PI-Team Composition

Principal Investigator

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PI Outline

- PI Qualities
- PI Responsibilities
- Mission organization
- Mission schedule
- Science and mission traceability matrices
- Descope principles
- Example PI Challenges

PI Leadership Qualities

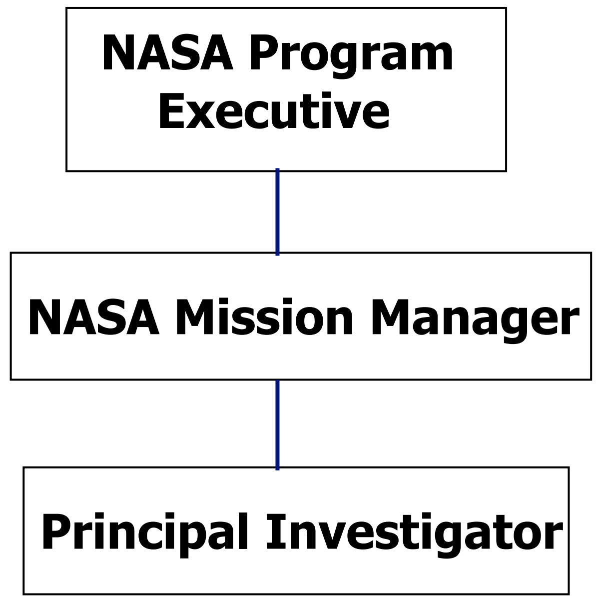
- Inspire and motivate
- Develop ownership*
- Foster cooperation and communication
- Stimulate creativity (empower the team)
- Develop trust
- Recognize talent
- Communicate mutual goals and objectives effectively
- Know what and when to delegate
- Be willing to pay the price – sacrifice your time – burn your bed*
- Engender loyalty
- Listen
- Be a problem solver
- Anticipate problems*
- Encourage
- Acknowledge performance well done

PI Responsibilities

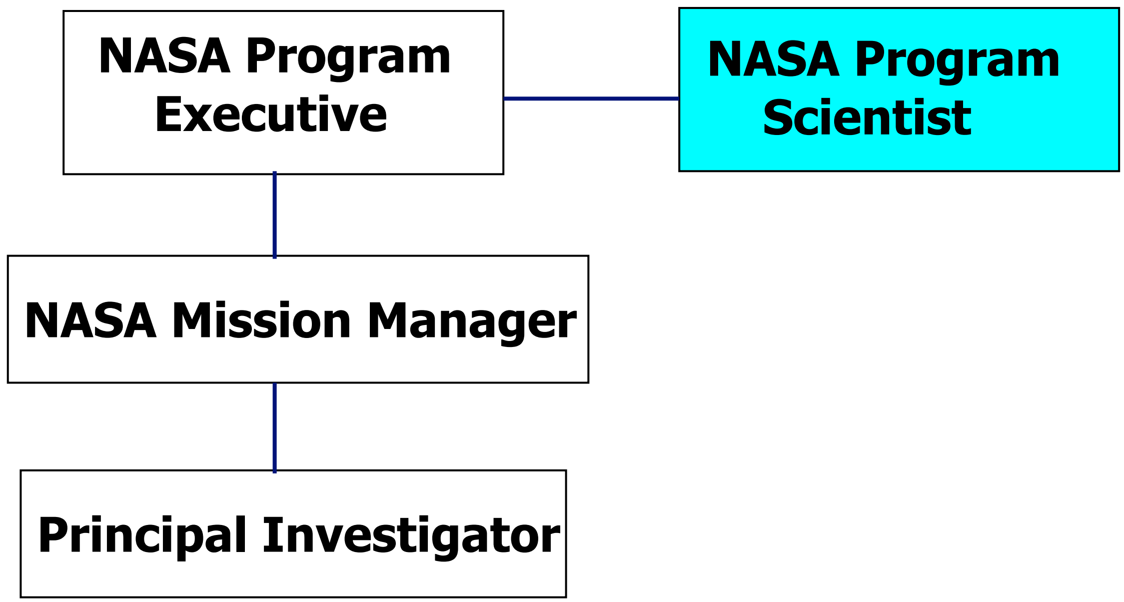
- Leader
- Team organizer
- Team builder
- Establish a ‘whole team’ approach*
- Team Communicator---do not isolate yourself*
- The one person who feels the total responsibility to make the mission succeed*
- The one who has the mission big picture always in mind
- Make sacrifices of time and effort
- Manager of all team elements from hardware to scientific journal article publications
- Ultimate decision maker after debates
- Final cost authority at the project level

