SMEX 2007 Pre-Propsal Conference

Overview of SMEX AO
Evaluation/Selection Criteria and Process

Hashima Hasan
Explorer Program Scientist

Willis Jenkins
Explorer Program Executive

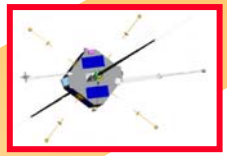
Science Mission Directorate
NASA Headquarters

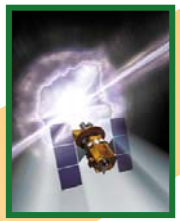
November 6, 2007

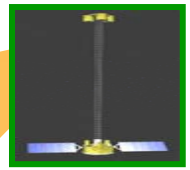
Explorer Program – Management Philosophy

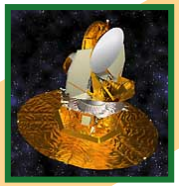
- Explorer Program Objectives
  - Address NASA's heliophysics and astrophysics goals
  - PI-led missions and fully competitive selection process encourages optimized mission concepts from every facet of the community (university, industry, NASA centers, government labs)
- Explorer policies and processes designed to maximize science return within fixed budget
  - Frequent opportunities allows Explorers to respond to evolving science priorities
  - Two independent peer reviews insure premier science with acceptable risk
  - Competitive mission concept studies concentrates on implementation plan and technical/cost risk
  - Greater weighting given to schedule and cost reserve
  - More headroom means more likelihood of proposal success
  - Tough management requires terminating missions that cannot meet commitments (e.g. FAME, IMEX, SPIDR)

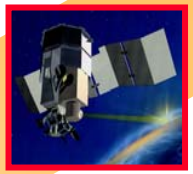
Explorer Program

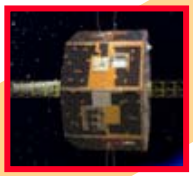


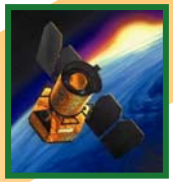












Explorers/MIDEX

SMEX

UNEX & Missions of Opportunity and Internationals

AO Highlights

- Science Investigations must support NASA scientific goals to understand
  - The Sun and its effects on Earth and the solar system
  - To discover the origin, structure, evolution and destiny of the universe
  - Search for Earth-like planets
- This AO solicits
  - Small Explorer (SMEX) investigations
    - expect to select and launch 3
    - fourth mission may be designated as an unfunded backup
  - Missions of Opportunity (MO) investigations
    - may select one (or more)
    - MO is an opportunity to propose

AO Highlights

- SMEX Investigations are
  - Free flyers launched by ELV
- MO Investigation may be
  - Partner MO: SMD participation in non-SMD mission
    - √ Participation in international or commercial mission going to International Space Station (ISS) permitted if transportation to ISS is provided by mission partner at no cost to SMD
  - New Science Mission using Existing Spacecraft
  - Small Complete Missions
  - Focused Opportunity for Solar Orbiter (separate presentation)

AO Highlights : Launch

- SMEX launch must be no later than 30 September 2015
- Commitment dates for MO's
  - Partner MO requires NASA commitment no later than 31 December 2012
  - New Science Missions using existing spacecraft requires NASA commitment no later than 31 December 2010

- Small Complete Missions: launch not later than 30 September 2015
  - No launch vehicle will be provided by NASA
  - Proposal must include access to space
  - Contributed LV's will be evaluated consistent with National Space Transportation Policy, Public Law and NASA's Launch Service

AO Highlights : Science Requirements

- Scientific requirements for the investigation must be explicitly described and linked to the scientific objectives
- Relationship between the objectives, the data, and the instrument payload must be unambiguous and clearly stated in the proposal
- Requirements that these objectives and observations impose on the mission design elements must be explicitly described
- Required “science objectives-to-measurements-to-mission traceability” may be provided either in narrative or tabular form

AO Highlights : Data

- Data must be made fully public, in a useable form, in a reasonable time
  - Data should be released as soon as possible
- Options for Enlarging Science Impact
  - E.g. extended missions, guest investigators, archival data analysis programs, etc.
  - Baseline mission must accomplish proposed science goals
  - Options beyond baseline may be included
  - Cost for SEO will not count against the PI Mission Cost

