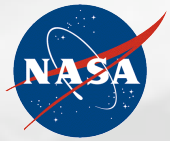

National Aeronautics and Space Administration

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Launch Approval Engineering

Nuclear Launch Safety Approval Processes for U.S. Missions: Process Overview

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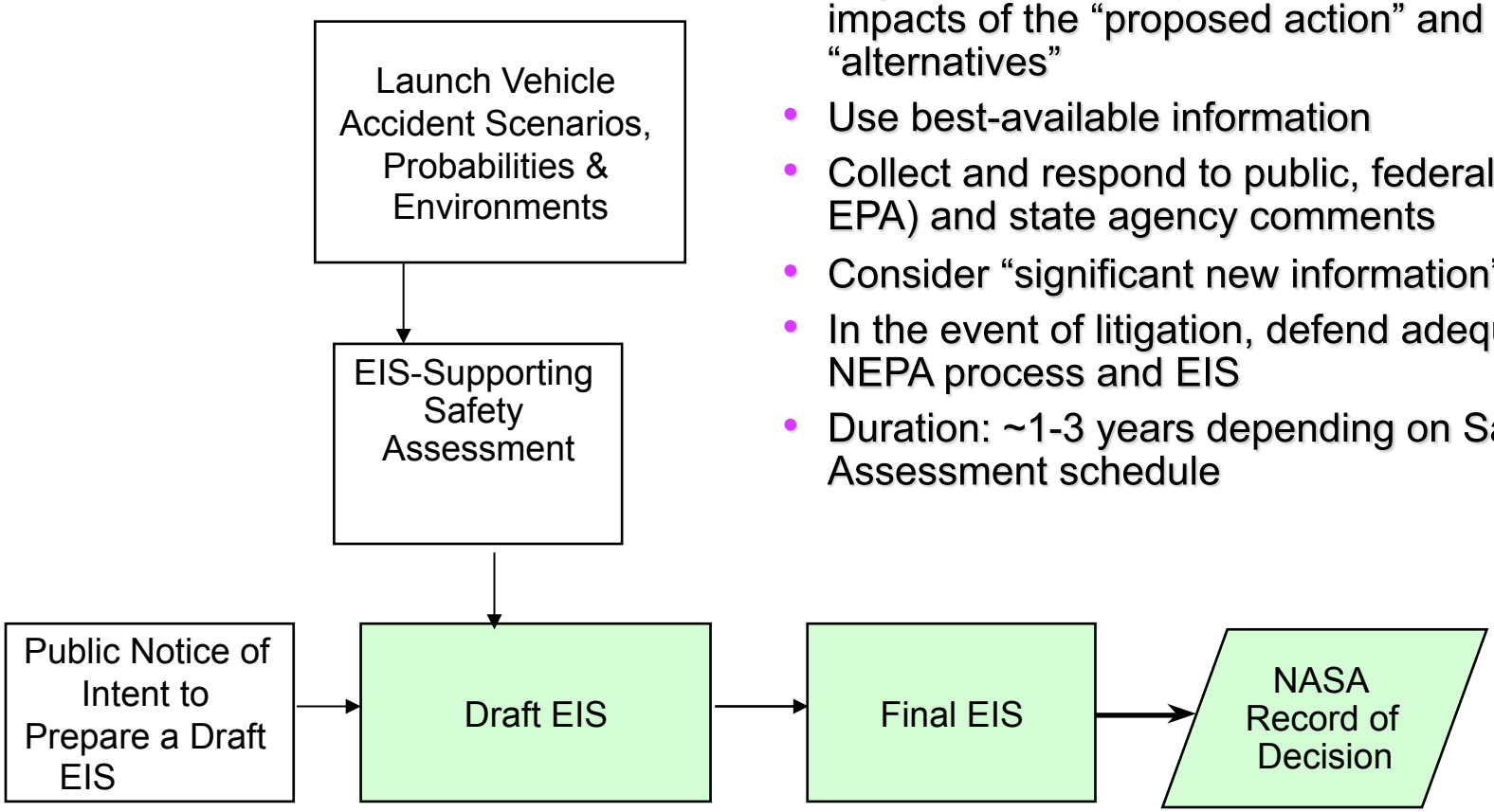
U.S. Nuclear Launch Safety Process Overview

