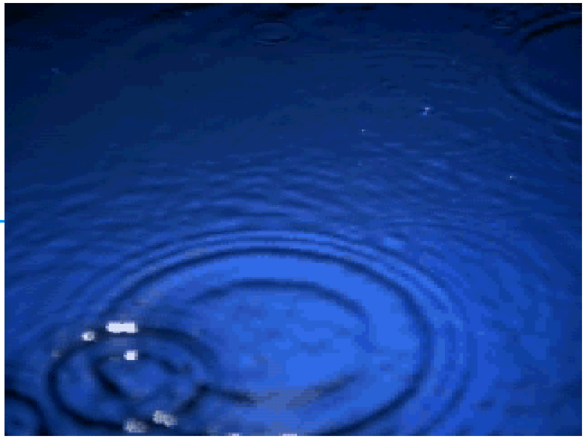
Global Precipitation Measurement

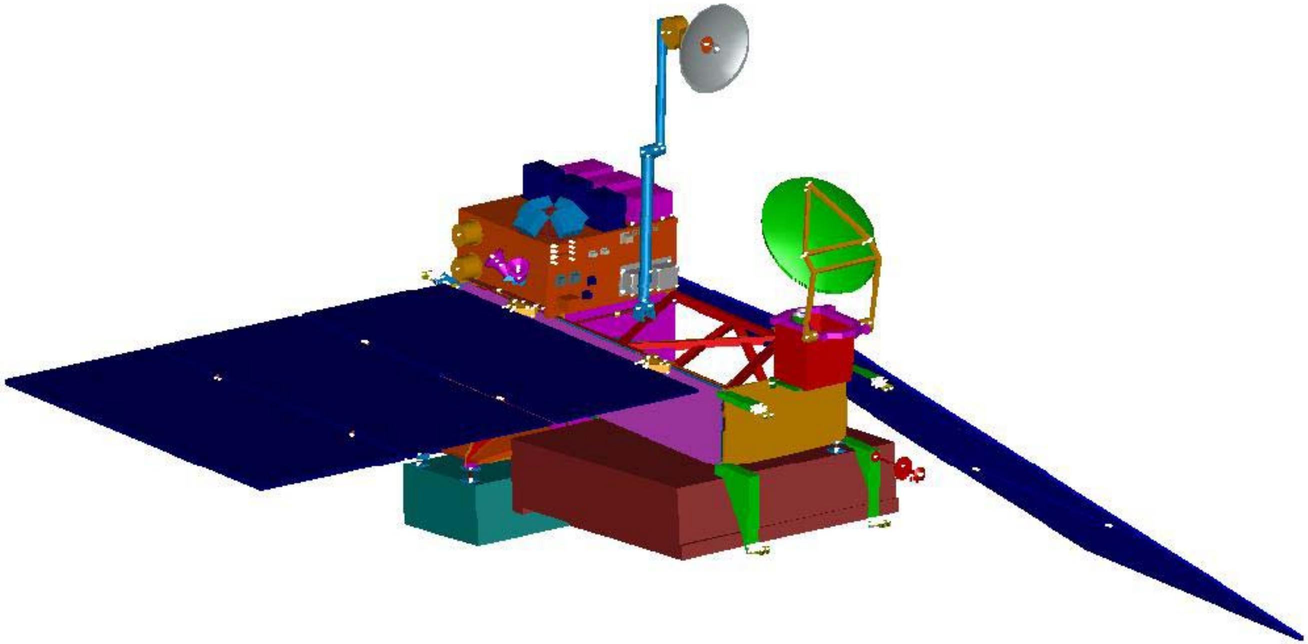
System Requirements Review – Core Spacecraft



