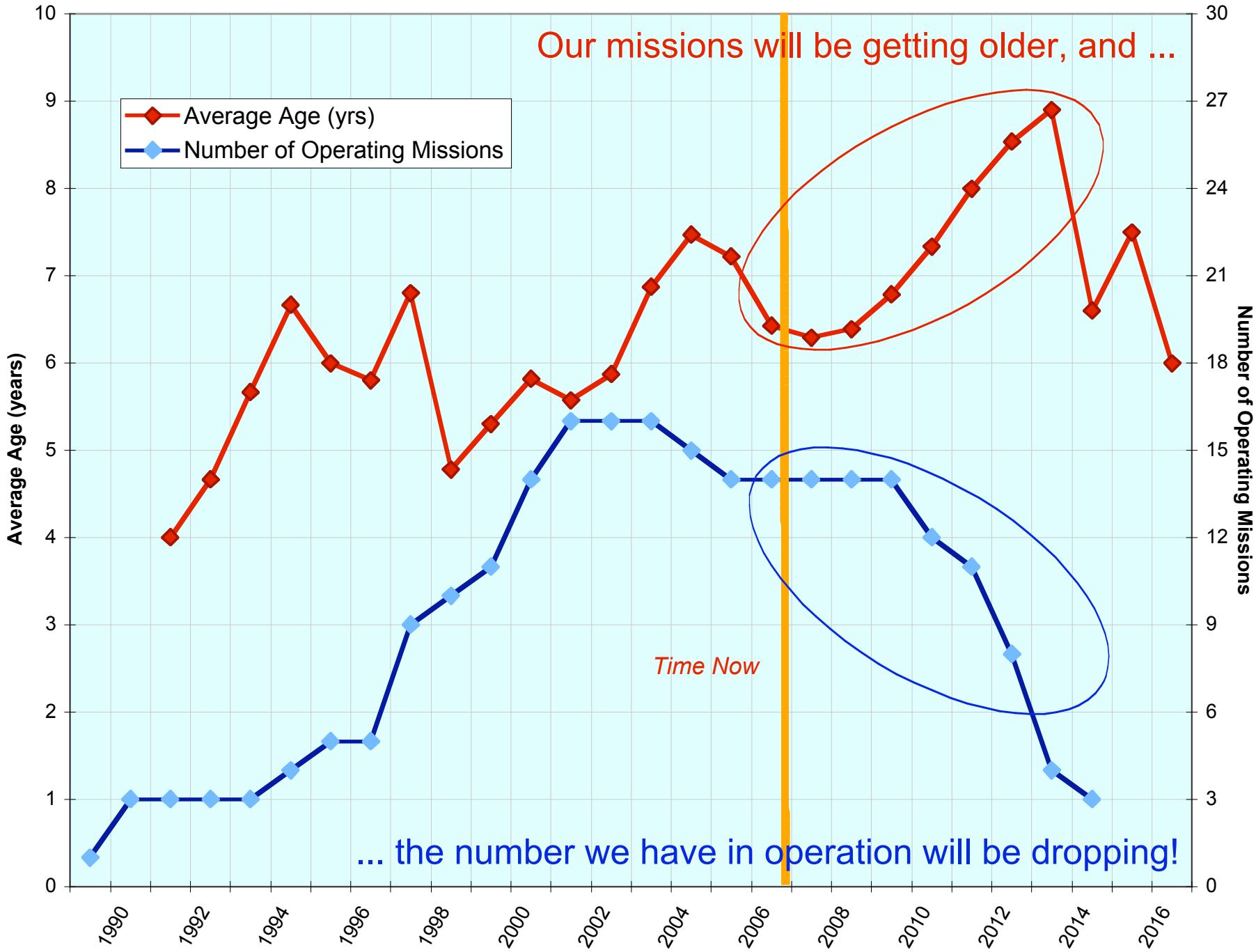
History and Context of Senior Review

- Senior Review for Earth Science initiated in 2004
  - Replace an ad hoc process for termination decisions with an open process
  - Used approach employed by Space Science with minor changes
  - Led by Chuck Holmes, who had led previous SR's for heliophysics
  - Intended to rank the science quality of all Earth Science satellites in extended mission phase (operation past the defined prime mission lifetime)
- 1st SR convened April 2005
  - Included: TRMM, Terra, ICESat, TOMS, Jason-1, ERBE, GPS, UARS, SAGE III, QuikSCAT, GRACE, Acrimsat
  - Resulted in termination recommendation for UARS and ERBS
  - Since then SAGE III, ERBS and UARS have failed or been terminated