- Process evolved from existing federal requirements
- Process has four components
  - National Environmental Policy Act (NEPA) became law in 1969
    - NASA regulations explicitly require an environmental impact statement (EIS) for flight of space nuclear power sources (i.e., radioisotope heater units, radioisotope power systems)
  - Presidential Directive/National Security Council Memorandum #25 (PD/NSC-25), "Scientific or Technological Experiments with Possible Large-Scale Adverse Environmental Effects and Launch of Nuclear Systems into Space"
    - Memorialized in 1977 a process formally in place since 1965
  - National Response Plan, Nuclear/Radiological Incident Annex originates with Federal Radiological Emergency Response Plan (1980) [Radiological Contingency Planning]
  - Risk Communication
    - RPS-specific activities originated in activities undertaken to explain risk of Galileo mission in wake of 1986 Challenger and Chernobyl accidents

National Environmental Policy Act (NEPA) Process

NASA is Required to:

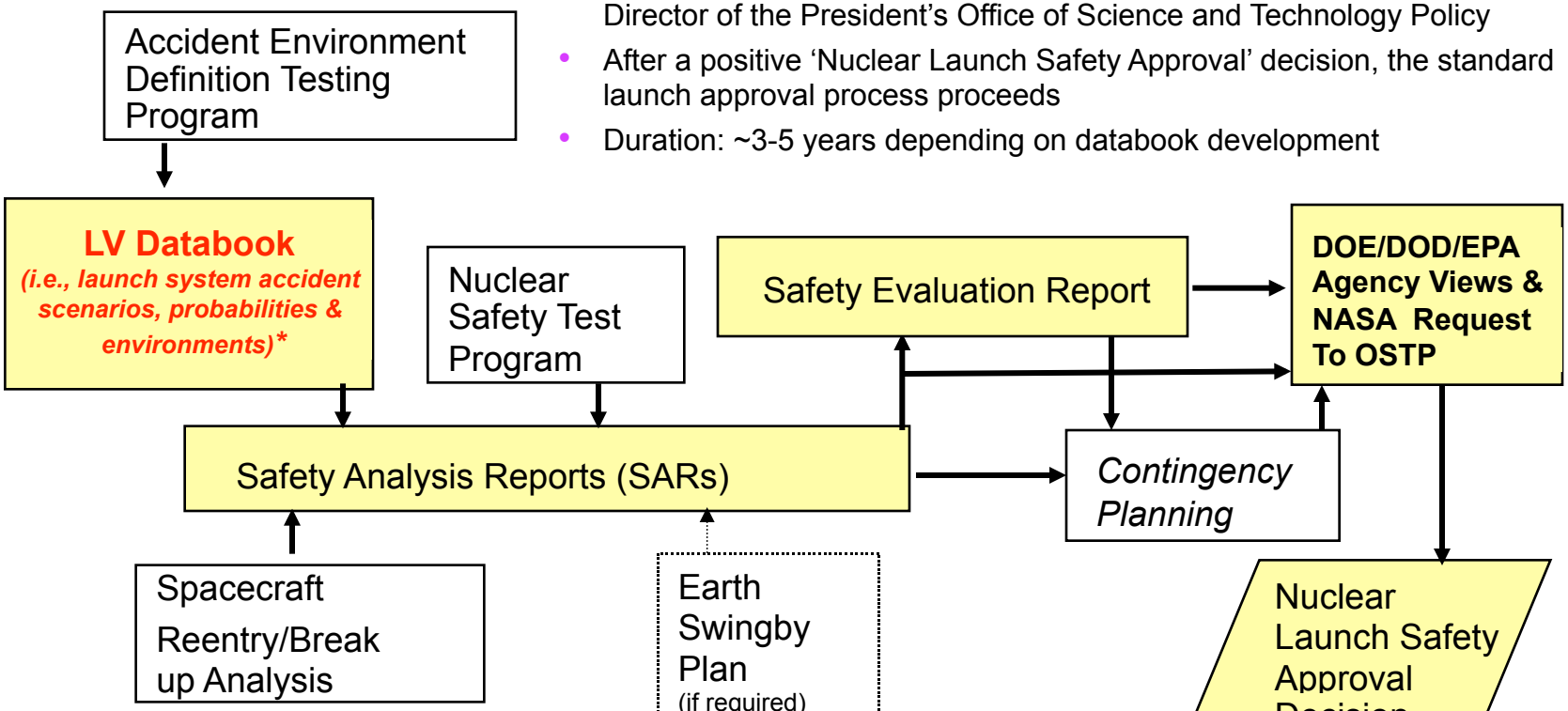
- Complete a NEPA Environmental Impact Statement (EIS) early in the Program
- Objectively assess potential environmental impacts of the "proposed action" and "alternatives"
- Use best-available information
- Collect and respond to public, federal (e.g., EPA) and state agency comments
- Consider "significant new information"
- In the event of litigation, defend adequacy of NEPA process and EIS
- Duration: ~1-3 years depending on Safety Assessment schedule