Mission Organization

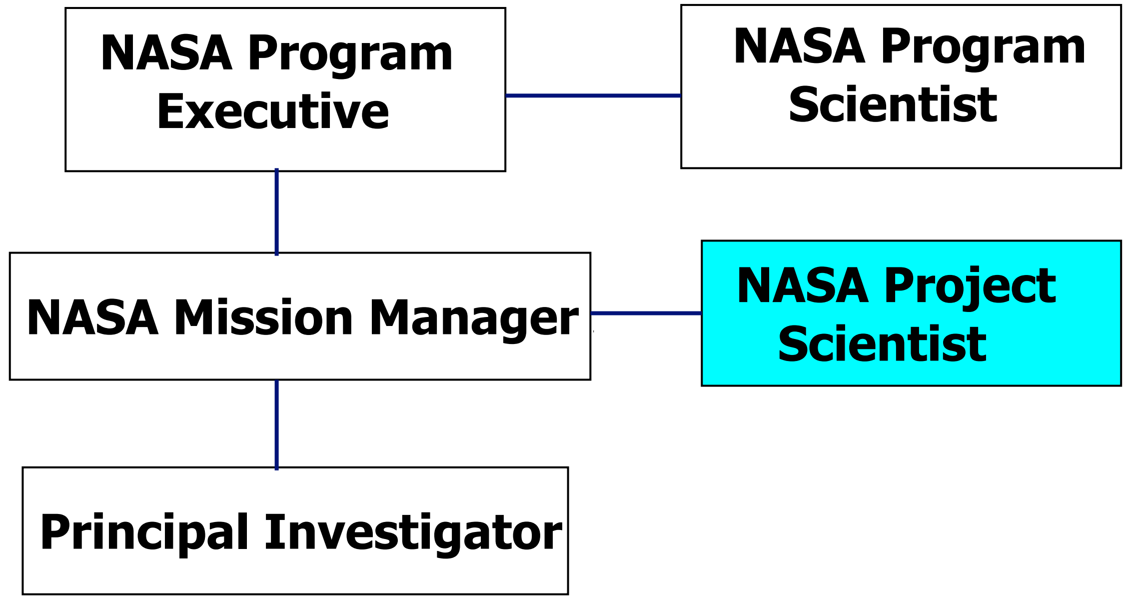
NASA Program Executive, NASA Mission Manager and the PI



