



NASA-DOE Joint Dark Energy Mission

Paul Hertz / NASA
Robin Staffin / DOE

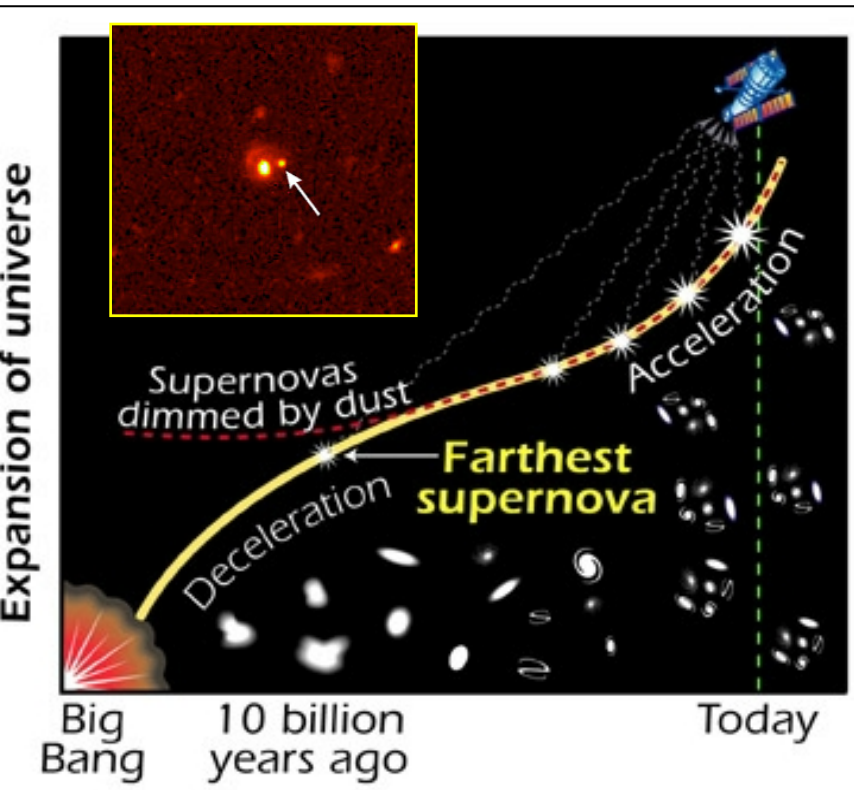
Endorsed by

Raymond L. Orbach
Director of the Office of Science
Department of Energy
September 24, 2003

Edward J. Weiler
Associate Administrator for Space Science
NASA
September 25, 2003

What is the Dark Energy?

Einstein introduced the Cosmological Constant to explain what was then thought to be a static Universe, “*my biggest blunder . . .*”

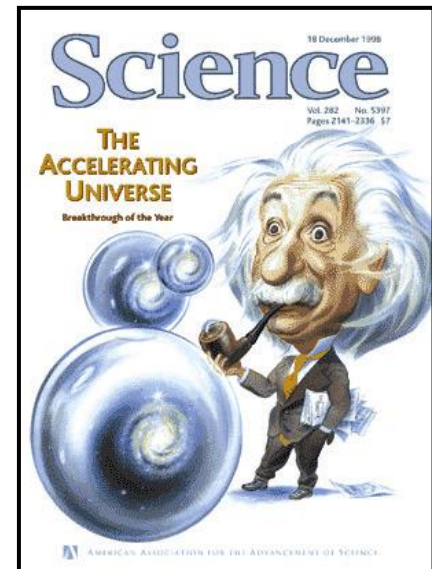


A surprising recent discovery has been the discovery that the expansion of the Universe is accelerating.

Implies the existence of *dark energy* that makes up 70% of the Universe

Dark Energy maybe related to Einstein’s Cosmological Constant; its nature is a mystery.

Solving this mystery may revolutionize physics . . .



Recommendations from the NAS

Of the 11 questions that the committee has posed, the nature of dark energy is probably the most vexing. It has been called the deepest mystery in physics, and its resolution is likely to greatly advance our understanding of matter, space, and time.

The committee recommends that NASA and DOE work together to construct a wide-field telescope in space to determine the expansion history of the universe and fully probe the nature of dark energy.

Connecting Quarks with the Cosmos
Report of the Committee on the Physics of the Universe
Michael Turner, Chair

Recommendations from the NSTC

Multiple, complementary, and independent approaches are necessary for a complete understanding of the Dark Energy. A dedicated space-based experiment to precisely measure the nature of the Dark Energy and its evolution over the history of the Universe is a critical centerpiece to this program.

Mission concept design studies for a space based Dark Energy Mission will be undertaken in 2004 to identify the best space-based methodology. NASA and DOE will then jointly develop a mission, with a target launch date of 2011.