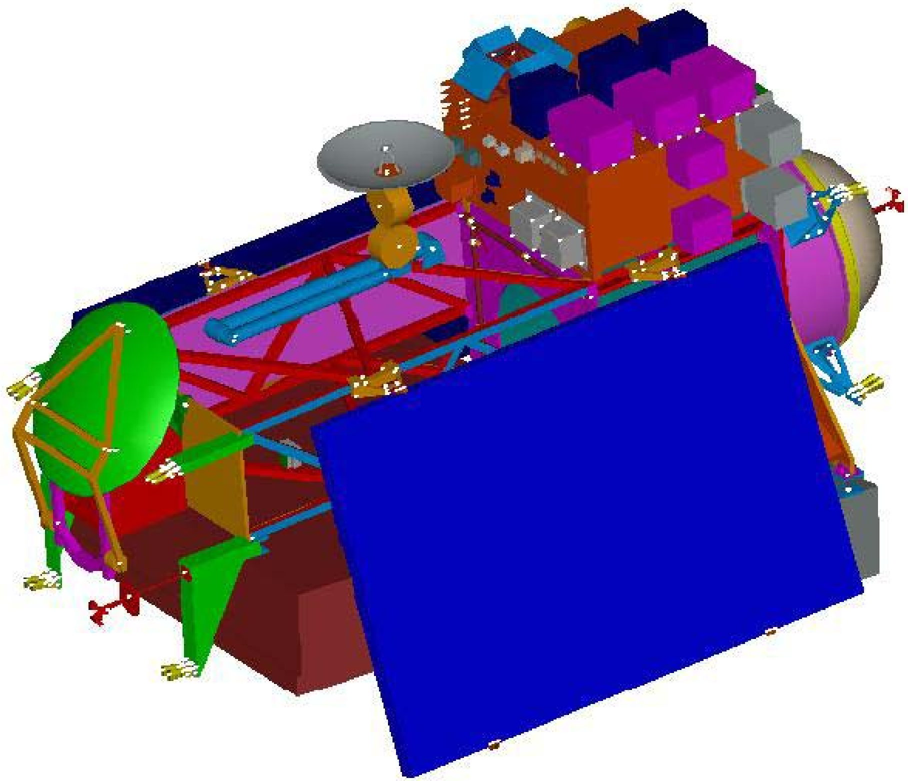
June 4 - 5, 2002

John Durning 301/286-2508
John.durning@gsfc.nasa.gov
Goddard Space Flight Center