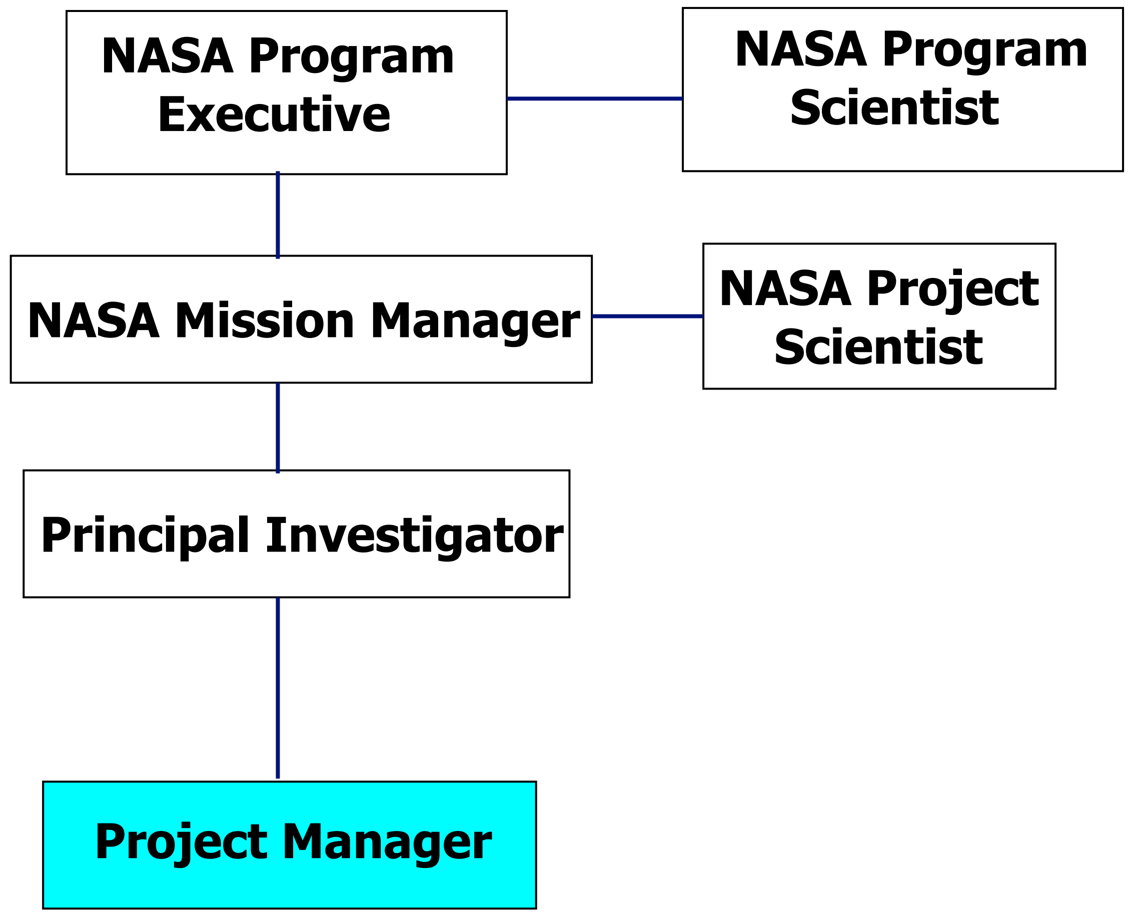
Relationships with the Program Scientist



Relationships with the Project Scientist



