Earth System Science Pathfinder Program

EV-2 Pre-Proposal Conference

Program Management

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ESSPPO-RI-EV2-0001

EV-2 is Different from other ESSP missions

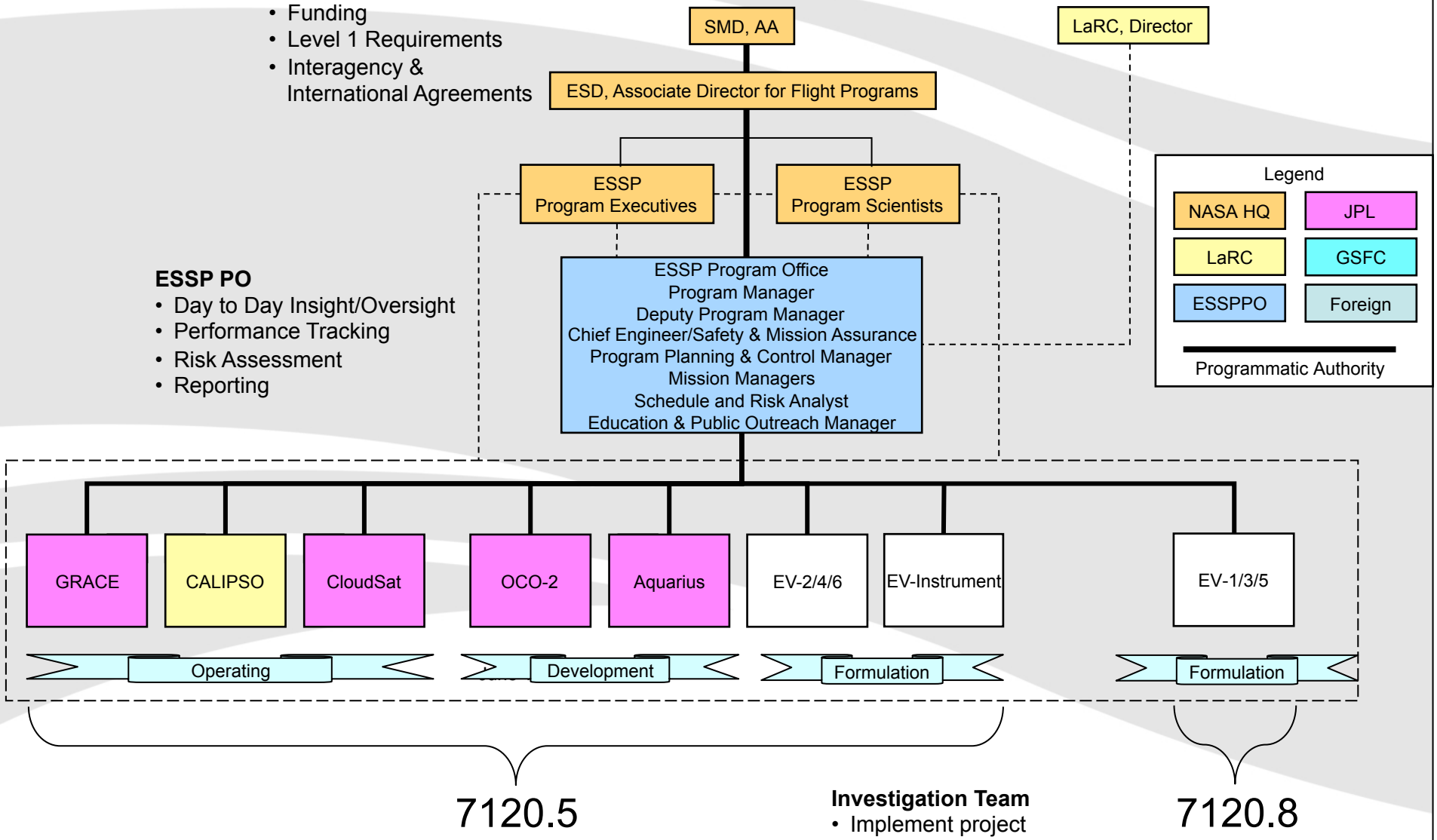
- Cost capped at $150M
- Schedule capped at 5 years from award until launch
- Risk classification
  - Payload Class D allowed (low priority, high risk)
  - Mission Category 3 (<$250M, medium/low priority)
- Access to space
  - NASA-provided launch vehicle
  - PI proposed non-NASA access to space
- Partnerships (domestic or international) encouraged