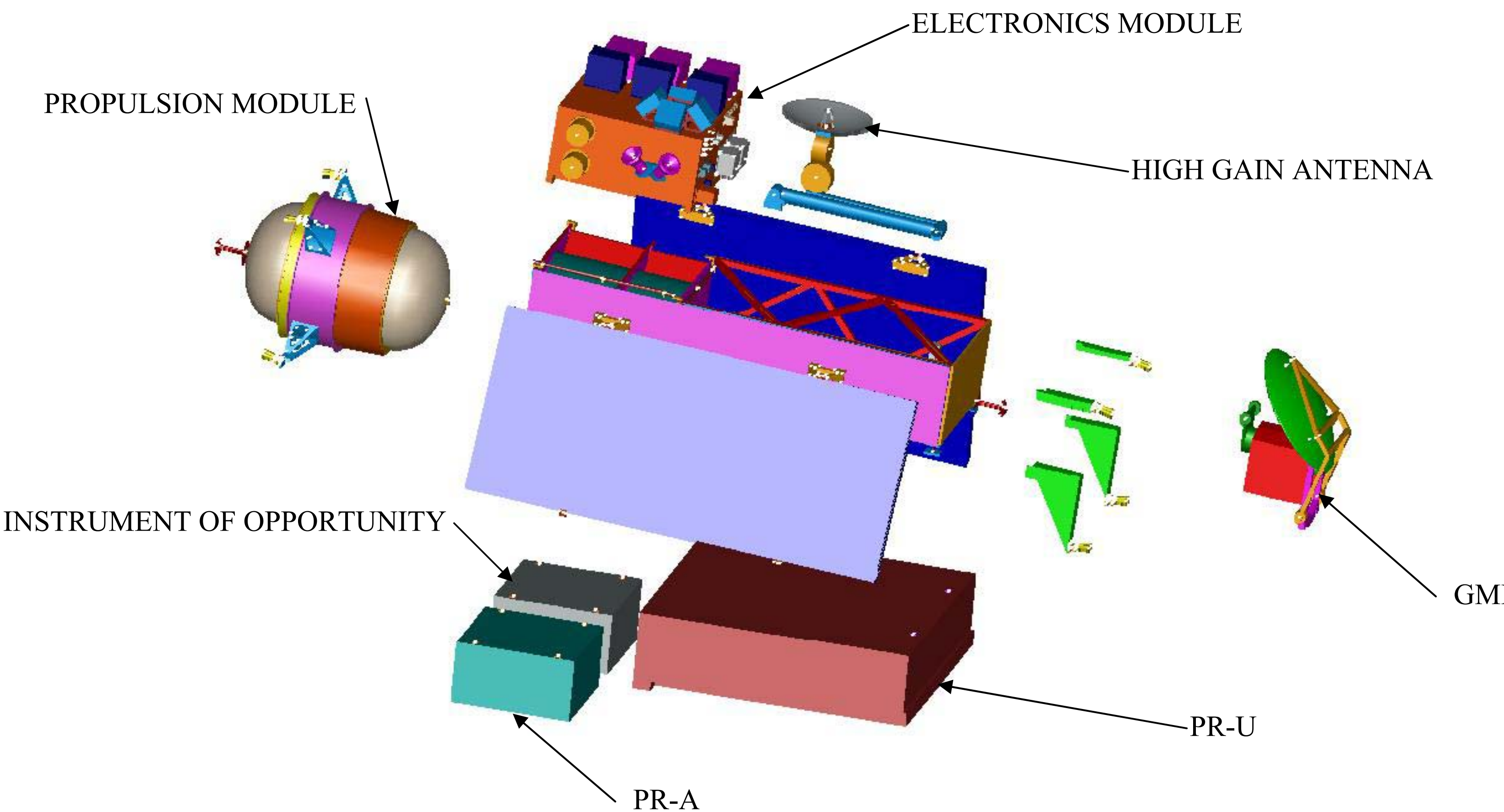
- ***The GPM core spacecraft has been identified as an in-house formulation effort here at GSFC.***