PD/NSC-25 Nuclear Safety Launch Approval Process

Requirements:

- DoE prepares Nuclear Safety Analysis Report (SAR) based on NASA-provided SAR Databook*
- Mission-specific (*ad hoc*) Interagency Nuclear Safety Review Panel evaluates SAR and prepares Safety Evaluation Report (SER)
- SAR and SER Reviewed by DOE, DOD and EPA
- NASA Administrator requests nuclear safety launch approval through Director of the President's Office of Science and Technology Policy
- After a positive 'Nuclear Launch Safety Approval' decision, the standard launch approval process proceeds
- Duration: ~3-5 years depending on databook development

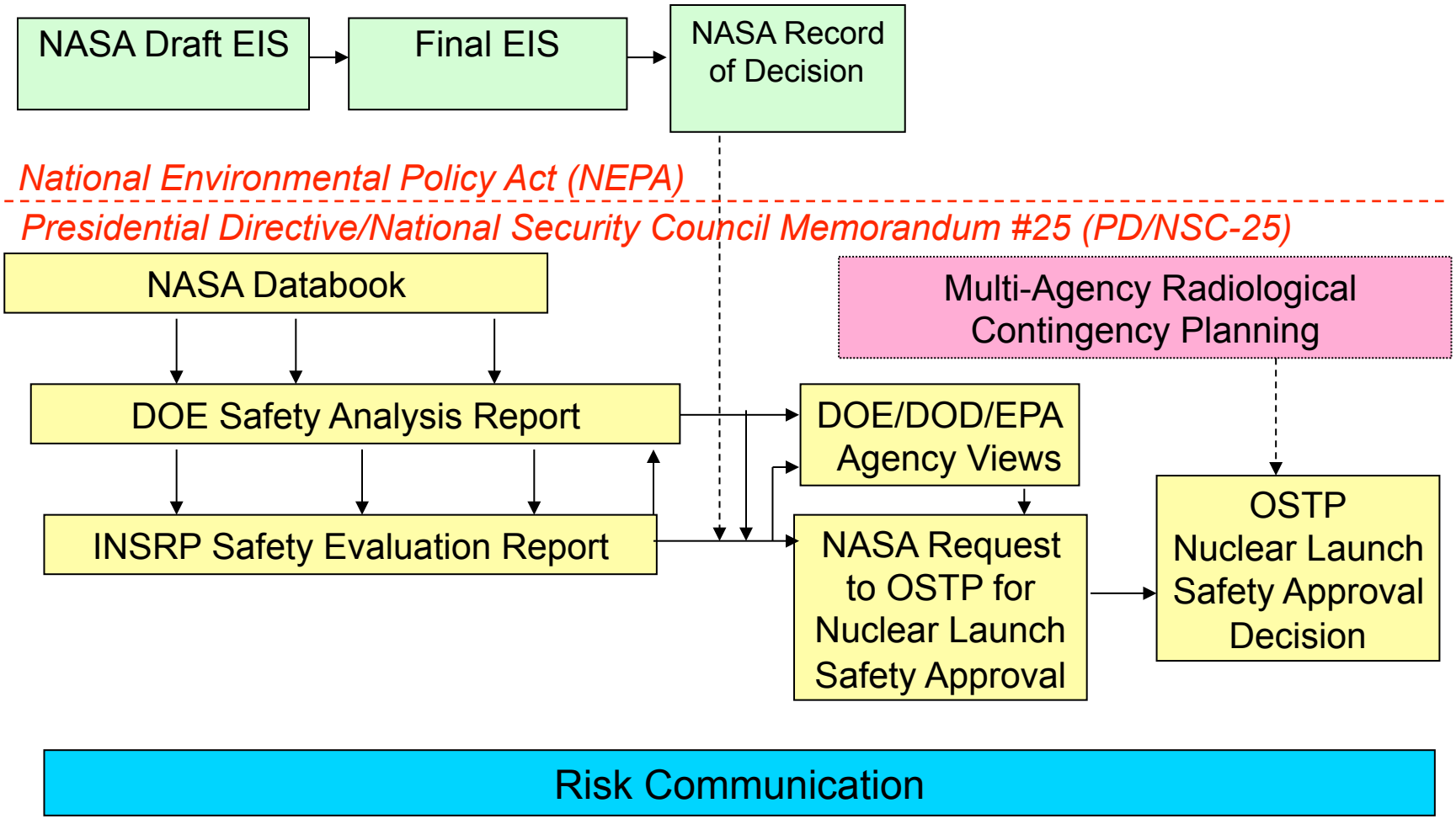


* Primary critical schedule path delivery

Comparison of NEPA and PD/NSC-25 Processes

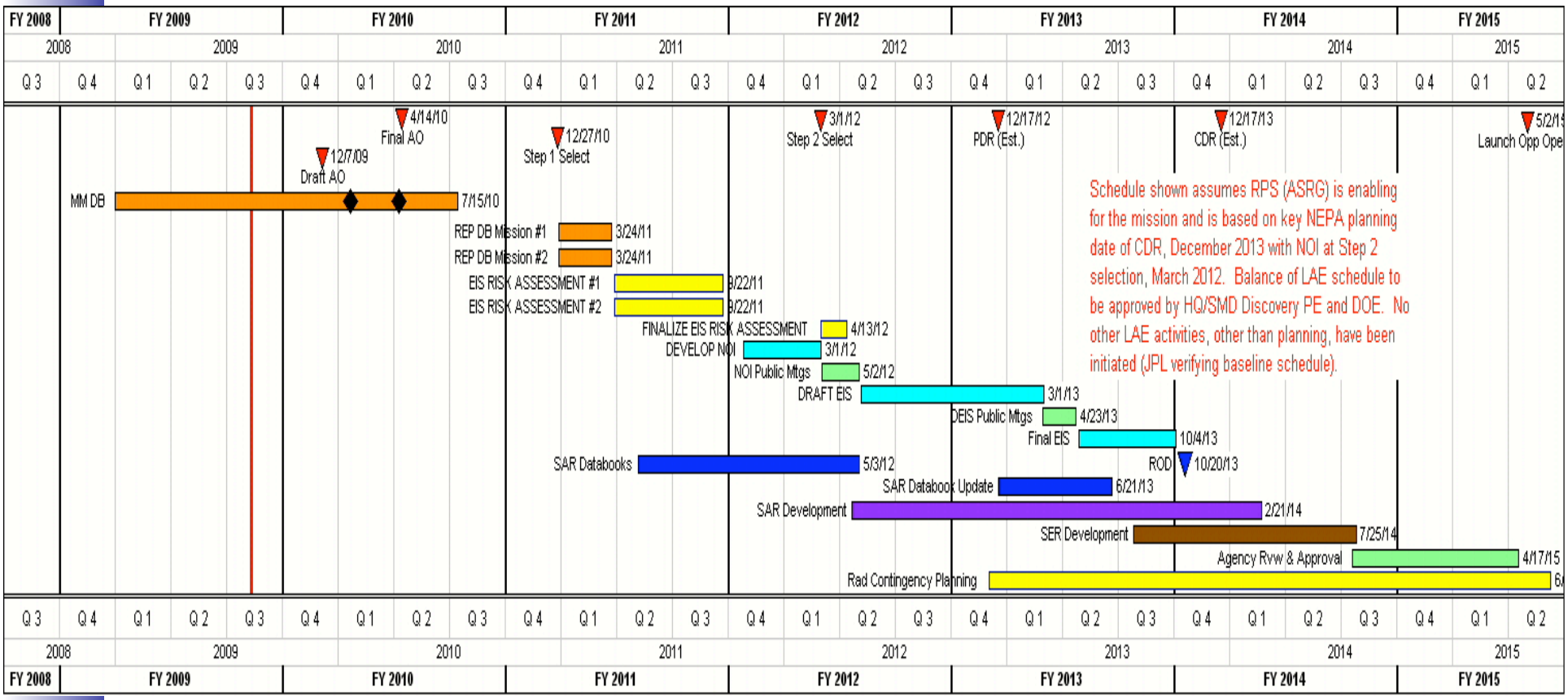
Process Component	NEPA Process	PD/NSC-25 Process
Decision	Proceed with activities to support mission development, integration, test, and launch	Approve launch nuclear safety
Decision Maker	Cognizant Associate Administrator for the mission	White House Office of Science & Technology Policy Director (or President)
Target Timeframe for Decision	Early Design/ Development Phase	Late development phase
Review Mode	Public, government, non-governmental organizations, etc. participation; full public disclosure of draft/final EIS including underlying documents and agency response to comments prior to decision	Mission-specific Interagency Nuclear Safety Review Panel (INSRP) coordinates independent agency evaluations; deliberations and documents internal to the government until White House decision made