"These missions should focus on fostering revolutionary innovation and on training future leaders of space-based Earth science and applications."
Decadal Survey, 2007

Program Organization

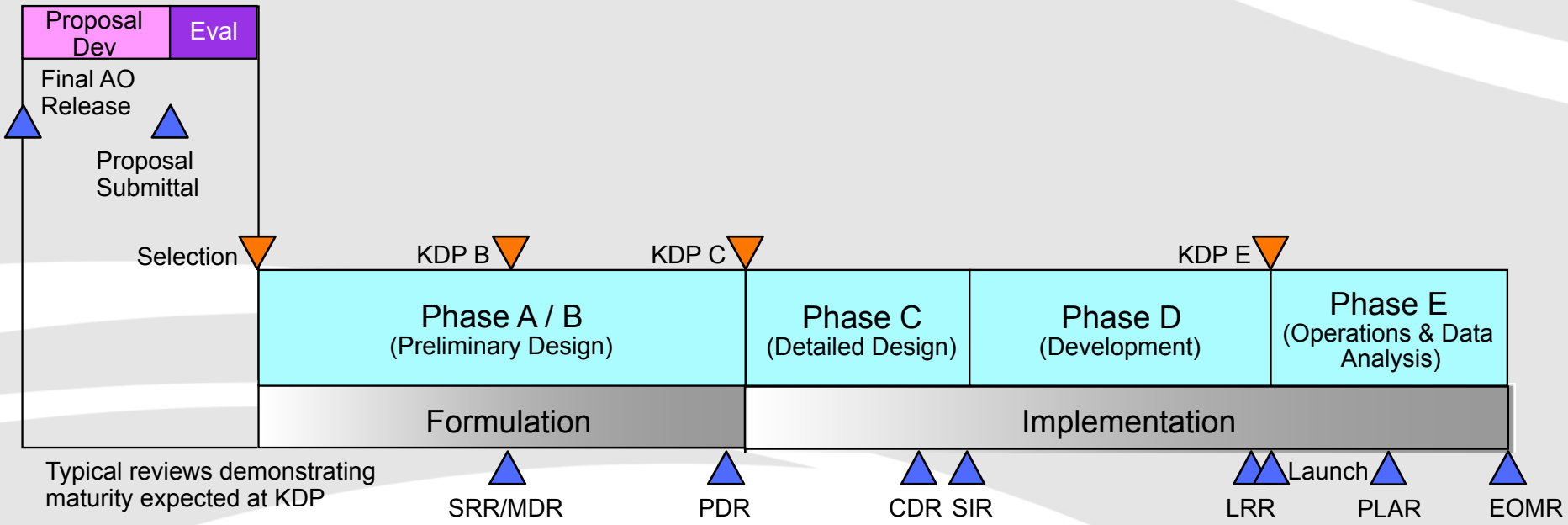
HQ
- Funding
- Level 1 Requirements
- Interagency & International Agreements

ESSP PO
- Day to Day Insight/Oversight
- Performance Tracking
- Risk Assessment
- Reporting



Investigation Team
- Implement project

EV-2 Mission Life Cycle



Risk Classifications Defined

Class D Risk classification defined in NPR 8705.4, "*Risk Classification for NASA Payloads*"