GPM Core Spacecraft - stowed

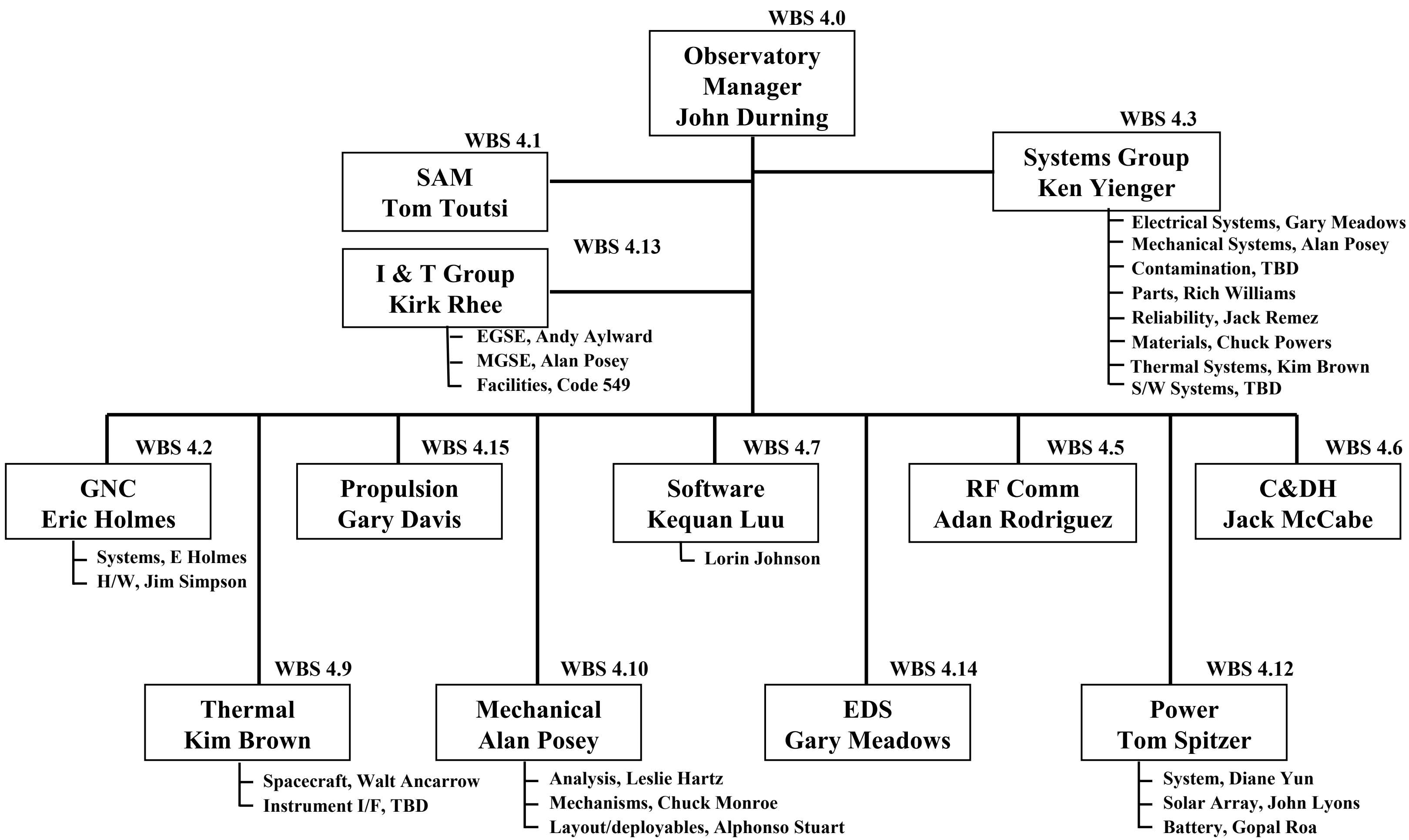


GPM Core Spacecraft – Exploded View



- ***The in-house team is in place:***
  - *From code 500:*
    - *16 Civil Servant FTEs*
    - *8 contractor FTEs*
  - *From rest of the codes:*
    - *2 Civil Servant FTEs*
    - *3 Contractor FTEs*
- ***In discussions with the branches on the ramp up of support as we progress towards PDR in third quarter of CY03***

