

THE SURVIVAL CRISIS OF THE U.S. SOLAR SYSTEM EXPLORATION PROGRAM

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ACTUALLY, THERE HAVE BEEN SEVERAL SURVIVAL CRISES

- In 1967, after Congress cancelled plans to send two spacecraft to Mars on a Saturn V
 - Administrator Webb ordered a rethinking of the planetary program; result was basis of 1970s planetary program
- In 1976 – Noel Hinners, AA for Science: “planetary program was on ‘a going out of business’ trend”
 - New head of JPL, Bruce Murray, tried to redesign program to make it more publicly attractive
- In 1981, when new Reagan administration threatened to end planetary exploration, at least for some years, and transfer JPL to DOD or CIA
 - Planetary program survived this threat and reinvented itself to be more sustainable

“PURPLE PIGEONS” VS “GREY MICE”

- **After becoming JPL Director in 1976, Bruce Murray advocated missions that had exploratory appeal in addition to scientific merit**
 - **Mars rovers, leading to sample return**
 - **Jupiter orbiter and lander on one of its moons**
 - **Saturn orbiter and lander on Titan**
 - **Asteroid rendezvous**
 - **Radar mapping of Venus**
 - **Rendezvous with Halley’s Comet using solar sails for propulsion**

NO HALLEY MISSION APPROVED

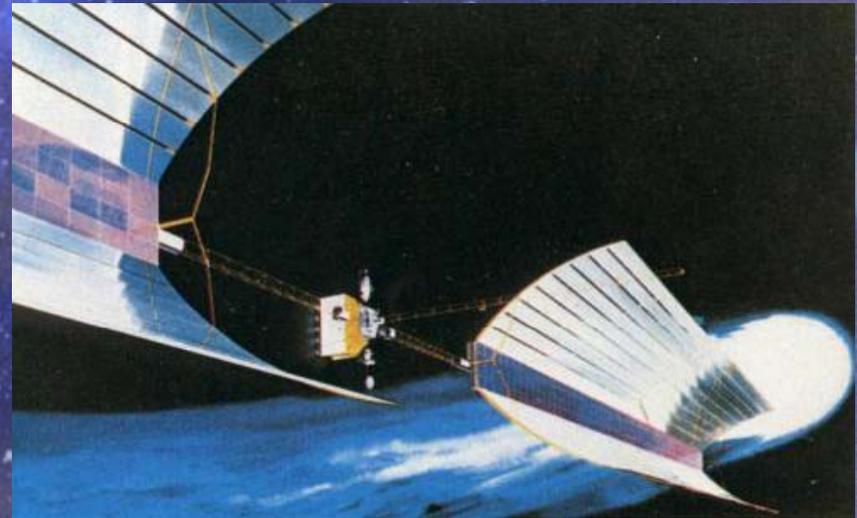
- Halley mission became focus of Murray advocacy in 1976-1981 period
- NASA HQ preferred solar electric propulsion for mission; ensuing debate in 1977-1978 over propulsion choice killed possibility of Halley rendezvous.
- Only possibility of Halley mission was intercept, not rendezvous



Halley Rendezvous Using Solar Sail

NO HALLEY MISSION APPROVED

- Space Science Board endorsed a Halley Flyby/Tempel-2 Rendezvous Mission; long lead time item was solar electric propulsion
- Two other missions, Gamma Ray Observatory and Venus Orbiting Imaging Radar, were ahead of this mission in approval queue
- President Carter in 1979 approved GRO, but not solar electric, and in 1980, VOIR; comet community and Murray fought a rearguard action through 1980 and 1981, but to no avail



Halley Intercept Using Solar Electric

NEW ADMINISTRATION NEW PRIORITIES

- **Ronald Reagan became president in January 1981 with pledge to cut the Federal budget.**
- **His budget director, David Stockman, rescinded Carter administration approval of VOIR and required NASA to cancel one of three approved space science missions**
 - **Hubble Space Telescope**
 - **Galileo mission to Jupiter**
 - **International Solar Polar Mission, joint with ESA**
- **Continued advocacy of a mission to Comet Halley by Bruce Murray and the new Planetary Society he had founded with Carl Sagan and Lou Friedman caused divisions in the planetary community.**