Principal Investigator and Project Manager Relationships



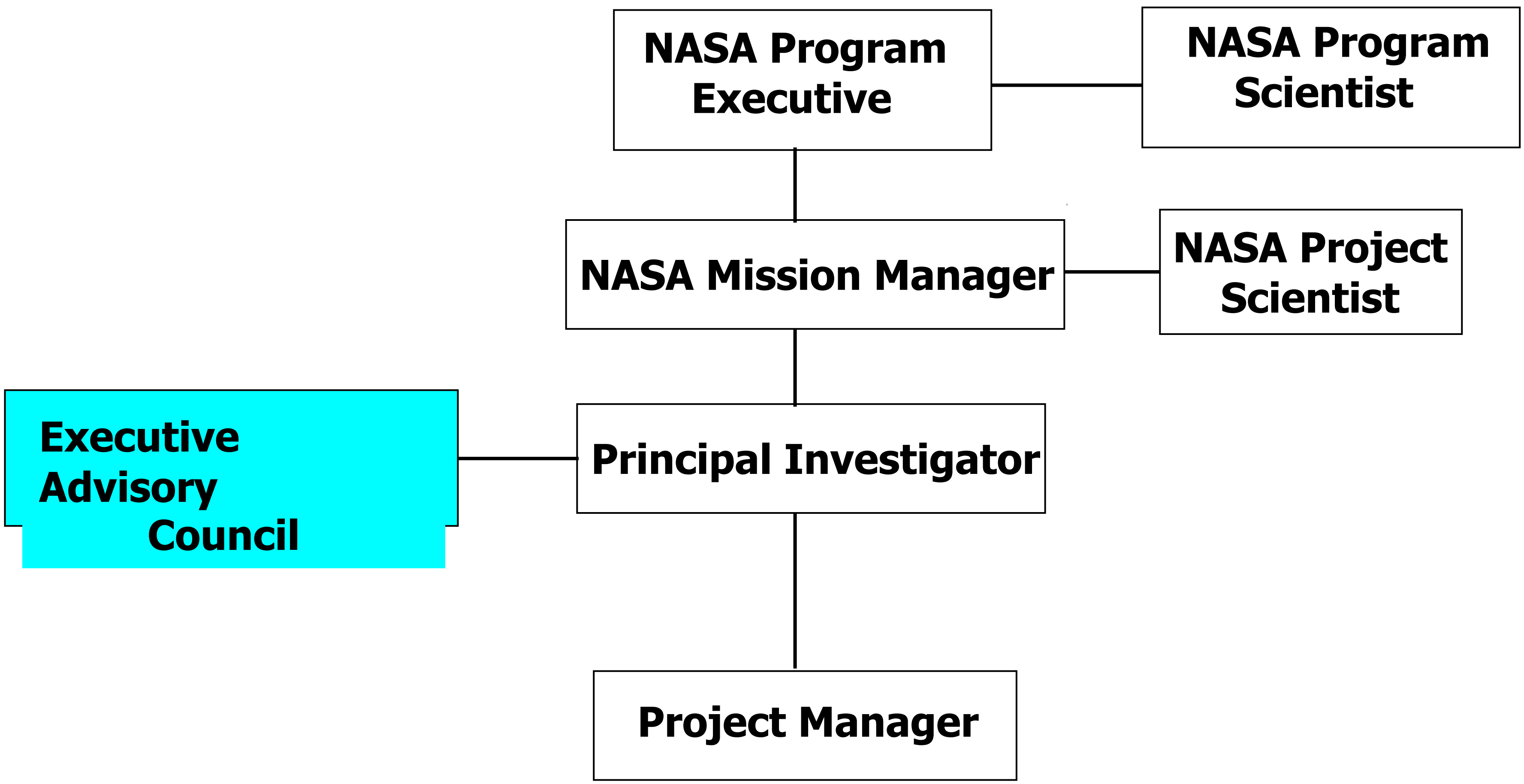
Selecting and working with the Project Manager

