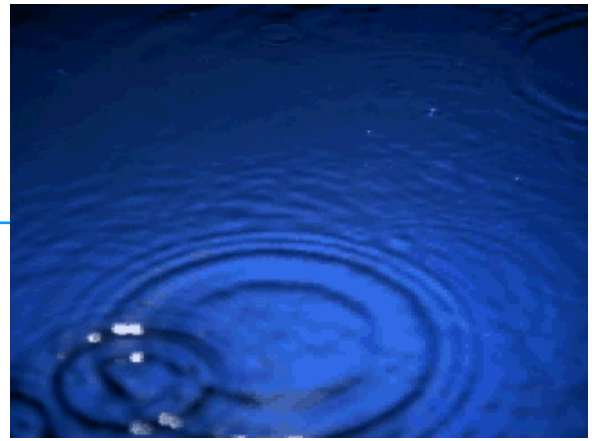
Global Precipitation Measurement

System Requirements Review
Constellation Spacecraft Concept



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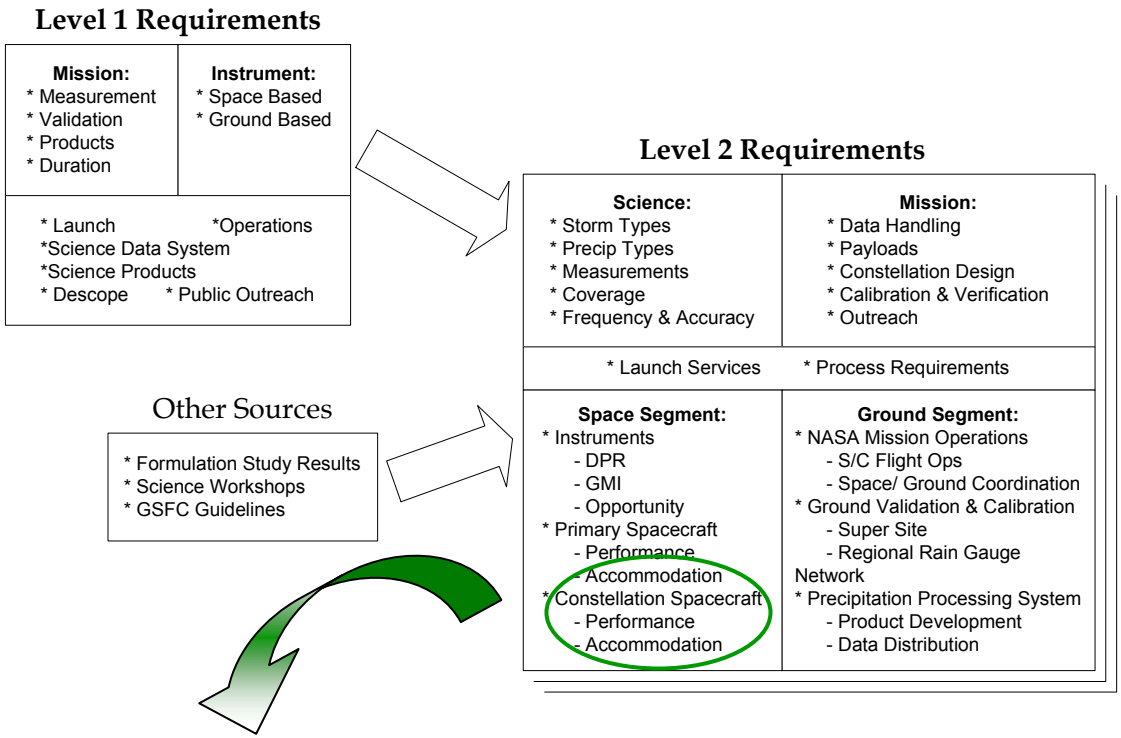
David Everett 301/286-1596
David.Everett@gsfc.nasa.gov
Goddard Space Flight Center

Outline

- *Driving requirements*
- *Options for acquisition*
- *Studies performed*
- *Mass*
- *Risk assessment*
- *Schedule*
- *Future trades*