NEW ADMINISTRATION NEW PRIORITIES

- **New NASA Administrator James Beggs in mid-1981 told White House that he needed a policy decision on how to meet the constrained budget guidelines given NASA for FY1983**
- **He said that meeting the budget ceiling would mean major cuts in the space shuttle program or “dropping out of one or more major program areas, such as planetary exploration.”**
- **No policy decision was forthcoming.**

BEGGS PROPOSED CUTTING PLANETARY PROGRAM

“In terms of scientific priority, it [the planetary program] ranks below space astronomy and astrophysics. . . . In our judgment, it is better for future planetary exploration to concentrate on developing the Shuttle capabilities rather than attempt to run a ‘sub-critical’ planetary program given the current financial restrictions we face. Of course, elimination of the planetary exploration program will make the Jet Propulsion Laboratory in California surplus to our needs.”

**James Beggs to David Stockman,
September 29, 1981**

INFLUENCES ON NASA'S POSITION

- While planetary science community was divided on priorities, the just-issued decadal report on astronomy and astrophysics supported field's scientific merit, and the community had proposed "Great Observatories" program based on shuttle-launched spacecraft
- Beggs was playing budgetary hardball, betting that the Reagan White House would not cut a very visible portion of NASA's program with deep roots in southern California
- Deputy Administrator Hans Mark in 1975 had written "the results of space science to date have not been of major significance... No fundamental or unexpected discovery has been uncovered in the course of our exploration of the planets." He had also written in 1981 "JPL must take immediate and aggressive steps to get a strong and stable defense-related program going."

BUDGET PROCESS, NOVEMBER- DECEMBER 1981

- Beggs unable to get a meeting with White House policy people
- NASA November budget allowance from OMB had no funds for Galileo, an approved mission, or any other solar system mission. This would have had the effect of terminating the planetary program.
- Final decision to be made at December Budget Review Board meeting
- OMB staff paper for that meeting – “lower priority programs such as planetary exploration must be curtailed – even if they have been successful in the past.”
- Science Adviser Keyworth – “the cut in planetary exploration represents an example of good management.”

ACTORS IN POLITICAL PROCESS

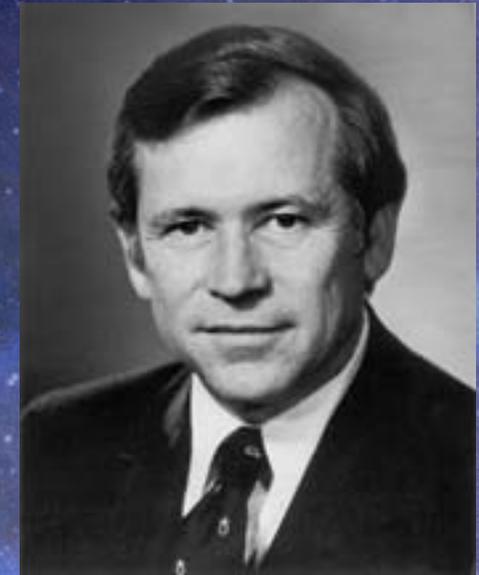
- Planetary science community
 - But controversy within space science community regarding whether advocacy for one area of space science was justified
- Public with particular interest in solar system exploration
 - But Planetary Society had organized letter-writing campaign on Halley mission and did not repeat that effort for planetary program survival
- Those who had worked with Bruce Murray in campaign to get approval for a Halley mission
 - Caltech had set up a “Trustees Committee” on the future of JPL, headed by Mary Scranton
 - Murray had gotten Caltech faculty approval for more defense work
- Those primarily interested in the health of Caltech
 - Caltech trustee Arnold Beckman in contact with Reagan chief of staff Ed Meese
 - Caltech president Marvin Goldberger made December trip to Washington



Founders of The Planetary Society

THE END GAME

- **Mary Scranton contacted Senators Charles Percy, Chales Mathias, and Mark Hadfield and the chief of Senate Majority Leader Howard Baker's staff**
- **Goldberger spoke directly with Baker**
- **On December 9, Baker wrote President Reagan in support of continuing the planetary program**
- **This intervention led to a budgetary compromise providing enough funds to continue Galileo and thus avoid terminating planetary program**