- Second to the PI, a strong PM is the most important member of your team
- There must be chemistry between you and the PM. If not, you must make it so
- The PM must be well respected and have a great relationship with the implementing organization
- If PM is not at the PI's institution, a signed agreement must be put in place stating that the PM works for the PI.
- The two of you will ensure that the mission meets its objectives within the resources proposed

PI Delegation

- **Delegate most of the day-to-day decision making authority to the PM**
- **You must not build in a mentality of new/more money will come as problems arise**
- **Make it known that you will hold the line on cost**
- **Decide on thresholds for PM to have authority to decide and expend resources**
- **Develop reporting vehicles for your use, e.g., planned vs. actual key milestones, manpower and cost**

The Executive Advisory Council Role

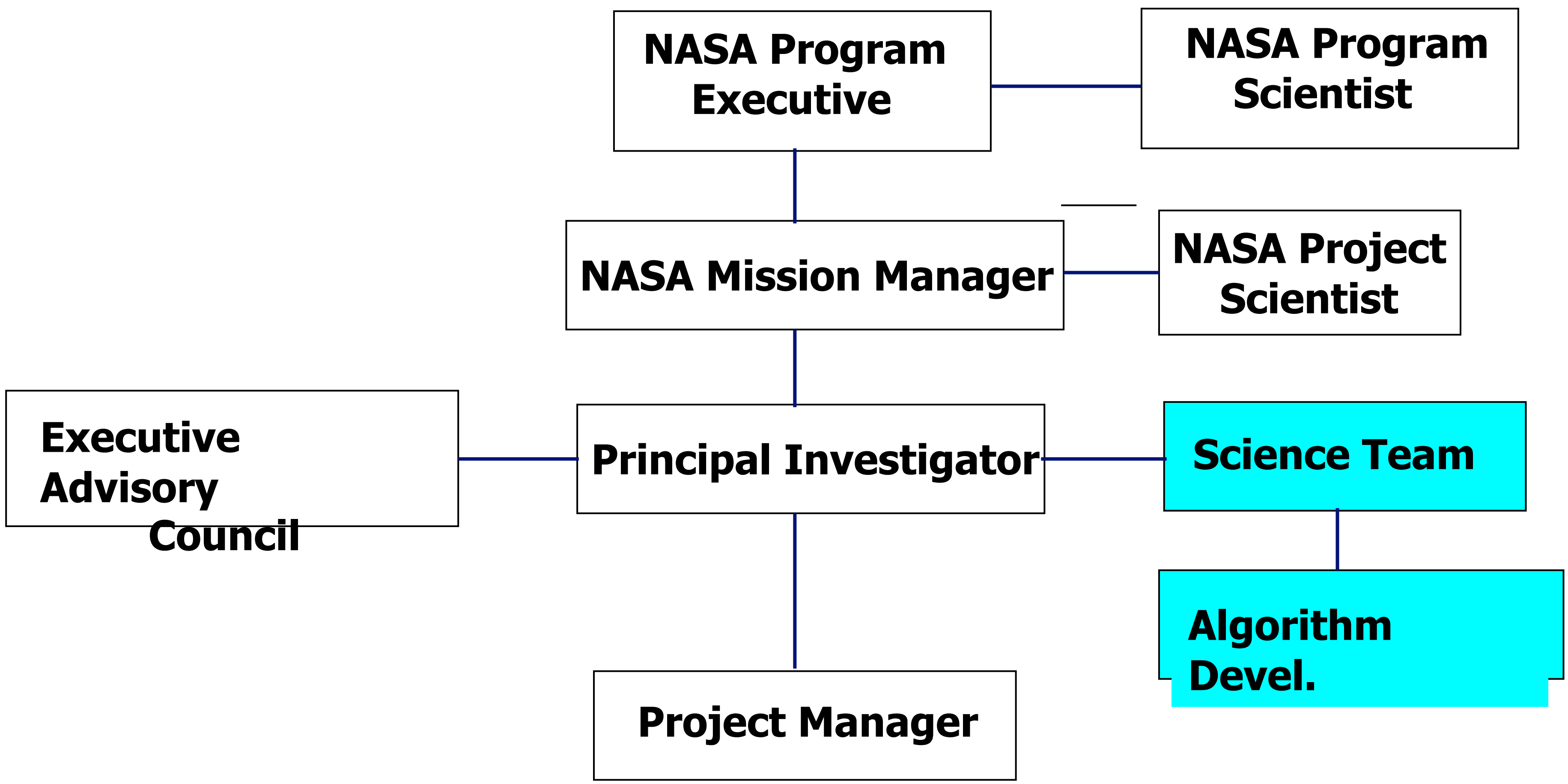


Executive Advisory Council Considerations

What are the key considerations in forming an Executive Advisory Council? How is this council used to help in the development?

- **A key council to help control costs**
- **Members must be in a position to control organization physical, fiscal and people resources**
- **Keep them in the information flow --- good and bad**