AO Highlights : Cost

- **PI Mission Cost** is the cost to SMD of the portion of the mission that is under PI management responsibility
- SMEX hard **cost cap** on PI Mission Cost is **$105M** FY08
  - Excludes cost of ELV, non-SMD contributions, or of extended missions or SEO efforts
- **MO** budget is **$70M** FY08
- During Phase A PI Mission Cost shall not increase more than **20%** from that offered in original proposal and must not exceed the PI Mission Cost cap
- Total **non-SMD** contributions to a SMEX investigation is not to exceed **one half** of the PI Mission Cost
- **Government Furnished Equipment** (GFE)
  - Expendable launch vehicle services
- **Space Operations and Communications**
  - Proposers are free to use services from offerors other than NASA
- All **Federal Government** elements of the proposal must follow their agency cost accounting standard for **full cost**
- An adequate **unencumbered reserve** on PI Mission Cost is measured against the cost to complete through Phases A/B/C/D/E/F and is a minimum of **30%** including funded schedule reserve
- **Earned Value Management System** shall be applied to a selected NASA mission

AO Highlights : Management

- Principal Investigator (PI) led investigations
- PI must demonstrate minimum requisite experience (SMEX only)
- PI team may use own management procedures and methods
- Risk classification for SMEX missions is tailored Class D
- Define risk management approach
- Emphasize mission success within cost and schedule
  - Incorporate sufficient margins, reserves, and resiliency
- Minimum mission must be defined (SMEX only)
  - Consider all possible descope options
- Co-investigator must define role and identify funding
  - Plays necessary role

AO Highlights : PI Experience

- Three parts to minimum space flight experience
  - Senior project experience for a minimum of two years (PI, Deputy PI, Project Scientist or Deputy, Program Manager or Deputy)
  - Space project can be a full mission, an instrument, or an experiment
  - Project has gone or will go into space or near-space (greater than 100K feet) environment
- Senior Project experience
  - Duties listed in Appendix H of AO
- Table B7
  - Must be filled **completely** by **every** proposal PI, even by those who have been the PI of a flight mission
  - Proposals with incomplete or inadequately filled tables will be declared non-compliant and may be returned without review
  - Pre-screen dates are offered. Last two dates are November 19, 2007 and December 7, 2007.

Table B7

- Name of PI: ***Proposal*** *PI name should be entered*
- PI Institution: ***Proposal*** *PI institution*
- Space Project: *Name of project PI has acquired experience in*
- Project launch date: *Actual or proposed date*
- Title of position held: *e.g. Mission Scientist*
- If different title, position with the same roles and responsibilities: *e.g. Project Scientist*
- Dates position held: *Should span a minimum of 2 years*
- Role, responsibilities, authority (*See appendix H)*
  - Leadership
  - Planning
  - Implementation
  - Approval

Example from Appendix H: Project Scientist

- **Leadership**
  - Provide **scientific guidance and oversight** of all elements of project implementation, from the beginning of formulation to the end of science operations
  - Support definition of Level-1 specifications
- **Planning**
  - Takes **lead** in identifying scientific options for the PI (and PM for larger projects) in all matters regarding science, science policy, and science-engineering trades required to scieve mission objectives within the schedule and resources available
  - Participate in project meetings/reviews and be **responsible** for confirming that science requirements will or will not be met
- **Implementation**
  - **Oversee** the implementation of the science observation program of the mission
  - Review and **approve** plans for calibration, operations and data analysis
- **Approval**
  - Review and **recommend** approval of, and **propose** modifications to, the science and technical requirements
  - Provide **recommendations** on mission success criteria.
  - **Approve** budgets and **make decisions** regarding expenditure of resources

Common mistakes in filling table B7

- **Name of PI**
  - *Wrong:* PI of the mission in which proposal PI has gained experience is filled
  - *Right:* proposal PI name should be filled
- **Description of duties**
  - *Wrong:* Duties listed without stating PI role in those duties. E.g. Implementation of science observation program
  - *Right:* Explicitly state PI role. E.g. Oversaw implementation of science observation program
  - *Wrong:* Weak verbs used to describe role. E.g. participated in Science Working Group(SWG) meetings
  - *Right:* Led/Chaired the SWG to develop scientific guidance (or supported Project Scientist in providing scientific guidance) for project implementation.
  - *Wrong:* No duties listed (blank form submitted)
  - *Right:* Complete all four areas *Leadership, Planning, Implementation, Approval*
- **Extraneous material provided**
  - *Wrong:* Material irrelevant to position provided. E.g. I convinced xxx that mission yyy should be selected; I provided Dr. X with a final report of … ; I presented scientific papers at international conferences.
  - *Right:* Provide only your role in tasks **relevant** to the job experience required