Characterization	Class A	Class B	Class C	Class D
Priority (Criticality to Agency Strategic Plan) and Acceptable Risk Level	High priority, very low (minimized) risk	High priority, low risk	Medium priority, medium risk	Low priority, high risk
National significance	Very high	High	Medium	Low to medium
Complexity	Very high to high	High to medium	Medium to low	Medium to low
Mission Lifetime (Primary Baseline Mission	Long, >5years	Medium, 2-5 years	Short, <2 years	Short < 2 years
Cost	High	High to medium	Medium to low	Low
Launch Constraints	Critical	Medium	Few	Few to none
In-Flight Maintenance	N/A	Not feasible or difficult	Maybe feasible	May be feasible and planned
Alternative Research Opportunities or Re-flight Opportunities	No alternative or re-flight opportunities	Few or no alternative or re-flight opportunities	Some or few alternative or re-flight opportunities	Significant alternative or re-flight opportunities
Achievement of Mission Success Criteria	All practical measures are taken to achieve minimum risk to mission success. The highest assurance standards are used.	Stringent assurance standards with only minor compromises in application to maintain a low risk to mission success.	Medium risk of not achieving mission success may be acceptable. Reduced assurance standards are permitted.	Medium or significant risk of not achieving mission success is permitted. Minimal assurance standards are permitted.
Examples	HST, Cassini, JIMO, JWST	MER, MRO, Discovery payloads, ISS Facility Class Payloads, Attached ISS payloads	ESSP, Explorer Payloads, MIDEX, ISS complex subrack payloads	SPARTAN, GAS Can, technology demonstrators, simple ISS, express middeck and subrack payloads, SMEX

Characteristics of Payloads

Class D Risk classification defined in NPR 8705.4, "*Risk Classification for NASA Payloads*"

	CLASS A	CLASS B	CLASS C	CLASS D
Single Point Failures (SPFs)	Critical SPFs (for Level 1 requirements) are not permitted unless authorized by formal waiver. Waiver approval of critical SPFs requires justification based on risk analysis and implementation of measures to mitigate risk.	Critical SPFs (for Level 1 requirements) may be permitted but are minimized and mitigated by use of high reliability parts and additional testing. Essential spacecraft functions and key instruments are typically fully redundant. Other hardware has partial redundancy and/or provisions for graceful degradation.	Critical SPFs (for Level 1 requirements) may be permitted but are mitigated by use of high reliability parts, additional testing, or by other means. Single string and selectively redundant design approaches may be used.	Same as Class C.
Engineering Model, Prototype, Flight, and Spare Hardware	Engineering model hardware for new or modified designs. Separate prototype and flight model hardware. Full set of assembled and tested "flight spare" replacement units.	Engineering model hardware for new or significantly modified designs. Protoflight hardware (in lieu of separate prototype and flight models) except where extensive qualification testing is anticipated. Spare (or refurbishable prototype) hardware as needed to avoid major program impact.	Engineering model hardware for new designs. Protoflight hardware permitted (in lieu of separate prototype and flight models). Limited flight spare hardware (for long lead flight units).	Limited engineering model and flight spare hardware.
Qualification, Acceptance, and Protoflight Test Program	Full formal qualification and acceptance test programs and integrated end-to-end testing at all hardware and software levels.	Formal qualification and acceptance test programs and integrated end-to-end testing at all hardware levels. May use a combination of qualification and protoflight hardware. Qualified software simulators used to verify software and system.	Limited qualification testing for new aspects of the design plus full acceptance test program. Testing required for verification of safety compliance and interface compatibility.	Testing required only for verification of safety compliance and interface compatibility. Acceptance test program for critical performance parameters.