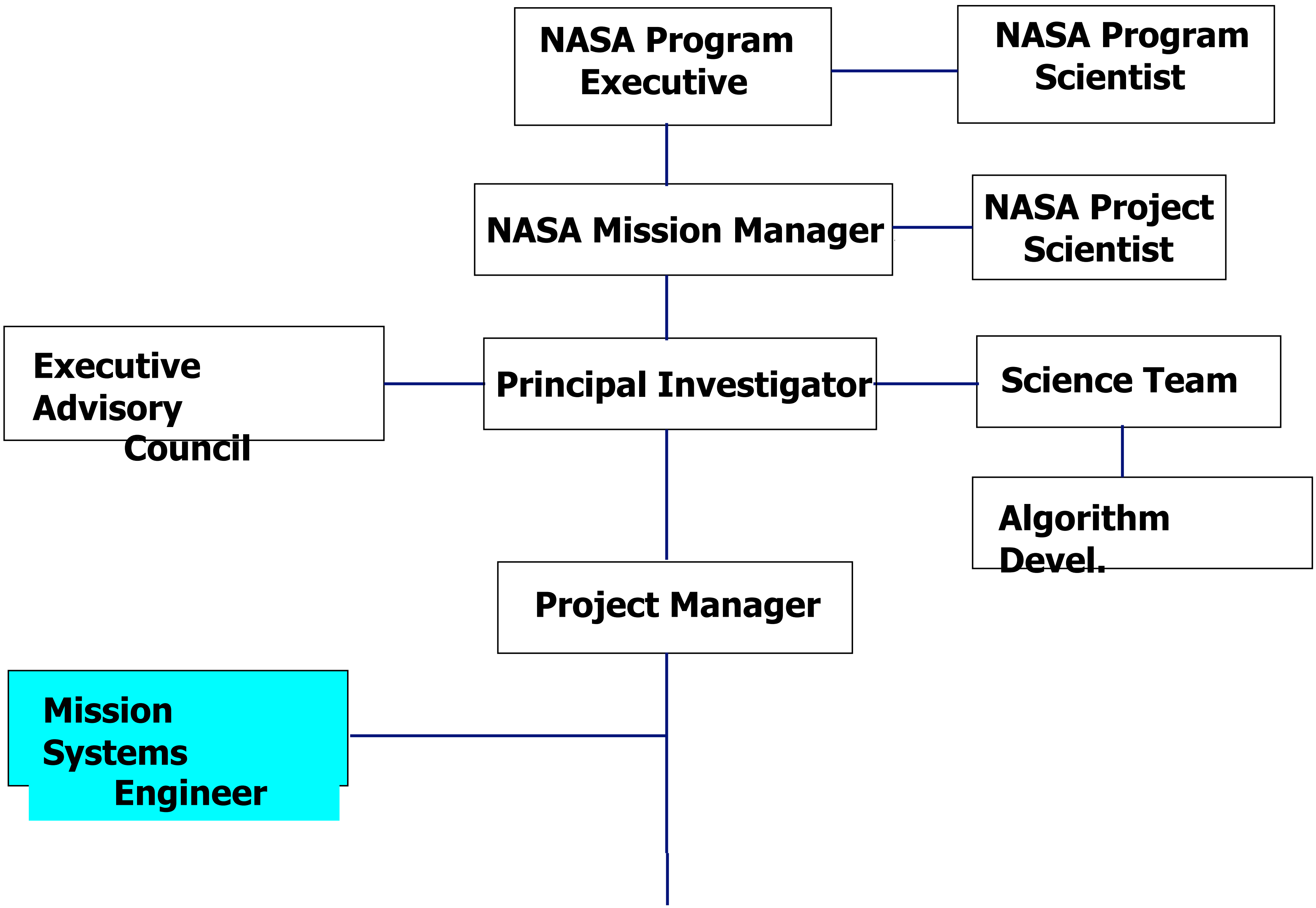
Science Team and Algorithm Development



Science Team Considerations

- Organization rationale
- Instrument (s)
- Algorithm team
- Cost awareness
- Validation team — e.g., leader can be experimentalist or modeler
- EPO – science team member oversight will maximize return

Mission Systems Engineer



Mission Systems Engineer

- Key translator of science-to-technical requirements
- The MSE understands all technical parts of the mission and how they come together
- Develops the Mission Requirements Document. The MRD flows from the Science Requirements Document.
- These documents become the underpinnings for the mission. Here is where you stop mission creep. The MRD becomes sacrosanct! *
- Implements requirements tracking system, e.g. DOORS