Earth Science &
Heliophysics
Missions
Wind
Voyager 1 & 2
RHESSI
Geotail
SOHO
TIMED
TRACE
ACE
Cluster
IMAGE
Ulysses
Polar
FAST
Jason-1
QuikSCAT
ACRIMSAT
Landsat 7
EP-TOMS
NMP/EO-1
TOPEX/Poseidon
TRMM
Aqua
SORCE
GRACE
Terra
ICESat
CALIPSO
CloudSat
Aura

Earth Science Missions




Our missions will be getting older, and ...
Average Age (yrs)
Number of Operating Missions
Time Now
... the number we have in operation will be dropping!
Average Age (years)
Number of Operating Missions
0
1
2
3
4
5
6
7
8
9
10
0
3
6
9
12
15
18
21
24
27
30
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016

Senior Review Process

- Every two years the missions present proposals for continued operation for a four year period
- Senior Review panel rates the proposals and the missions against each other, looking for science value per $ requested
- SMD reviews SR Panel recommendations and establishes budget for missions over the four year period
  - Letter from SMD AA to the missions documenting decision by SMD
  - First two years (FY1 and FY2) are a “commitment” for funding by NASA SMD to the mission
  - Second two years (FY3 and FY4) are placeholder allocations, and an indication of the likely funding, but do not constitute a commitment by SMD. FY3 and FY4 are to be revisited at the next SR

Figure 1. Relative rank of each mission with 1 being the highest rank and 12 the lowest.

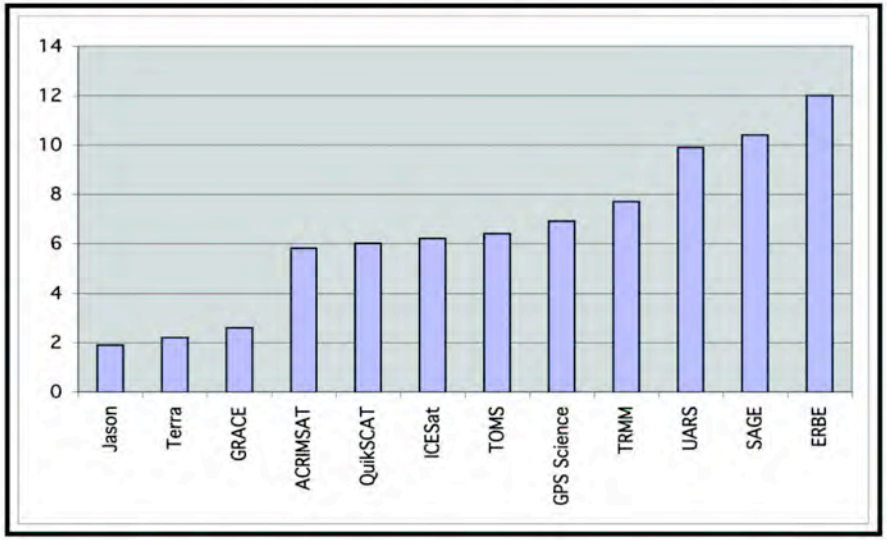
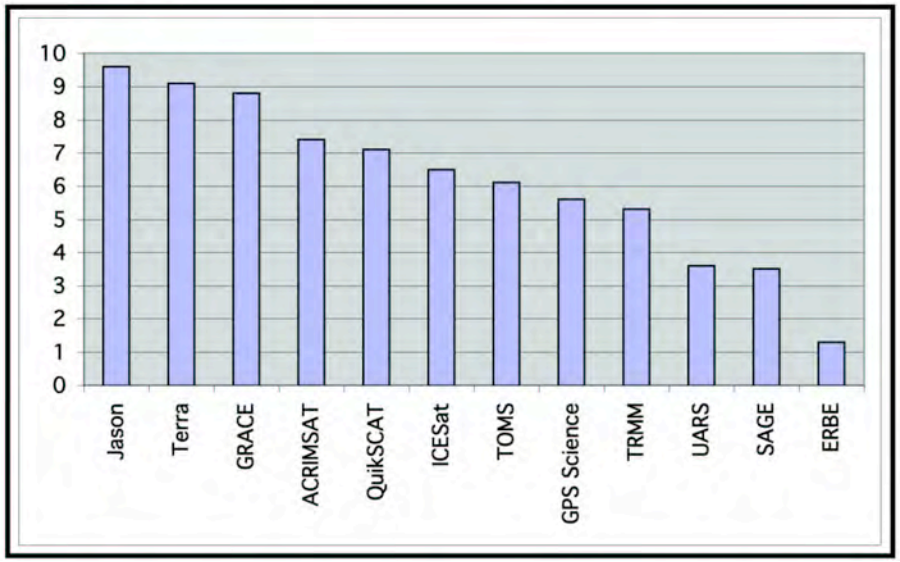