AO Highlights : International Participation

- International participation adds management complexity and risk
  - Includes risk of problems beyond PI's control
  - Cooperative arrangements should offer significant benefits
  - No-exchange-of-funds basis
- Letters of endorsement are required
  - Funding agency endorsement required if applicable
- Must describe how export laws will be complied with
  - During Phase A and Phases B/C/D/E
  - See separate export control presentation
- If LOA is anticipated, letter of endorsement must contain either (1) statement that sponsoring entity can bind government or (2) advance agreement that LOA's will be governed by U.S. law

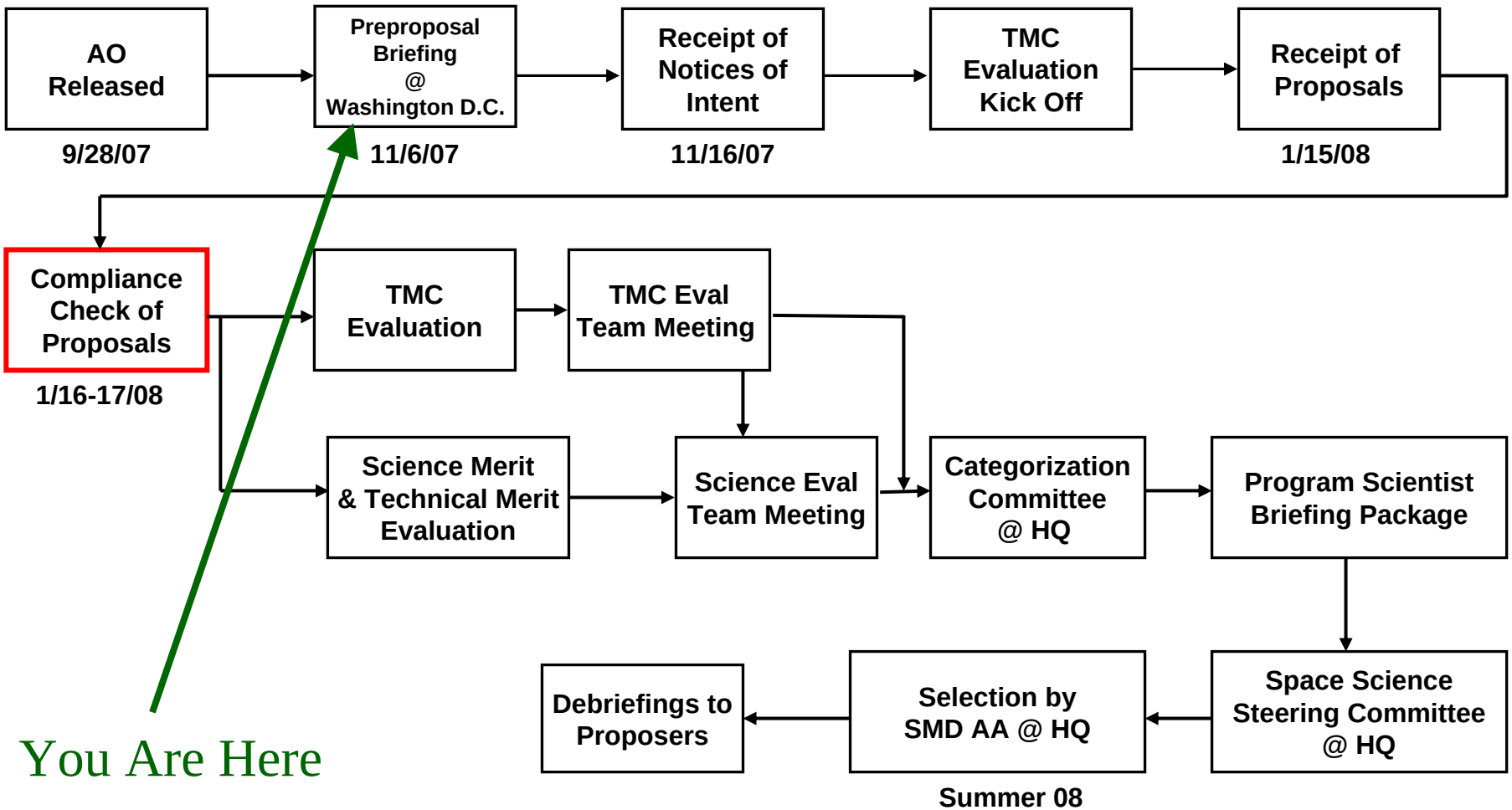
AO Highlights : Student Collaboration

- Direct involvement of undergraduate and/or graduate students in a spaceflight experience through a Student Collaboration is encouraged
  - *Separate presentation*

What's "New" in this AO?