Nuclear Launch Safety Process



DOE – Department of Energy
EPA – Environmental Protection Agency
DOD – Department of Defense
INSRP – Interagency Nuclear Safety Review Panel
EIS – Environmental Impact Statement
OSTP – White House Office of Science and Technology Policy

Launch Approval Engineering Summary Schedule – Discovery



NASA HQ Program Executive Launch Approval Responsibilities

- Ensure compliance with launch approval process requirements to support launch schedule
  - Ensure that launch approval engineering resource requirements are sufficiently met to support data requirements in schedule
  - Establish, monitor and track launch approval schedule
  - Develop and maintain effective interfaces with launch approval decision authorities (both internal and external to NASA)
- Facilitate reconciliation of launch approval requirements with spacecraft and launch vehicle development plans
  - Launch vehicle selection required early
  - Standard launch system and spacecraft design vs. spacecraft and launch system design changes motivated by nuclear risk reduction
- Lead NASA HQ efforts to assure development of site-specific ground operations and radiological contingency plans
- Serve as primary NASA Headquarters spokesperson and program lead for mission's nuclear safety risk communications

Project Inputs and Support to Launch Approval Engineering Processes

- NEPA
  - Spacecraft/mission descriptions
  - Alternative power system/trajectory design information
  - Participation in reviews, public meetings and response to government/public comments
- PD/NSC-25
  - Detailed spacecraft/mission design information
  - Trade studies and implementations supporting NPR 8715.3 paragraph 6.2.2
    - "b. Basic designs of vehicles, spacecraft, and systems utilizing radioactive materials provide protection to the public, the environment, and users such that radiation risk resulting from exposures to radioactive sources are as low as reasonably achievable."
    - "c. Nuclear safety considerations are incorporated from the initial design stages throughout all project stages to ensure that overall mission radiological risk is acceptable."
  - Participation in reviews
- Radiological Contingency Planning
  - Out-of-orbit contingency plans
  - Accident response team support
  - Participation in reviews
- Risk Communication
  - Public spokespersons
  - Fact sheets, response-to-queries, web pages, etc.