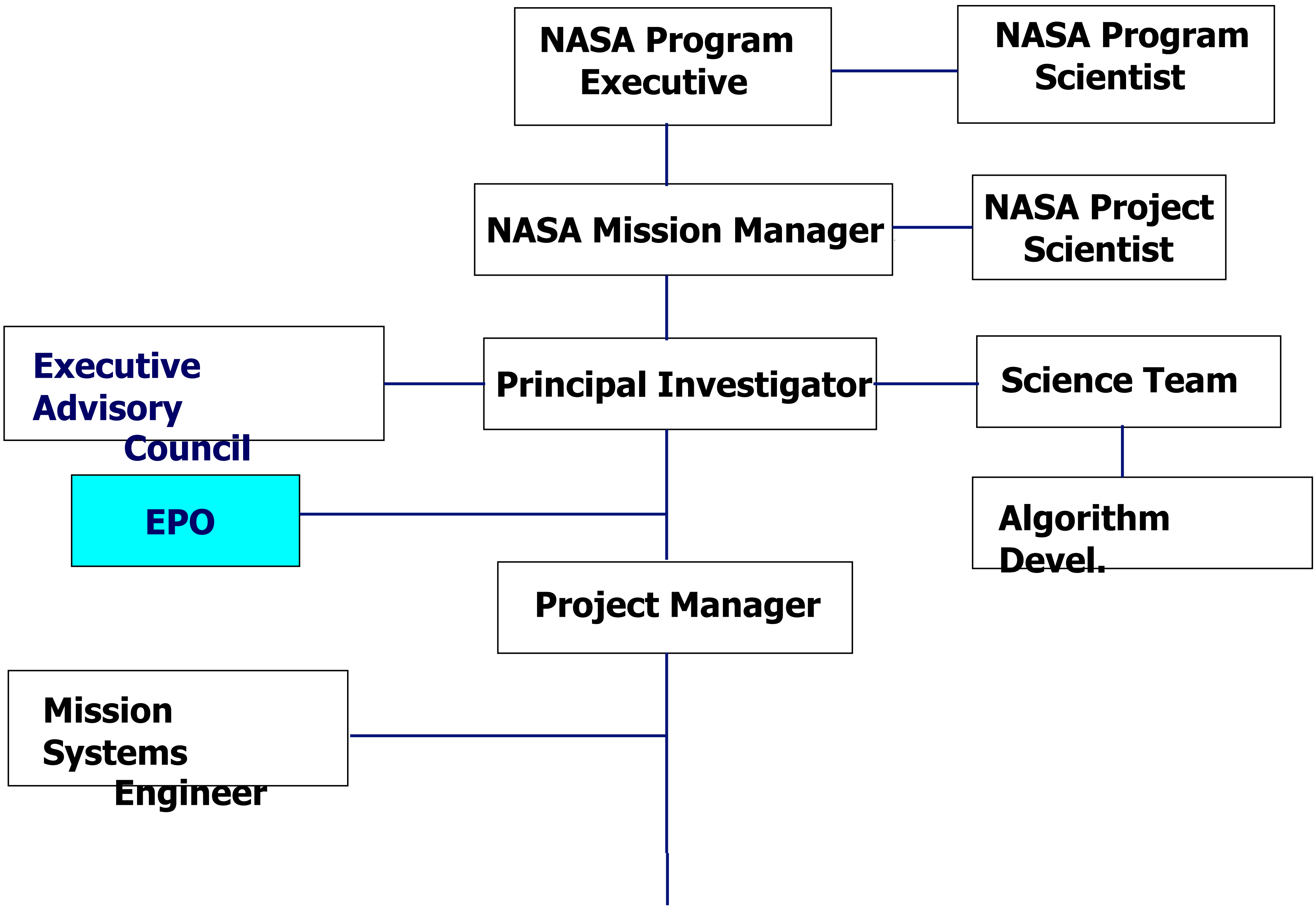
Example Science Traceability Matrix

Science Goals	Science Objectives	Scientific Measurement Requirements		Instrument Functional Requirements		Projected Performance	Mission Functional Requirements (Top Level)
		Observables	Geophysical parameters				
How does the presence of waves affect the atmospheric structure of planet X	What is the global morphology of gravity wave activity?	CO_2 absorption	Temperature	Alt. Range	5 – 40 km	1 - 60 km	Four different observing strategies: Solar, limb, nadir, zenith; requires yaw and elevation maneuvers Launch window: 6 minutes to meet nadir and limb overlap requirement. Window applies day to day Need 2 seasons to see planetary wave activity transition Need 8 months of observation
				Vert. Resol.	3 km	1.5 km	
				Horiz. Resol.	10 deg x 24 lat x lon	5 deg x 24 lat x lon	
				Temp. Resol.	10 min	5 min.	
				Precision	3 K	1 K	
				Accuracy	8 K	5 K	
	Objectives 2 to n			Repeat above categories			