- Cost cap: $105M FY08 SMEX; $70M MO allocated to MO
- Launch dates (NLT September 30, 2015 SMEX)
- Standard launch services on an ELV will be provided for SMEX
- MO may not propose to be launched by CEV, COTS or Space Shuttle; transportation for MO's on ISS must be by non-SMD sponsor
- MO proposals for suborbital missions not permitted
- Small complete missions may be proposed as MO
- Phase F now means closeout required at end of mission
- NASA intends SMEX and MO investigations to be implemented at Category 3, tailored Class D payloads
- NASA is instituting minimum experience requirements for the proposed PI of SMEX missions
- Additional emphasis on cost risk; minimum cost reserves
  - An adequate **unencumbered reserve** on PI Mission Cost is measured against the cost to complete through Phases A/B/C/D/E/F and is a minimum of **30%** including funded schedule reserve
  - **Weight of TMC evaluation criterion raised to 50%**
- Contributions to a SMEX investigation may not exceed 1/2 PI Mission Cost
- Allocation for Education and Public Outreach is 0.25 - 1% PI Mission Cost

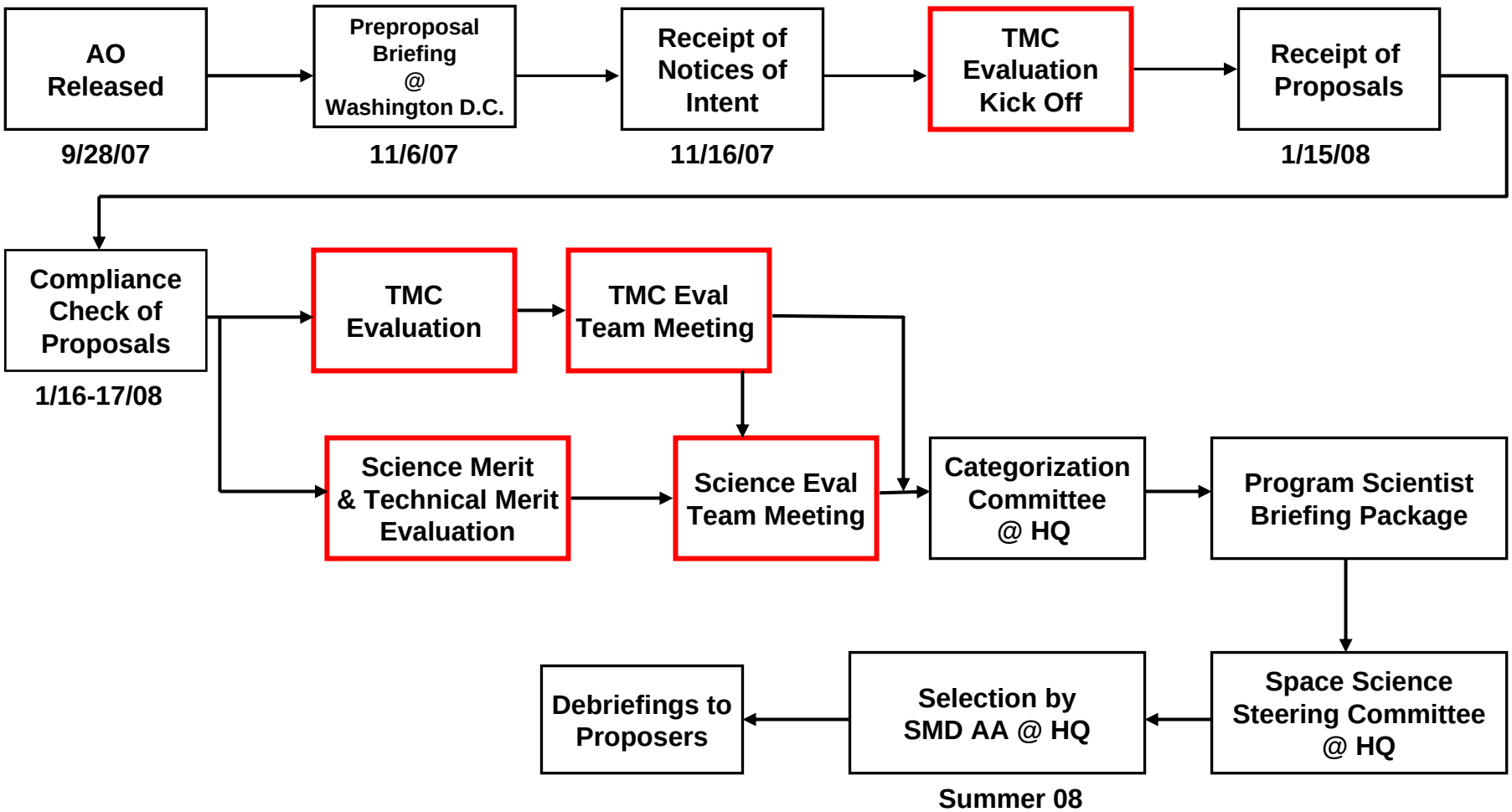
SMEX 2007
Proposal Evaluation Process



Compliance Check (Appendix E)

- Proposals received and screened for compliance with AO
  - Proposal received on time (signed original, 55 copies, CD)
  - Complete and within page limit (one volume containing investigation summary, cover page, fact sheet, satisfies Appendix B, required appendices, budget files)
  - Science goals and objectives within solicited themes
  - Includes flowdown, archiving, minimum mission, resources for data analysis
  - PI meets space flight experience requirements (SMEX only)
  - Cost within cap (cost to NASA, total mission cost)
  - Launch/commitment date
  - E/PO etc. commitment
  - Letters of Endorsement (organizations offering goods/services, major participants, launch service provider if not NASA, non-NASA funding agencies).

SMEX 2007
Proposal Evaluation Process



Evaluation Process

- Scientific/Technical Peer Panels
  - Assigned to science panel based upon primary science proposed, primary science instrumentation and technology proposed
  - Panels formed with expertise in scientific topic areas and science instrumentation
  - Conflict of interest avoided
- Proposals reviewed in depth for scientific merit and technical merit/feasibility
  - Major/minor strengths and weaknesses identified and recorded
  - Evaluation criteria assigned an adjectival rating (Excellent, Very Good, Good, Fair, Poor) based on findings

Evaluation Process (continued)

- Technical, Management, Cost Panels
  - Managed by Earth and Space Science Support Office at Langley Research Center
  - See next presentation