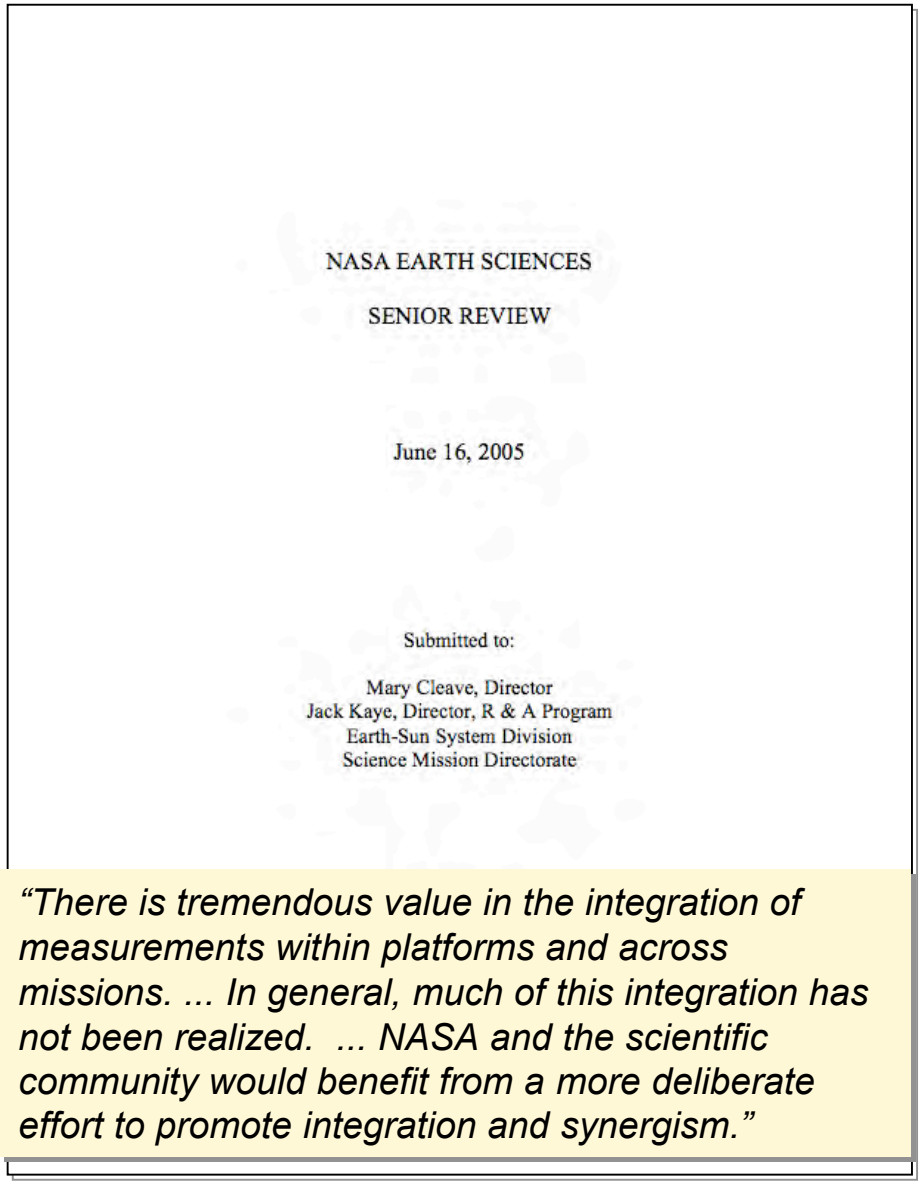
Figure 2. Rank based on absolute scientific value (10-8 compelling; 7-4 excellent, but less compelling, and 3-0 modest).