Senator Howard Baker

RE-INVENTING THE PLANETARY PROGRAM

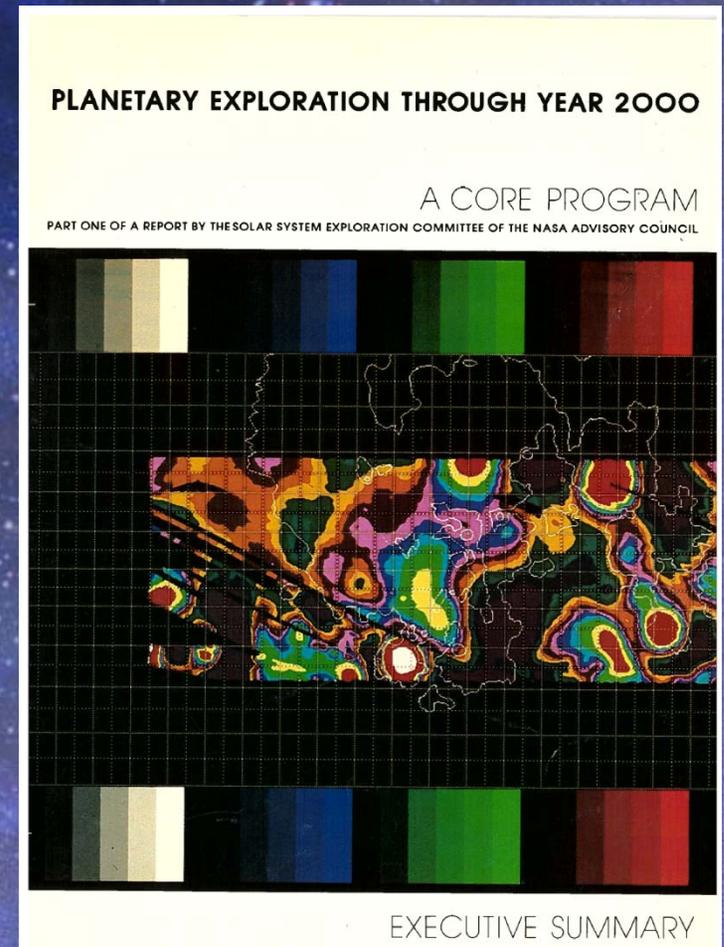
- Vehicle for re-invention was the Solar System Exploration Committee (SSEC), which had been created as an ad hoc subcommittee of the NASA Advisory Council in October 1980
- Prime mover in creating SSEC and its chair for first year was John Naugle, who had led redesign of planetary program in late 1960s.
- Charge to SSEC was to develop a strategy for solar system exploration in the 1985-2000 period
- Scientific priorities set by Space Science Board's Committee on Lunar and Planetary Exploration (COMPLEX) were starting point for SSEC

RE-INVENTING THE PLANETARY PROGRAM

- SSEC was working in 1981 in parallel with threats to planetary program's survival.
- Major issue was whether to propose a program balanced among solar system destinations or focused on a particular issue or destination, e.g. Mars
 - SSEC decided on a balanced approach
- SSEC developed a strategy based on three classes of missions
 - Those costing ~\$100 million, to be called "Observers"
 - Those based on a common spacecraft bus named Mariner Mark II and costing \$250 - \$500 million
 - Eventually, more expensive and technologically challenging "Viking Class" missions
- Hope was for constant overall program funding of \$300 million/year

RE-INVENTING THE PLANETARY PROGRAM

- SSEC Report listed four “core missions” for as new starts for 1980s
 - Venus Radar Mapper (Magellan)
 - Mars Geoscience/ Climatology Observer
 - Comet Rendezvous/ Asteroid Flyby (CRAF)
 - Titan Probe/Radar Mapper (became Cassini)



SSEC STRATEGY DID NOT SERVE AS BASIS FOR SUSTAINABLE PROGRAM

- **Venus Radar Mapper went forward as Magellan and was launched (after *Challenger* accident) in 1989**
- **Only Mars Geoscience/Climatology Observer, much enhanced, was developed; no line of Observer missions was created**
- **Attempts to use Mariner Mark II spacecraft for both CRAF and Saturn mission Cassini as a cost reduction approach failed**
- **No stable funding line for solar system exploration was established**