Evaluation Criteria: Scientific Merit

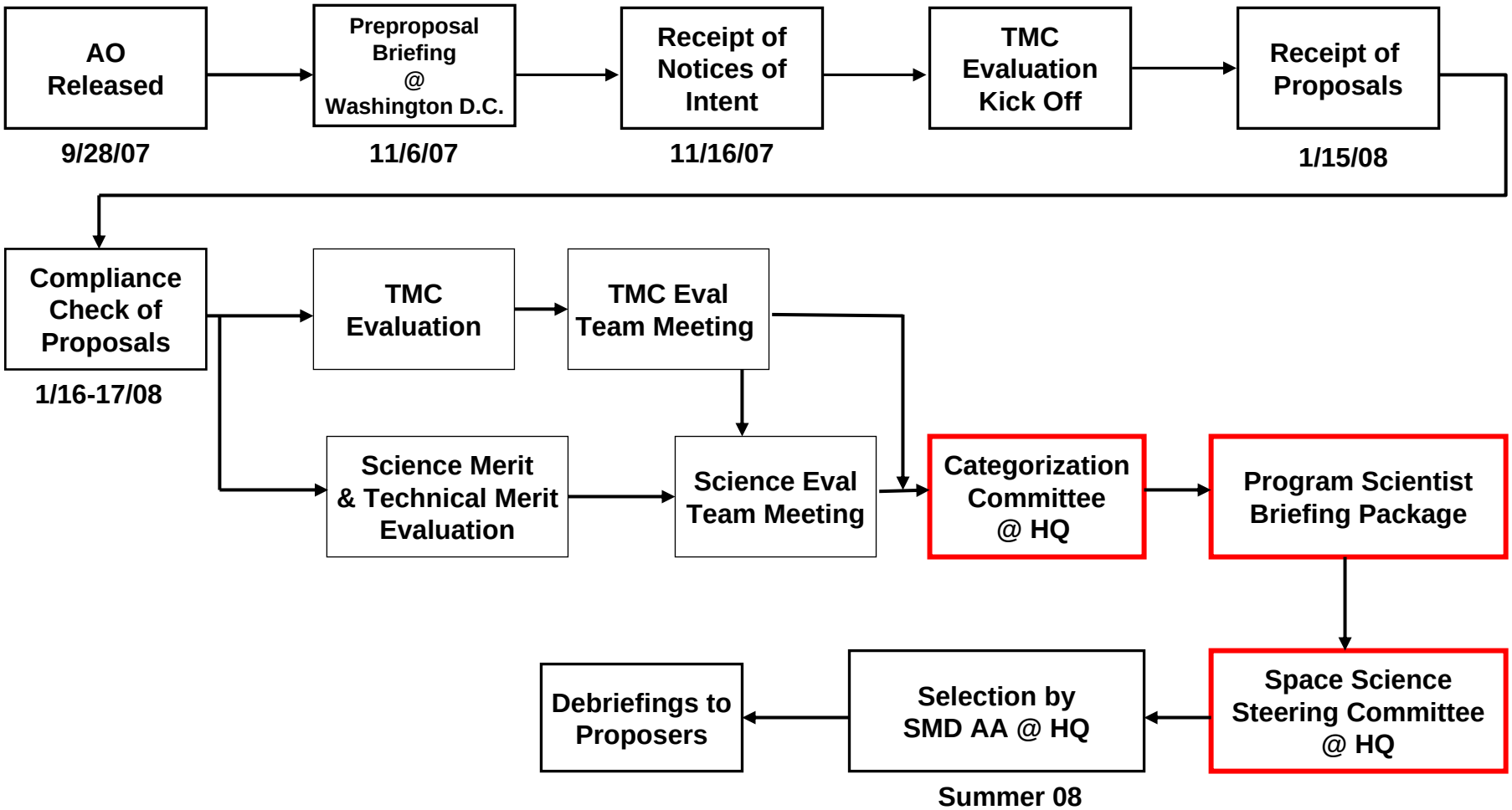
- To evaluate the Scientific Merit of the proposed investigation**, the following factors will be considered:
  - Impact of the investigation on NASA's heliophysics and astrophysics research programs and on the U.S. space science program
  - How well the investigation
    - fills gaps in the understanding of space science
    - provides progress in NASA's heliophysics and astrophysics research programs
    - synergistically supports ongoing space science missions
    - provides ancillary benefits to U.S. space science program
  - Sufficiency of data to complete the proposed investigation
  - (SMEX only) Scientific value of Minimum Mission
- Scientific merit of a Student Collaboration (if proposed) will be evaluated and given a grade independent of the grade for the main mission

** For a Mission of Opportunity, the proposed investigation encompasses only the contribution to the mission, not the entire mission.

Evaluation Criteria: Scientific Implementation Merit

- **To evaluate the Scientific Implementation Merit of the investigation, the following factors will be considered:**
  - Relationship between the proposed scientific objectives, the data to be returned, and scientific implementation to be used in carrying out the investigation.
  - Degree to which the proposed instrument(s) can be built using the proposed technologies.
  - Degree to which the proposed instrument and mission can provide the necessary data.
  - Degree to which the mission will support the accomplishment of acquisition of the required data
  - Merit of the proposed calibration/validation, data analysis and archiving plan; merit of the proposed plan for timely release of data to the public domain.
  - Selection of appropriate science enhancement options; impact of SEO evaluation on overall score of this criterion will be provided to NASA
  - Likelihood of success of any proposed new technology or untested advance in the state of the art.
  - Resiliency will be evaluated by assessing the approach to descoping the Baseline Mission to the Minimum Mission should development problems force a de-scope
  - Probability of success based on (i) experience, expertise, and organization of science team and on (ii) technical risk associated with mission design and instrument set.
  - Necessary contribution of each co-investigator.
- **Scientific implementation merit of a Student Collaboration (if proposed) will be evaluated and given a grade independent of the grade for the main mission**

SMEX 2007
Proposal Evaluation Process



Categorization (§8.1)