GPM IN-HOUSE CORE S/C ORG CHART



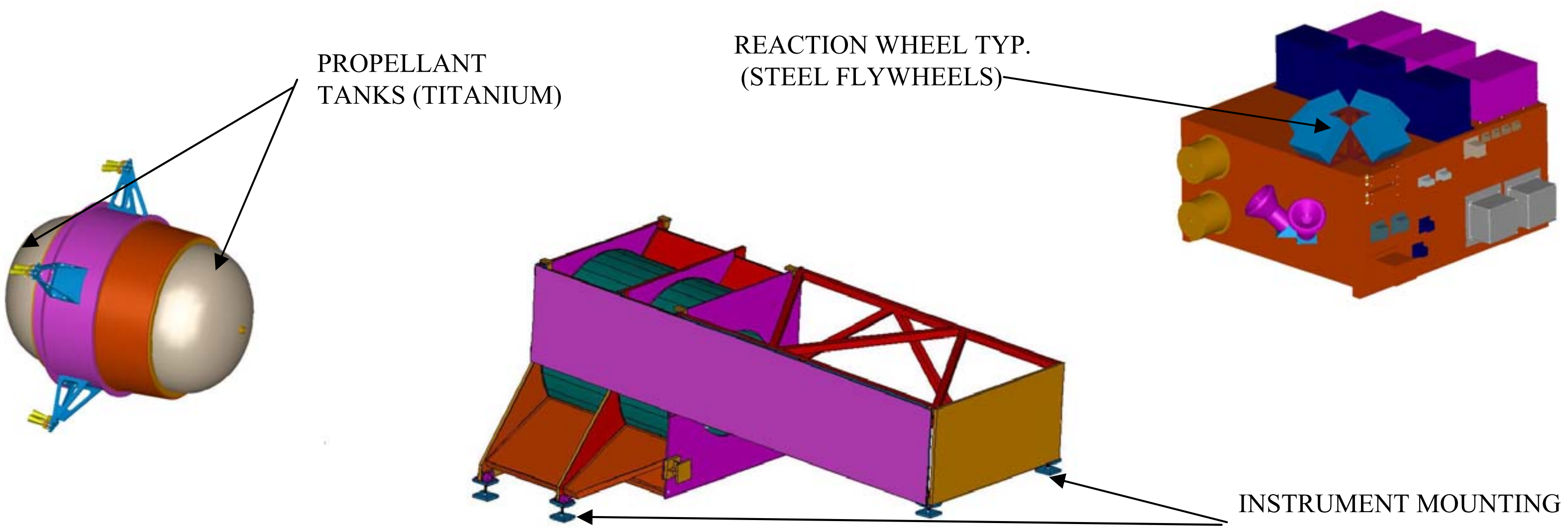
GPM Design Philosophy

- **Technologies:**
  - GPM can fly new technologies but are not permitted to fund the development of said technologies - working closely with ESTO and other codes (S, Q & M) to coordinate technology funding in the GPM time frame
  - If new technology is baselined in the design the functionality must be demonstrated by subsystem PDR and GPM design breadboarded by subsystem CDR, e.g. LiOn Batteries or UltraFlex array
  - If baselined design is major modification of existing design the GPM design must be breadboarded by subsystem CDR, e.g. power supply electronics.
- **Fault Tolerances:**
  - The Core spacecraft shall be single fault tolerant.
    - Implementation of this is that no single reasonable fault (only have 1 structure) in one subsystem shall bring down the overall spacecraft system
    - To ensure this - work on Fault Tree Analyses and Probability Risk Assessments will begin concurrently with the design activities

- ***Mission Lifetime:***
  - *The only consumable identified on this design is the propellant.*
  - *All subsystems and parts shall be designed for a minimum mission of 3 years save for the propellant budget. The propellant budget shall be designed for 5 years (mean solar flux).*

GPM Design Philosophy (cont'd)

- ***De-Orbit:***
  - *In order to meet the NASA end of mission disposal requirement without the need for controlled re-entry the GPM mission has instituted a "Design for Demise" philosophy.*
  - *What does this mean?*
    - *No pieces or parts of the spacecraft survives the de-orbit process in any substantial way to cause a risk to people or object on the ground or in the air (to be determined by ORSAT analysis).*
    - *Therefore, material selection is critical – no Stainless Steel or Titanium or Beryllium of significant mass in the design*



Design for Demise

- ***Pros:***
  - *Inherently more reliable than controlled reentry*
  - *Enables maximum use of spacecraft resources*
    - *No mass allocation for controlled reentry*
    - *No unique hardware for de-orbit*
    - *No early reentry due to reliability risk – operate spacecraft to the bitter end as ACS components gracefully degrade - unlike GRO.*
  - *Avoids operations costs associated with controlled reentry (>$1M for GRO)*
- ***Cons:***
  - *Standard designs for prop tanks and reaction wheels utilize Ti and Stainless Steel, respectively*
  - *Ti utilized in structural components – alternatives are not as mass efficient*
  - *More extensive de-orbit analyses to ensure demise compliance*
- ***TRMM analysis shows the PR & TMI comply with this philosophy***

Spacecraft Integration and Test