Assessment of 2005 Senior review

- Assessment of 2005 Senior Review was mixed
  - It provided a reasonable first shot at science quality ranking of all of our operating missions
  - The missions responded well but being new to the process their proposals were not always clear or fully responsive to the call
- We are considering Lessons Learned from the inaugural review as we prepare for the next Senior Review, including
  - How do we deal with the operational utility of the missions?
  - Is a review every two years reasonable, considering the amount of required on the mission teams?
  - What model do we use for directing/anticipating improvements in the mission operations for the missions (Reduce cost? Allow for increased risk?)
  - What should be the scientific criteria for a successful proposal? New Science? Improved production of existing science data records? Increased collaboration?

No Shortage of Advice



NASA EARTH SCIENCES

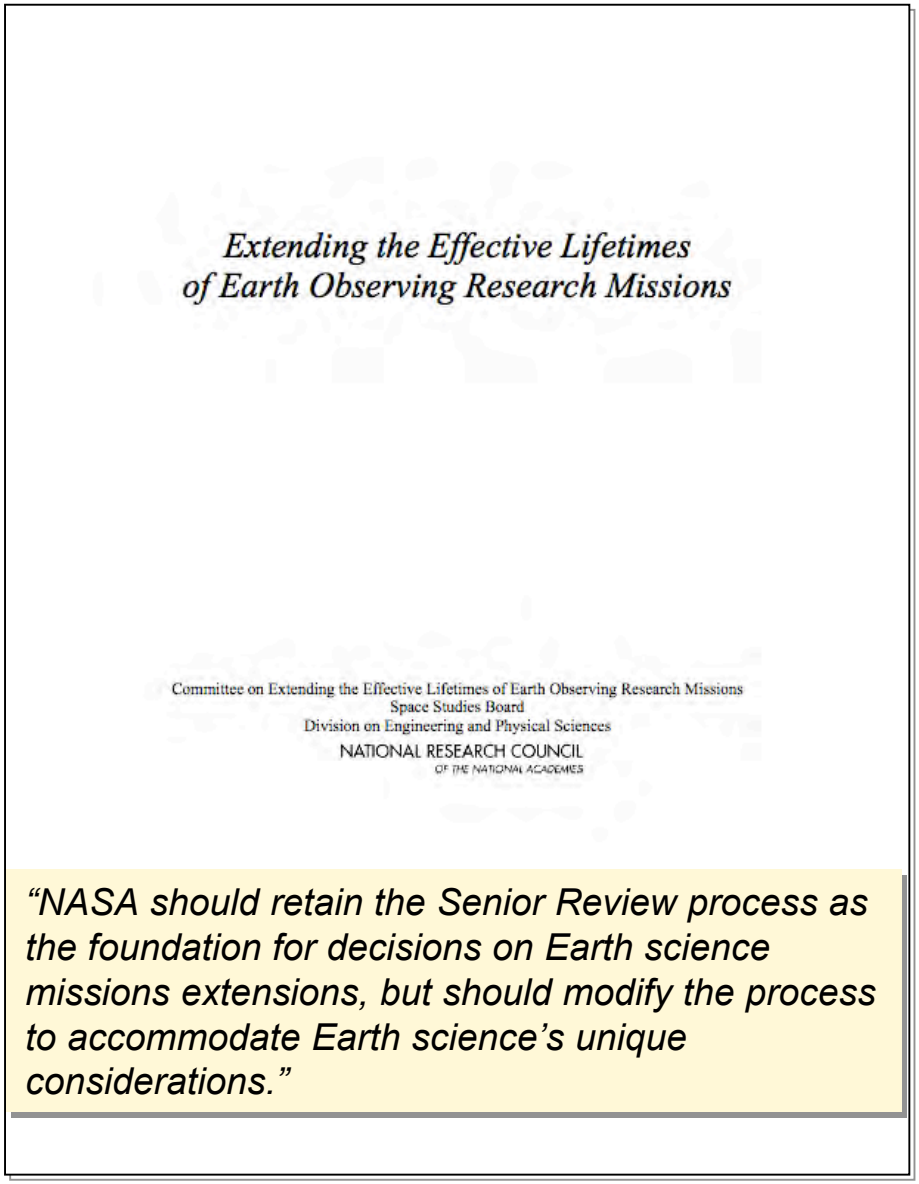
SENIOR REVIEW

June 16, 2005

Submitted to:

Mary Cleave, Director
Jack Kaye, Director, R & A Program
Earth-Sun System Division
Science Mission Directorate

"There is tremendous value in the integration of measurements within platforms and across missions. ... In general, much of this integration has not been realized. ... NASA and the scientific community would benefit from a more deliberate effort to promote integration and synergism."



Extending the Effective Lifetimes of Earth Observing Research Missions

Committee on Extending the Effective Lifetimes of Earth Observing Research Missions
Space Studies Board
Division on Engineering and Physical Sciences
NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

"NASA should retain the Senior Review process as the foundation for decisions on Earth science missions extensions, but should modify the process to accommodate Earth science's unique considerations."

Preparations for 2007 Senior Review

- Next Senior Review is scheduled for Spring 2007
- Preparation for the scope and execution has been following three parallel paths
  - Define scope of Senior Review, including available budget, missions included and schedule
  - Collect Science Review Panel
  - Conduct Community outreach through talks with mission teams and partner agencies