A Coordinated DOE-NASA-NSF Plan

Report of the NSTC Interagency Working Group on the Physics of the Universe

Joseph Dehmer, Anne Kinney, Peter Rosen, Co-Chairs

Process for Cooperation

- Discussions between DOE and NASA have been ongoing for more than a year.
 - The science of dark energy is featured in both agencies' roadmaps.
 - Both agencies' roadmaps suggest that a space-based dark energy mission will be required.
 - It is natural that DOE and NASA work together to realize shared science objectives.
- OSTP has requested a plan for NASA and DOE working together to jointly realize a space based dark energy mission.
 - With the help of OSTP, the agencies have arrived at a Roadmap to a strawman Joint Dark Energy Mission (JDEM).
- The plan is endorsed by the NASA Office of Space Science and the DOE Office of Science.
- The plan has been presented to OSTP as an indication of how DOE and NASA can jointly realize a dark energy mission.
- The plan is now presented to the community for discussion.

Principals of Cooperation

- Both NASA and DOE have made the nature of dark energy a high priority science objective. Precision measurements require a dedicated mission. A space based dark energy investigation requires a space observatory with a telescope and appropriate focal plane instruments.
- NASA brings to the NASA/DOE partnership its successful experience in developing space observatories and space based science investigations. Proven processes for developing space observatories will be used to ensure the success of the joint mission.
- DOE brings to the NASA/DOE partnership its successful experience in science investigations of fundamental physics conducted by PI-led collaborations. DOE has invested in the development of technology that could be used in a space based dark energy investigation.
- The dark energy science investigation will be a PI-led effort.
- Competitive selection will be used to the maximum extent practical, in full support of the President's Management Agenda. All competitions will be open.
- NASA is responsible for the overall success of the space mission.
- The dark energy science investigation is the joint responsibility of DOE and NASA.

JDEM Management Components

- The Joint Dark Energy Mission will be a joint mission between NASA and DOE.
- The Joint Dark Energy Mission will be an observatory containing a telescope and appropriate focal plane instruments.
- A joint oversight group (JOG) between NASA Headquarters and DOE Headquarters will provide mission oversight. NASA will retain responsibility and authority for ensuring the successful development of the mission within the guidelines set by the JOG.
- Project management will be at GSFC. GSFC is NASA's managing center for the development of space observatories.
- Science oversight of the Joint Dark Energy Mission will be by a science oversight group (SOG). The SOG is responsible to the agencies and to the community for ensuring the scientific success of the mission; this includes both the dark energy investigation and the general astronomical observatory.

JDEM Science Components

- The first ~3 years of the mission will be dedicated to a dark energy science investigation. The remainder of the mission will be used for general astronomical observations selected through an open, peer-reviewed competition.
- The dark energy science investigation is the centerpiece of the Joint Dark Energy Mission. The joint NASA/DOE AO will solicit a dark energy science investigation requiring a space-based observatory.
- A science support and mission operations center will be established to operate the Joint Dark Energy Mission through all phases of the mission.
- All data will be archived in an established astrophysics data archive. All data will be made public after an appropriate proprietary data period.

JDEM Competitions

- The joint NASA/DOE AO will solicit the dark energy science investigation which includes provision of the required science payload; the AO will also solicit science investigations by members of the SOG.
- The GSFC issued RFP will solicit a prime contractor to perform the usual prime contractor functions for a space observatory.
- Calls will be issued during the general astronomical observing phase of the mission for general observing and archival analysis proposals.
- Assignment of the science support and mission operations center is TBD.

Strawman Assignment of Funding Responsibilities

- All JDEM budget requirements will be discussed assuming full cost budgeting, accounting, and reporting.
- NASA will fund GSFC managed activities (project management, prime contractor, launch services).
- NASA and DOE will fund the dark energy science investigation including development of the science payload, obtaining and analyzing the required science data, and communicating the results to the science community through publication in the peer reviewed science literature.
- NASA and DOE will fund the science support and operations center.
- NASA will fund GO programs.
- NASA will continue to fund an (existing) data archive to include JDEM data.