Constellation Spacecraft Level 2 Introduction



Spacecraft Requirements:

- Lifetime
- Launch Vehicle Interface
- Operational Orbit
- Performance
- Autonomous Operations
- Payload Accommodation

Constellation Spacecraft Requirements

- ***Lifetime – 3 years with 5 year goal*** ***[5.4.1]***
  - *Satisfies L1R*
- ***Probability of Returning Instrument Data – GMI [5.4.2]***
  - *Provides a means to evaluate reliability design decisions*
- ***Geolocation of Measurements – GMI*** ***[5.4.4]***
  - *Needed to relate measurements to models and co-observations*
- ***Orbits –Operational*** ***[5.4.3]***
  - *Defines orbits to satisfy coverage and mission life*
- ***Instrument Accommodation*** ***[5.4.10]***
  - *Defines technical resources needed by the payload*
- ***Attitude Control & Knowledge*** ***[5.4.5,-6]***
  - *Needed to support geolocation and co-observations*
- ***Communications*** ***[5.4.11]***
  - *Defines uplink, downlink, data allocations*
- ***Use GPS*** ***[5.4.8]***

Driving Requirements

- ***Mission Objective: provide radiometric measurements of precipitation to improve GPM sampling.***
- ***Single instrument—microwave radiometer***
- ***Lifetime: 3 years, 5-year goal (5.4.1)***
- ***Probability of retrieving 3 years of science data: TBD (5.4.2)***
- ***End-of-life disposal (L1 req): design for uncontrolled deorbit***
  - *Small spacecraft*
  - *Minimal fuel requirements*
- ***Orbit near 600 km altitude (5.4.3)***
  - *Lowest fuel requirement; lower orbits require more drag makeup and higher orbits require fuel to drop perigee at end of life.*
  - *Better coverage than at lower orbits (wider swath)*
  - *Better resolution than 800 km*
- ***Inclination: TBD***
- ***Point instrument to within 0.2°, determine IFOV to within 1 km (5.4.4-7)***
- ***TDRSS-MA communications, GN backup (5.4.11.1)***
- ***Taurus Launch (baseline concept)***

Options for Acquisition

- ***Spacecraft bus:***
  - *Rapid Spacecraft Development Office (RSDO)*
  - *Dedicated procurement*
- ***Instrument:***
  - *In-house Synthetically Thinned Aperture Radiometer (STAR)*
  - *GPM Microwave Imager (GMI) duplicate instrument*
  - *Reduced-mass version of GMI*

Studies Performed

- ***Integrated Mission Design Center (IMDC) studies***
  - *July 2000 using STAR*
  - *August 2001 using GMI-type radiometer*
- ***RSDO vendor study—4 vendors in the fall of 2000 using STAR***
- ***Orbit studies to evaluate options***

IMDC August 2001 Study

MISSION MASS	
Payload Total	70.0
Bus Subsystems Total	324.1
Actual Mass (Bus+Payload)	**394.1**
Contingent Mass (Bus+Payload+20%)	**472.9**
Taurus 2110 capability 400 km / 60 degree	1030.0
Interstage Adapter Structure	115.0
Per s/c capability 400 km / 60 degree	**457.5**
Margin against actual mass [%]	13.9
Margin against contingent mass [%]	-3.4
Taurus 2110 capability 400 km / 40 degree	1200.0
Payload Support Structure	115.0
Per s/c capability 400 km / 40 degree	**542.5**
Margin against actual mass [%]	27.4
Margin against contingent mass [%]	12.8

Risk Assessment

- ***Minimal risk for spacecraft:***
  - *No new technologies.*
  - *Adequate time to work trades and procurement.*
- ***Some concern that the GMI may have more capability than necessary to achieve science requirements for this spacecraft—impacts mass and power, but common buy with primary spacecraft reduces cost.***
- ***Some possibility that the Taurus will not be available in 2007—impacts cost.***

Schedule

- *RFP in the fall of 2004*
- *Launch summer of 2008*

Future Trades

- *Trade among instrument capability, instrument commonality, target orbit, partnering, and ride sharing*