- And is then followed by one primary path
  - Finalize Senior Review process (includes formal announcement letter)
  - Issue Request for Proposals to missions
  - Missions generate proposals
  - Collect and review proposals
  - Formal presentation to the SR panel and obtain panel report
  - Complete ES internal review and decision process

Instructions to the 2005 Senior Review Panel

NASA HQ will instruct the Senior Review Panel to:

1) In the context of the science goals, objectives and research focus areas described in the NASA Science Strategic Plan, rank the scientific merits - on a "science per dollar" basis - of the expected returns from the projects reviewed during FY-06 and FY-07.

2) Assess the cost efficiency, technology development and dissemination, data collection, archiving and distribution, and education/outreach as secondary evaluation criteria, after science merit.

3) Drawing on (1) and (2), provide comments on an implementation strategy for the ES MO&DA program for 2006 and 2007 which could include a mix of
   - continuation of projects "as currently baselined";
   - continuation of projects with either enhancements or reductions to the current baseline;
   - mission extensions beyond the prime mission phase, subject to the "Mission Extension Paradigm" described below; or
   - project terminations.

4) Make preliminary assessments equivalent to (1), (2), and (3) for the period 2008 and 2009.

Taken directly from the call for proposals letter of January 13, 2005

Senior Review Evaluation Panel

- Drawn from outside of NASA entirely (preferable), from outside of the immediate NASA Earth Science organizations (definitely)
- 2007 Chair to be chosen from previous Senior Review panel

> Gregory P. Asner, Eric J. Barron (chair), Carol Anne Clayson, Marvin A. Geller, Chester J. Koblinsky, Michael J. Prather, Philip R. Schwartz, Laurence C. Smith, Charles C. Trees, and Curtis E. Woodcock

  - In general, the other panel members will be new to the process
- The goal for the panel is balance across earth science disciplines (oceans, atmospheric chemistry, weather, climate)
- The Panel is providing “findings” only to the Science Directorate, not formal recommendations

What will be the 2007 Senior Review Evaluation Criteria?