Next Steps

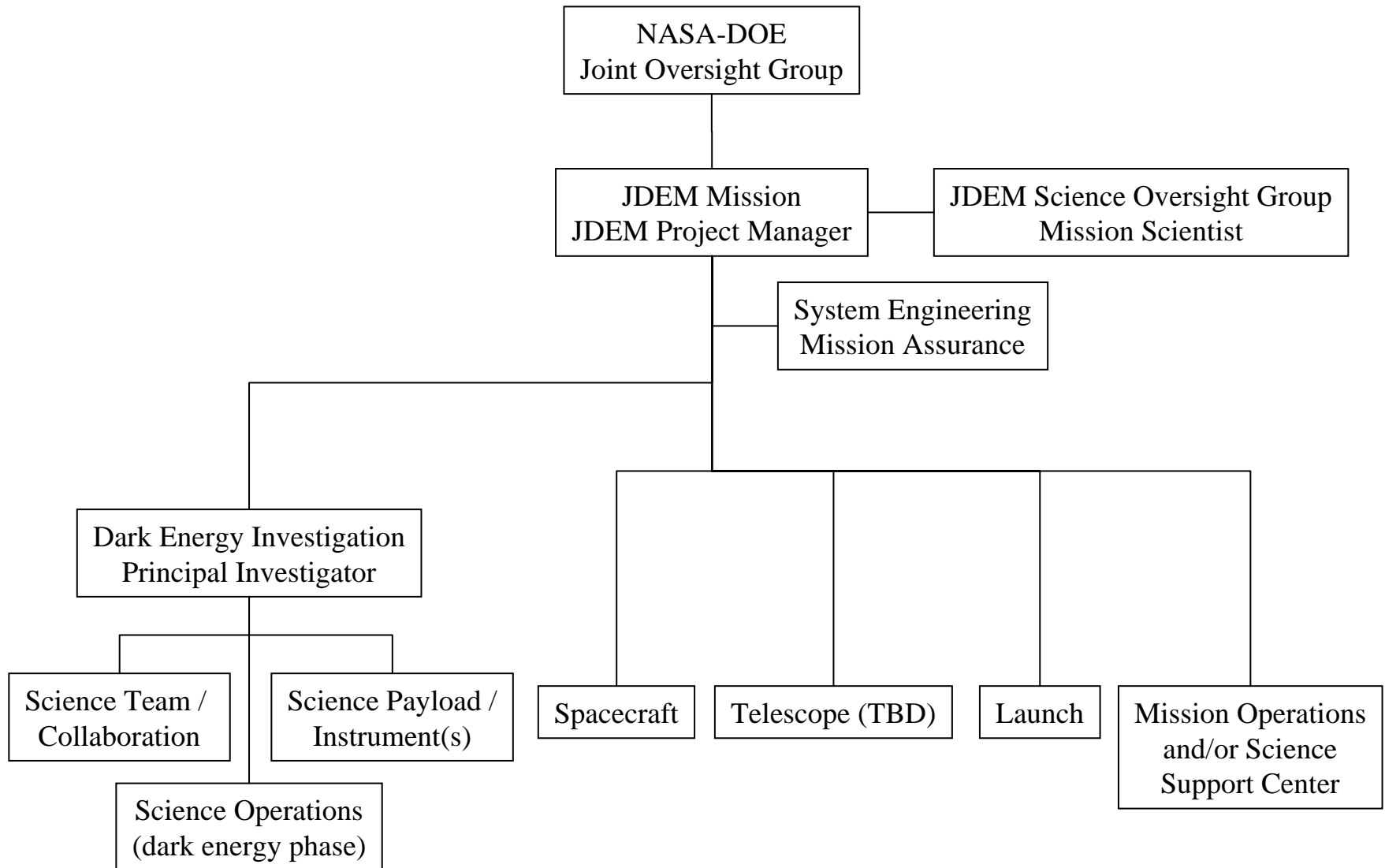
Near Term

- NASA will select “Dark Energy Probe” mission concept studies after consultation with DOE.
- NASA and DOE will brief communities on current state-of-affairs.
- Beyond Einstein Program Office at GSFC will begin planning.

Mid Term

- NASA and DOE will form a science definition team to establish science requirements for the JDEM joint solicitation.
- When funding is approved, NASA will form a pre-project office at GSFC to begin engineering and planning.
- When funding is approved, NASA and DOE will form a pre-JOG to begin negotiating management processes and other subjects for the MOU.

Notional Organization Chart



Strawman Schedule

(assumes new funding in Year 0)

- Year -1 Pre-phase A / Pre-conceptual planning (CD0)
 Conduct mission concept studies in anticipation of an AO
 Establish study office at GSFC
- Year 0 Phase A / Conceptual design
 GSFC in-house mission concept definition study
 Write AO
- Year 1 Issue AO; select investigations (CD1)
 Industry participation in spacecraft Phase A studies
- Yr 2-3 Phase B / Preliminary design (CD2)
 Issue RFP or use RSDO; select prime contractor
- Yr 4-8 Confirmation; Phase C/D / Final design (CD3) /
 Construction (CD4)
 Develop the mission, on time and on budget
- Yr 9-11 Launch; Phase E / Operations
 Dark energy phase
- Yr 12-14 General astronomical observing phase
- Year 15 End of 6 year prime mission

Challenges of the Plan

- Coordinating the required resources.
- Jointly solving problems (especially budget, but also schedule and technical)
- Aligning different management styles and requirements to include the best of both agencies rather than twice the management burden.
- Working with two different science communities that have different cultures, different expectations, different priorities, different vocabularies.

But ...

- Lessons learned from GLAST/LAT will be applied.
- Agencies have worked well to create this plan.
- Agencies have worked well together on RTG's for space, and are working well together on Project Prometheus: The Nuclear Systems Initiative
- Important first steps have been taken for bringing the science communities into the plan.