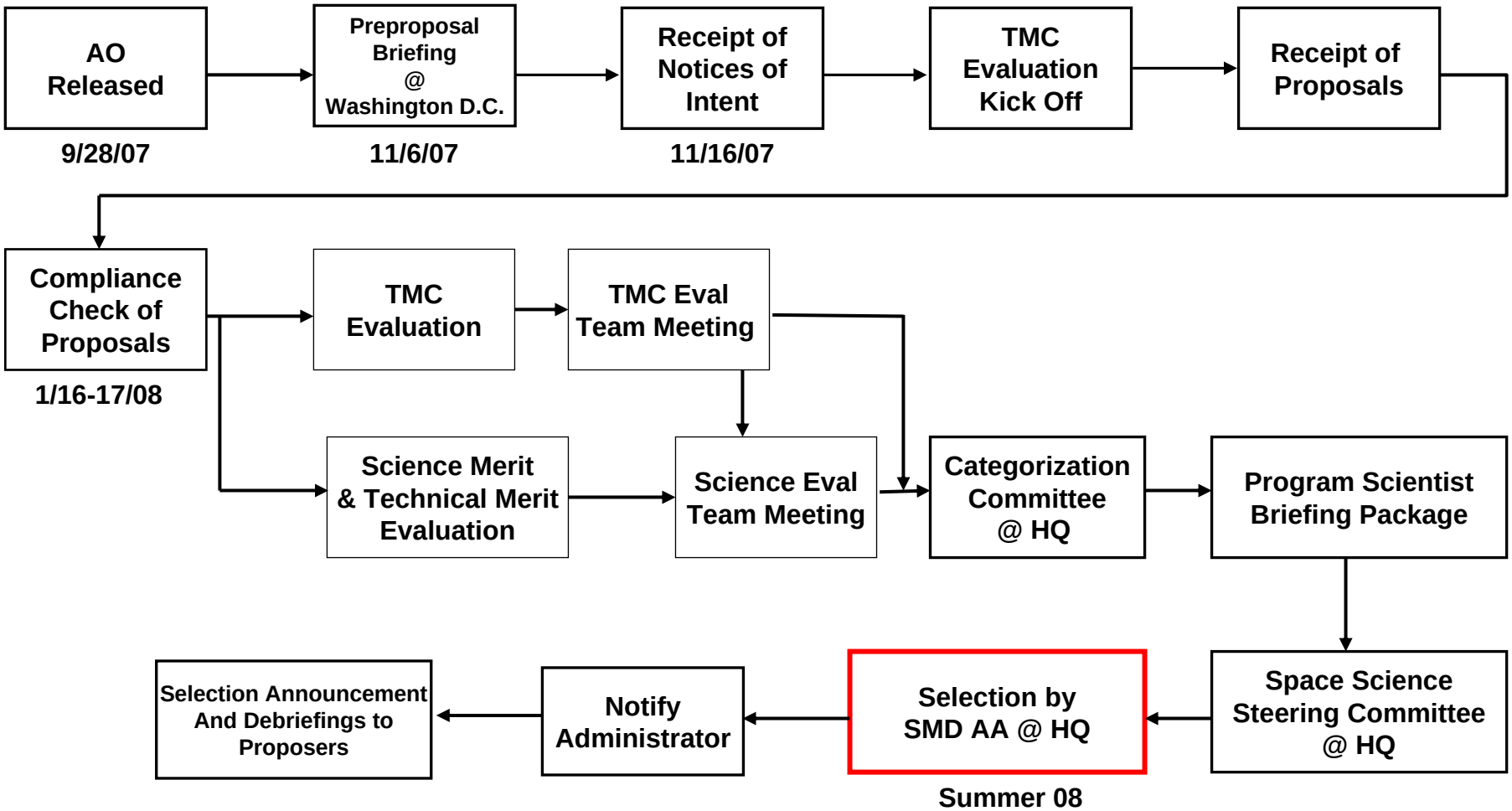
- Category I. Well conceived and scientifically and technically sound investigation pertinent to the goals of the program and the AO's objectives and offered by a competent investigator from an institution capable of supplying the necessary support to ensure that any essential flight hardware or other support can be delivered on time and that data can be properly reduced, analyzed, interpreted, and published in a reasonable time. Investigations in Category I are recommended for acceptance and normally will be displaced only by other Category I investigations.
- Category II. Well conceived and scientifically or technically sound investigations which are recommended for acceptance, but at a lower priority than Category I.
- Category III. Scientifically or technically sound investigations which require further development. Category III investigations may be funded for development and may be reconsidered at a later time for the same or other opportunities.
- Category IV. Proposed investigations which are recommended for rejection for the particular opportunity under consideration, whatever the reason.

In response to this AO, NASA intends to select and fund only Category I investigations for flight.