- The 2005 Senior Review is the baseline, but we will be deviating from that baseline to incorporate lessons learned
- The primary criteria will not be substantially different
  - Scientific relevance of the mission/measurement to NASA Science Strategic Plan, revised edition out in early December 2006
  - Refer to http://science.hq.nasa.gov/strategy/past.html
- Secondary but still important criteria include:
  - Efficiency and cost effectivity of the mission operations
    - Could be cost reductions with extended missions, but not necessarily so. Older missions may need more “care and feeding” than younger.
  - Multiple instrument and satellite utility of the data products
    - Looking for multiple satellite data fusion
  - Quality and timeliness of the baseline data products
    - Including processing, archiving, and dissemination of the data products to the broader scientific and general community (operational users)
  - TBD - Inclusion of Operational users’ considerations
  - Education & Public Outreach section will also be included

What about Operational Users?

- The Senior Review approach was borrowed from astrophysics and space science did not include input from operational users
  - With the possible exception of space weather data
- Earth Science satellites have multiple operational users
  - NOAA, DoD, EPA, Agriculture, DOE, FAA, USGS, as well as the general public
- Satellites with possibly less compelling science return may have more compelling operational utility
  - TRMM and QuikSCAT are two examples

How do we prioritize missions with these contributions?

- We may ask the missions to identify operational connections (users, shared research, field campaigns) in their proposals
- We are working with the Applications Division to collect operational users' inputs as well
- Following the Senior Review report we will coordinate with significant partner Agencies on the rankings and plans for mission extension

2005 Senior Review Schedule

Activity	2005 Review	2007 Review
Draft call for proposals issued:	November 19, 2004	mid November 2006
Call for Proposals issued:	January 13, 2005	mid December 2006
Proposals due:	March 16, 2005	mid February 2007
E/PO panel meets:	mid-April, 2005	mid March 2007
Senior Review panel meets:	April 26-29, 2005	late March 2007
Publication of the panel's report:	June 16, 2005	early May 2007
Discussions with Operational Agency "Partners":	N/A	April - June 2007
New budget guidelines with instructions to the projects:	July 7, 2005	late May 2007
Projects' responses with new implementation plans:	July 29, 2005	late June 2007

- This schedule made budget planning for FY06 (October 2005) too tight, so we plan to move up the timetable so we have the final Projects' implementation plans in hand by the end of June 2007.

Mission Split under Consideration

- There are many ways to evaluate the mission performance and to authorize the extended mission operations.
  - 2005 Senior Review allocated all funds to PI with some direction on competed science, but little or none regarding mission operations planning
- Current thinking is to review more carefully the mission ops execution and the competed mission science, looking for a budget split of the sort:
  - ☆ **Mission operations**
  - ☆ **Core Mission Science**
  - ☆ **Competed/Extended science**
  - **Missions ops**: satellite operations, Level 0 data reception and storage
  - **Core mission science**: production of baseline series of data products (Level 1 and 2), algorithm maintenance and minimal necessary refinements
  - **Competed/Extended Science**: direct use of mission data products, but in an experimental sense. Examples could be precipitation products for CloudSat, vegetation algorithms for ICESat, data fusion for elements in the A-Train

What are we looking for in the proposals?

- Mission Operations
  - Is the implementation efficient and cost effective?
  - Is the risk management approach appropriate?
- Core Science
  - Are the data products critical to addressing the SMD strategic science objectives (tied to the strategic plan)?
  - Are the mission specific data products produced efficiently and effectively?
  - Are the data products of use and being used by the science community?
- Competed/Extended Science
  - Do the proposals match the SMD strategic science objectives (tied to the strategic plan)?
  - Are the proposed investigations supported by the measurement capabilities, and are they inextricably linked to the core science?
    - I.e. why can't we fund these through some established ROSES announcement?
  - Is the data fusion from multiple instruments/satellites well conceived?

Some Possible Proposal Outcomes

Compelling / Excellent, not Compelling / Modest

- Compelling science, great proposal: $$
  - Core and Competed/Extended Science fully funded
- Compelling science, average proposal $$
  - Core Science funded (possibly with modifications), Competed/Extended Science not funded
- Excellent science, modest proposal $
  - Core science funded at reduced level with management direction, Competed/Extended not funded
- Modest science, not unique, not well presented ¢
  - Termination proposed