Characteristics of Payloads

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	CLASS A	CLASS B	CLASS C	CLASS D
EEE Parts *http: // nepp .nasa .gov/ index_nasa .cfm/ 641	NASA Parts Selection List (NPSL)* Level 1, Level 1 equivalent Source Control Drawings (SCDs), and/or requirements per Center Parts Management Plan.	Class A requirements or NPSL Level 2, Level 2 equivalent SCDs, and/or requirements per Center Parts Management Plan.	Class A, Class B or NPSL Level 3, Level 3 equivalent SCDs, and/or requirements per Center Parts Management Plan.	Class A, Class B, or Class C requirements, and/or requirements per Center Parts Management Plan.
Reviews	Full formal review program.Either IPAO external independent reviews or independent reviews managed at the Center level with Mission Directorate participation. Include formal inspections of software requirements, design, verification documents, and code.	Full formal review program. Either IPAO external independent reviews or independent reviews managed at the Center level with Mission Directorate participation. Include formal inspections of software requirements, design, verification documents, and peer reviews of code.	Full formal review program. Independent reviews managed at Center level with Mission Directorate participation. Include formal inspections of software requirements, peer reviews of design and code.	Center level reviews with participation of all applicable directorates. May be delegated to Projects. Peer reviews of software requirements and code.
Safety	Per all applicable NASA safety directives and standards.	Same as Class A.	Same as Class A.	Same as Class A.
Materials	Verify heritage of previously used materials and qualify all new or changed materials and applications/configurations. Use source controls on procured materials and acceptance test each lot/batch.	Use previously tested/flown materials or qualify new materials and applications/configurations. Acceptance test each lot of procured materials.	Use previously tested/flown materials or characterize new materials. Acceptance test sample lots of procured materials.	Requirements are based on applicable safety standards. Materials should be assessed for application and life limits.

Characteristics of Payloads

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	CLASS A	CLASS B	CLASS C	CLASS D
Reliability NPD 8720.1	Failure mode and effects analysis/critical items list (FMEA/CIL), worst-case performance, and parts electrical stress analysis for all parts and circuits. Mechanical reliability, human, and other reliability analysis where appropriate.	FMEA/CIL at black box (or circuit block diagram) level as a minimum. Worst-case performance and parts electrical stress analysis for all parts and circuits.	FMEA/CIL scope determined at the project level. Analysis of interfaces. Parts electrical stress analysis for all parts and circuits.	Analysis requirements based on applicable safety requirements. Analysis of interface.
Fault Tree Analysis	System level qualitative fault tree analysis.	Same as Class A.	Same as Class A.	Fault tree analysis required for safety critical functions.
Probabilistic Risk Assessment NP R 8705.5	Full Scope, addressing all applicable end states per NPR 8705.5.	Limited Scope, focusing on mission-related end-states of specific decision making interest per NPR 8705.5.	Simplified, identifying major mission risk contributors.Other discretionary applications.	Safety only. Other discretionary applications.
Maintainability[1] NPD 8720.1	As required by NPD 8720.1	Application of NPD 8720.1 determined by program. (Typically ground elements only.)	Maintainability considered during design if applicable.	Requirements based on applicable safety standards.

Characteristics of Payloads

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	CLASS A	CLASS B	CLASS C	CLASS D
Quality Assurance NPD 8730.5 NPR 8735.2 (NPR 8735.1)	Formal quality assurance program including closed-loop problem reporting and corrective action, configuration management, performance trending, and stringent surveillance. GIDEP failure experience data and NASA Advisory process.	Formal quality assurance program including closed-loop problem reporting and corrective action, configuration management, performance trending, moderate surveillance. GIDEP failure experience data and NASA Advisory process.	Formal quality assurance program including closed-loop problem reporting and corrective action, configuration management, tailored surveillance. GIDEP failure experience data and NASA Advisory process.	Closed-loop problem reporting and corrective action, configuration management, GIDEP failure experience data and NASA Advisory process. Other requirements based on applicable safety standards.
Software	Formal project software assurance program. Independent Verification and Validation (IV&V) as determined by AA OSMA.	Formal project software assurance program. IV&V as determined by AA OSMA.	Formal project software assurance program. IV&V as determined by AA OSMA.	Formal project software assurance insight. IV&V as determined by AA OSMA.
Risk Management	Risk Management Program. Risk reporting to GPMC.	Same as Class A.	Same as Class A.	Same as Class A.
Telemetry	During all mission critical events to assure data is available for critical anomaly investigations to prevent future recurrence.	Same as Class A.	Same as Class A.	Same as Class A.