OUTCOME OF MARS OBSERVER

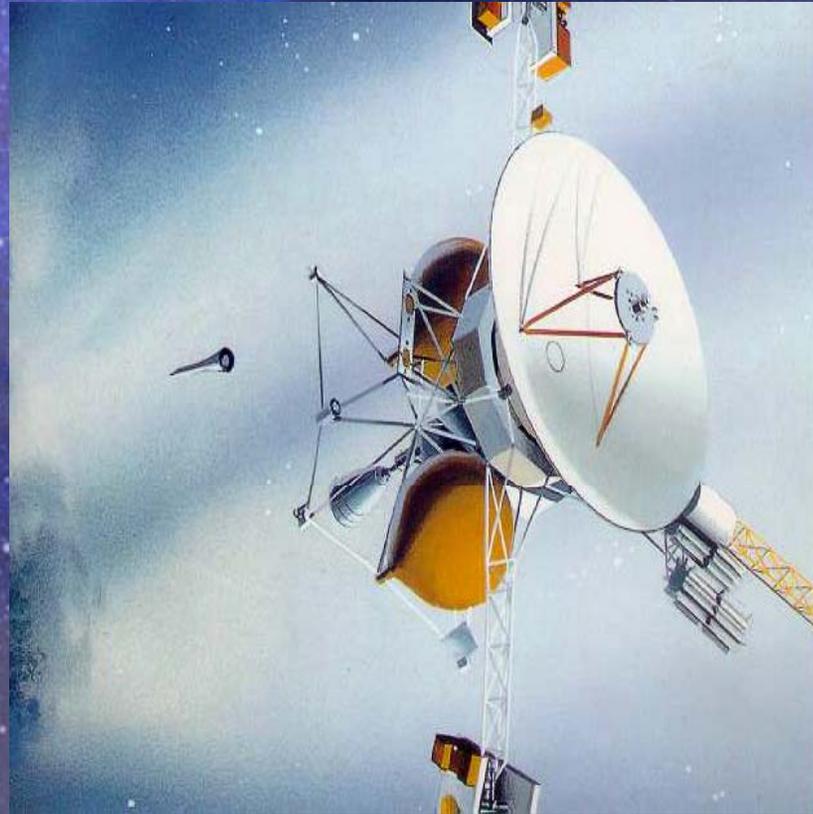
- Idea of a constant funding line for small and inexpensive solar system missions never took hold.
- As a result, Mars Observer, as the only mission to Mars in the planning horizon, grew from a small mission to one with multiple instruments, costing > \$1 billion rather than ~\$100 million
- Contact with Mars Observer was lost in August 1993, shortly before it reached orbit



One of the few Mars images returned by Mars Observer

OUTCOME OF CRAF/CASSINI

- Four attempts to get a new start for CRAF failed; finally approved in FY1990 along with Cassini mission to Saturn
- Tight budget caps all but ensured only one of the two missions would fly
- Technical problems also hit CRAF early in its development
- Cassini was considered to be the “sexier” mission; more science, and more interesting to the public
- CRAF cancelled in 1991



Artist's conception of CRAF

ANOTHER RE-INVENTION!

- **The Discovery Program**
 - In April 1992, Senate HUD, VA, and Independent Agencies Subcommittee directed NASA to develop planetary missions that could be accomplished by academic or research communities
 - In May 1992, NASA delivered Small Planetary Mission Plan Report to the Senate; origin of Discovery program
- **Faster, Better, Cheaper**
 - The centerpiece of NASA's new approach to solar system program for the 1990s
 - Ad hoc \$150 million (1992 dollars) cap per mission
 - Strongly advocated by then-NASA Administrator Dan Goldin
 - Good candidates for small body missions
- **Despite some well-publicized failures, Discovery program is still developing and launching missions, ten years after its inception**

CONCLUDING THOUGHTS

- Budgets for solar system exploration missions will continue to be constrained for the foreseeable future, so there will continue to be “crises.”
- Science return alone is generally not sufficient to win funding for larger missions
- Small, relatively inexpensive, innovative missions with public appeal have the greatest chances of approval
- The likelihood of future shifts in government spending priorities will continue to make strategic planning extremely difficult