Evaluation Criteria

- Scientific merit of the proposed investigation [25%]
- Scientific implementation merit of the proposed investigation [25%]
- Technical, management, and cost (TMC) feasibility, including cost risk, of the proposed investigation [50%]
  - Weights are for categorization
- Comments on the "core" E/PO element, and overall merit of the Student Collaboration will be evaluated, but will not be included in the overall merit of the proposal and will not be a factor in the categorization of the proposal

SMEX 2007
Proposal Evaluation Process



Selection (§8.3)

- Selection Factors
  - Proposal evaluations based on published criteria
  - Categorization
  - Cost to NASA SMD
- Overriding consideration: Maximize scientific return and minimize implementation risk within the available budget
  - Space Science program is an evolving activity; selecting official will use all available science planning, policy, and cost considerations
  - Objective (not requirement) to balance among scientific rsearch areas
- Select 6 - 8 SMEX investigations for Phase A concept studies

Phase A Concept Study and Downselection (§8.4)

- **6 - 8 SMEX investigations selected**
  - Selection by AA in Summer 2008
  - Phase A contract with option for bridge phase intended to cover a four-month period of Phase B effort
  - Concept study cost up to $750K (RY$)
  - Product of concept study is report to NASA and commitment by PI for cost, schedule, and scientific performance of investigation
  - See “Guidelines for Concept Study Report Preparation”
- **Expect to downselect to three SMEX investigations**
  - NASA may request presentations and/or site visits
  - A fourth mission may be designated as an unfunded backup until all selected missions pass or fail Confirmation Review to enter Phase C
  - Downselection for Extended Phase A may be made with no guarantee for approval to enter phase B
  - Downselection by AA in January 2009
- **Any selected MO may also be authorized to proceed**

Helpful Hints

- Read the AO carefully and follow all instructions
- Your audiences are the science and TMC peer review
- Science peer review panel
  - Out of all the excellent science investigations that are proposed, why is yours the one that should be selected? Why is your investigation the best way to achieve your science objectives?
- TMC peer review panel
  - How will you accomplish your science objectives within the proposed resources? Why do you believe that you can accomplish your science objectives within the proposed resources?

Guidelines for Science Section

- Describe scientific objectives, identify primary science research program (heliophysics or astrophysics), describe value of investigation to the strategic objectives of the program.
- Discuss scientific products, discuss how products and data will fulfill scientific objectives.
- Discuss science implementation, discuss how instruments and mission will deliver the required data.
- Discuss how data will be obtained, discuss plan for delivery of data products, identify individuals responsible.
- Describe history and basis for proposal, note relationships to other missions, provide overview of mission.

Guidelines for Science Section

- Define Baseline Mission: discuss measurements to be taken and data to be returned, identify approach leading from data to science objectives, identify quality and quantity of data returned, explicitly describe relationship between data products and scientific objectives.
- Define Minimum Science Mission: identify minimum acceptable data and scientific return below which mission would not be worth pursuing, discuss value of Minimum Science Mission, describe descope options available (not just instruments or mission life time) and their effect on meeting science objectives.
- Identify only one Baseline and one Minimum Science Mission.

Guidelines for Science Section

- Describe science implementation, including
  - Instrumentation: describe instrumentation, criteria for selection, individual instruments and heritage, characteristics and performance, block diagrams, interfaces, etc.
  - Mission: observing strategy, spacecraft performance, mission concept, etc.
  - Data Analysis and Archiving: data reduction and analysis plan, method and format, data products, schedule to NASA archive.
  - Science Team: members, roles, responsibilities.
- Science requirements should flow down to everything else.

Proposal Science Requirements

- Proposal must contain
  - Clearly stated relationship between the proposed scientific objectives, the anticipated data, and the instrument payload.
  - All technical aspects of the investigation from initial studies through delivery of data and scientific analysis.
  - Data plan** including appropriate period for science analysis (independent of archiving) and specification of time required for archiving appropriate data for the scientific community and the general public (justify minimum time necessary and any proprietary period).

** Mission of Opportunity investigation team's data analysis responsibilities defined by mission sponsor.

Proposal Science Requirements

- Science Team Responsibilities
  - Initial analysis of data, delivery to an appropriate data repository, publication of scientific findings, and communication of results to the public.
  - Release data as soon as possible (after appropriate brief validation period).
  - Collect scientific, engineering, and ancillary information necessary to validate and calibrate scientific data.
  - Implement E/PO program.

Primary Resources

- The SMEX AO NNH07ZDA003O
  - http://nspires.nasaprs.com/external/
- The SMEX Explorer Program Library
  - http://explorers.larc.nasa.gov/smexlib.html
- The SMEX Acquisition Additional Information Home Page
  - http://explorers.larc.nasa.gov/smexacq.html
- Technical Points-of-Contact
  - Points of Contact (see Library documents)
- The Explorer Program Scientist
  - smexao@nasa.gov