Roles and Responsibilities

- NASA responsibility
  - Program administration
  - Moderate insight, oversight
  - Project plan approval (at KDP C)
    - Reviewed for thoroughness, PI responsible for content choices
  - Limited NASA verification except for flight safety and interfaces

- PI responsibility
  - Defines approach to managing the project
  - Defines standards, processes and practices for mission assurance
  - Mission implementation (approach & execution)
  - Performance/Cost/Schedule/Risk management
  - Design guidelines
  - Peer reviews

NASA Insight

- Interactions between NASA and PI involve participation in project reviews and Technical Interchange Meetings, Science Team Meetings, etc
- Weekly telecons/meetings keep communication open to understand implementation progress and foster discussion of issues
- Monthly reporting to NASA program coordinated with Center reporting process & products
- When issues arise, NASA may enlist the support of Subject Matter Expert (SME) to provide assessments
  - Typically done in conjunction with the project's activity or tiger teams.
  - SME observation/reporting can be used to support the project decision making process.

Reporting to NASA

- Reports provide insight and record of progress to NASA
- Reflects technical, schedule, cost and risk status as well as "look ahead"
- Weekly telecons
  - Focus on current tasks, progress to be made during the week, and issues
  - Informal format (electronic media)
- Monthly reports
  - Assess and measure progress against the investigation baseline (technical, schedule and cost)
  - Review risks, mitigation plans and issues
  - Typically includes the Project Manager Assessment, Science Status, and Integrated Performance Management metrics (cost, schedule, technical, risk) for predictive assessments of future performance
- Ad hoc telecons/meetings

Independent Review Teams

- NASA assesses technical, cost and schedule performance using IRT
- Major Reviews
  - Conduct reviews during major transitions in the mission's phases
  - Identify gaps; compare plan vs. execution; cost, schedule and resource assessment
  - Identify and recommend solutions for technical and programmatic problems or issues
- Independent Review Teams (IRT)
  - Center establishes IRT to lead major reviews (Program Office funds)
  - IRT provides report to Center, Program Office, HQ
  - IRT only involved in major reviews; not involved in day to day implementation
  - Small team (~6 members)
- Terms of Reference (ToR)
  - Developed in advance of major reviews – with clearly defined entrance and exit criteria
  - Concurred with and signed by Program Office, Project, and implementing Center/ Organization
  - Approved by Decision Authority

Responsibility for Agreements

- Principal Investigator
  - PI develops and approves all agreements between PI and other organizations (Investigation internal)
  - Interagency agreements developed by PI, in coordination with NASA HQ and Program Office, signed by SMD AA
  - International agreements developed by PI, in coordination NASA HQ and Program Office, signed by Office of International and Interagency Relations (OIIR)
- Program Office
  - Task Plans, Internal Task Agreements (ITA's), or Contracts between the Program Office and PI and implementing organizations established to document understanding of expectations and funding profile
    - Management/Development Approach
    - Scope of Work/Work Description
    - Schedule
    - Cost Estimate
    - Deliverables
    - Period of Performance

Award Process

- NASA Technical Monitor and Contractor, with guidance from the NASA Contracting Officer, finalize the Statement of Work (SOW) and the deliverables

- The NASA Contracting Officer will:
  - Request revised cost proposal and negotiate based upon finalized SOW and contract type
  - Negotiate type of contract/terms and conditions – based on best method to achieve the objective of the statement of work and project and considering the contractors cost accounting system
  - Request certified cost and pricing data

Conclusion

- Program management for EV-2 is focused on project success
- Expectations of insight and oversight will be commensurate with the classification of the mission
- PI's are responsible for managing EV-2 projects

The ESSP program office wishes you all good luck and is looking forward to working with you in the future

Backup

The People in ESSP