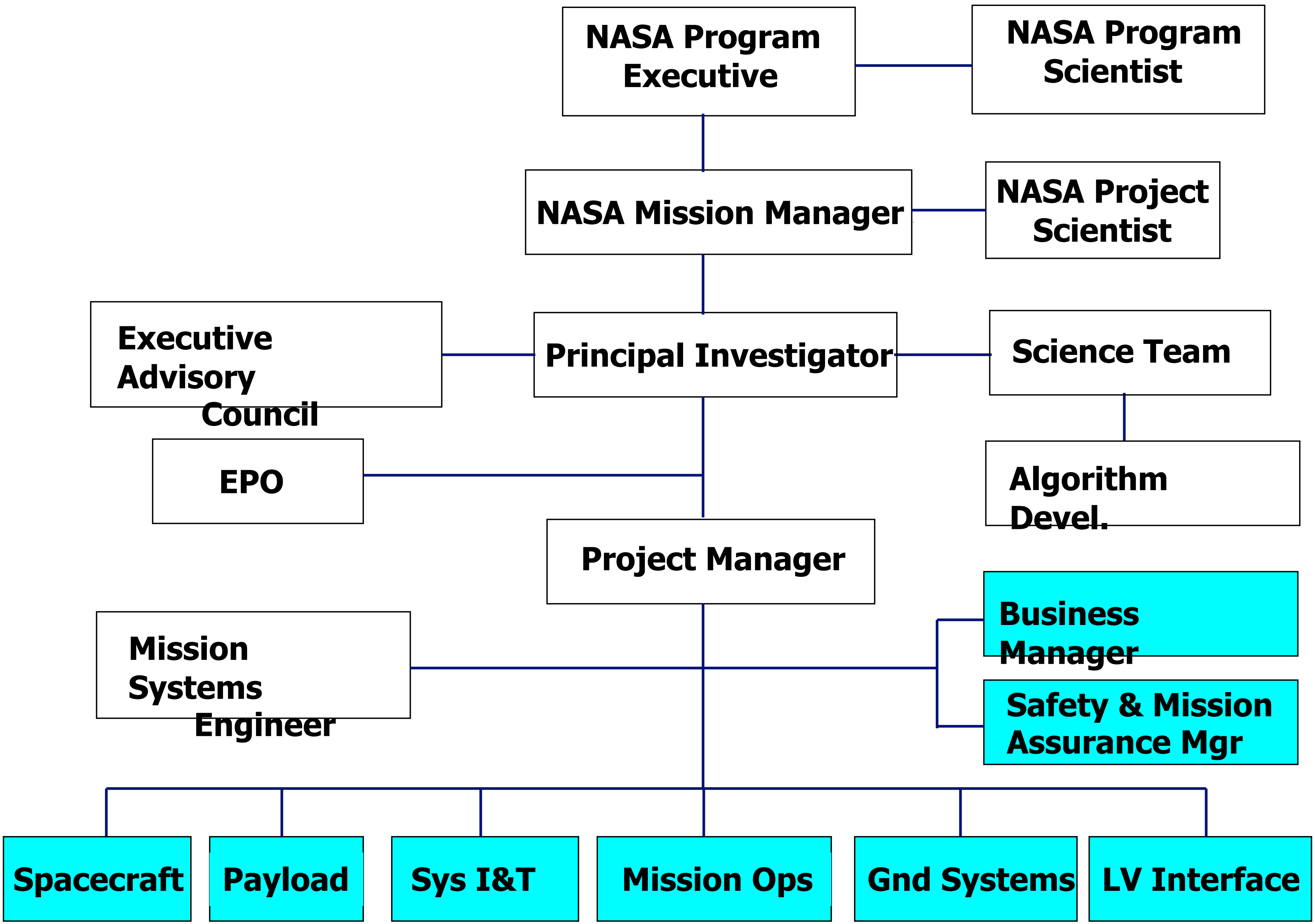
Example Mission Traceability Matrix

Mission Requirements	**Spacecraft Requirements**	**Ground System Requirements**	**Operations Requirements**
Rocket type Launch date: Mission length Orbit altitude requirement and rationale Geographic coverage and how it drives orbit requirement Orbit local time and rationale for the requirement Type of orbit, e.g. Sun synchronous, precessing, Lagrangian point, other Other	Spinning, stabilized Mass Power Volume Data Rate Temperature Range for spacecraft systems Pointing: Control: Knowledge, Stability, Jitter, Drift, Other Detector radiation shielding requirements and rationale Other	Passes per day and duration Assumed antenna size Data volume per day Real time data transmission requirements Transmit frequency Power available for communications (Watts) Downlink data rate, Number of data dumps per day Spacecraft data destination (e.g., mission operations center) Science data destination (e.g., science operations center Other	General spacecraft maneuver requirements and frequency Special maneuvers requirements Rationale for maneuvers Ephemeris requirements Changes in viewing modes and directions per orbit, per day or over longer time periods. Rationale for these changes Other

Education and Public Outreach (EPO)



The total integrated team must work together



Descope Principles

Descope Considerations

- Clear baseline science goals, objectives and baseline mission
- Measurements identified that lead to clear closure
- Carefully thought out minimum (floor) mission objectives
- An allowable degradation plan should be formulated, i.e. which descopes should be taken and in what order
- Descopes that unambiguously show the connection with baseline science objectives and the science "hit"
- Science descope "hit" should be quantified, i.e. relate back to baseline and loss of science
- The point in development when descope decision must occur should be clearly stated
- The cost, mass and schedule saving for the descope must be delineated
- Is a shortened mission a reasonable descope to propose?