Hydros ESSP and Risk-Reduction

Yunjin Kim
California Institute of Technology
Jet Propulsion Laboratory

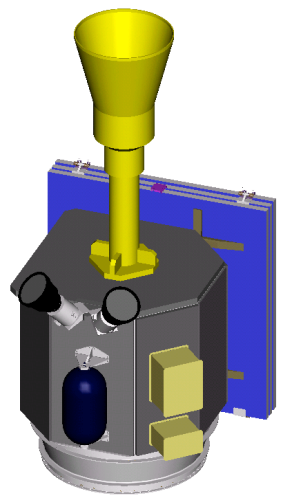
Hydros Project Overview

Feed Assembly (CSA)

Radar (JPL)

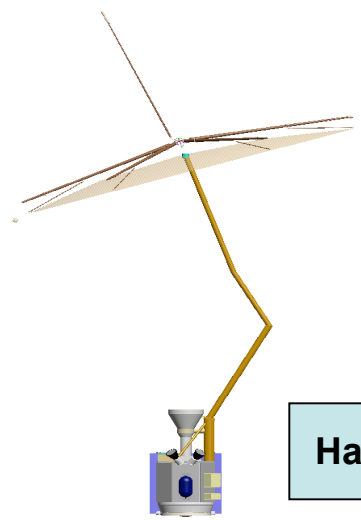
Radiometer (GSFC)

Spinning Reflector Antenna (Harris or Astro)



Spacecraft (GD C4 Systems)

NGST Astro



Harris

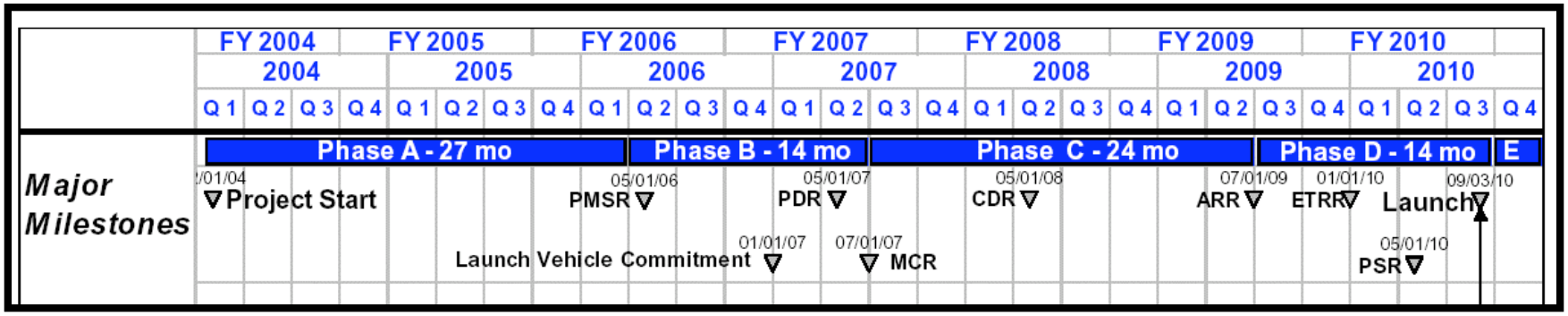
Minotaur IV launch services from STP

Data Downlink (IPO)

1. Hydros was selected as an ESSP mission in 2002 as an alternate mission.
2. Hydros was approved for the formulation phase in December 2003.
3. NASA notified the Hydros project in December 2005 that the project will not be funded to completion due to agency budgetary constraints.

Hydros Contributions to SMAP (1)

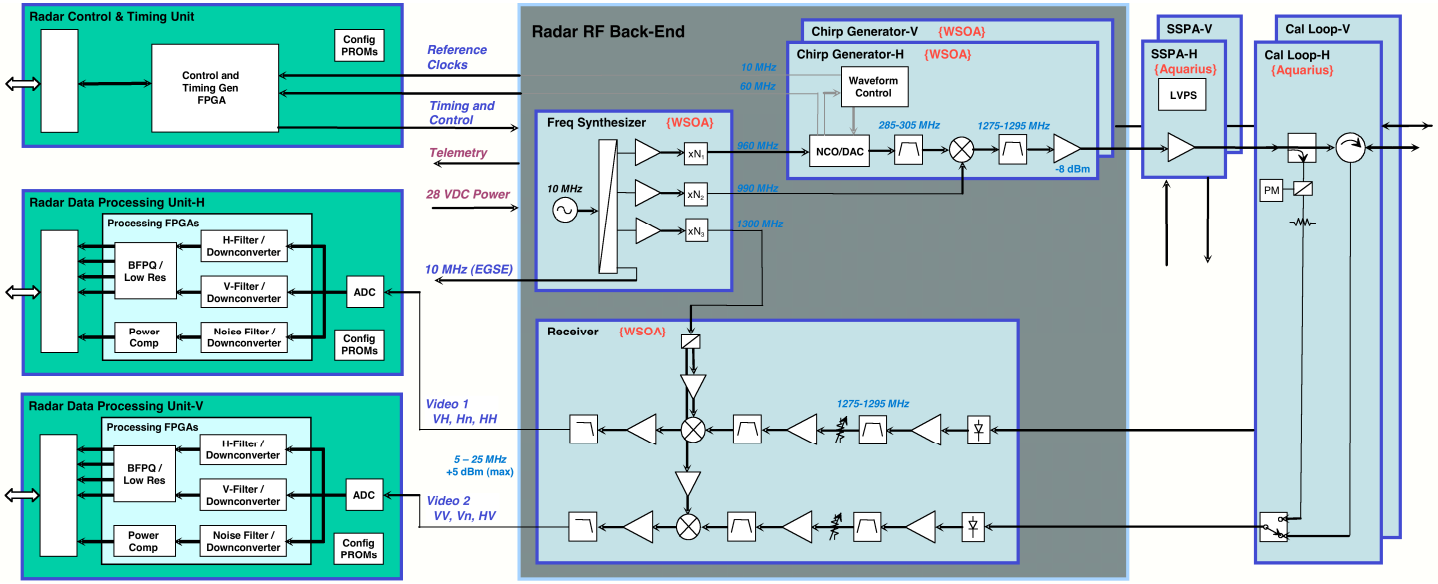
- **Due to the large amount of work performed during the risk mitigation/formulation phase, Hydros is suitable for a "fast track" mission when funding is made available.**
- **Project Management**
  - Hydros cost estimation, schedule and partnership can be an excellent basis for the SMAP implementation plan.
  - Final Hydros L1 requirements document is available.



- **Project System Engineering**
  - Hydros L2 and key L3 requirements were documented and reviewed
- **Mission Assurance**
  - The Hydros hardware design was based on the Environmental Requirements Document

Hydros Contributions to SMAP (2)

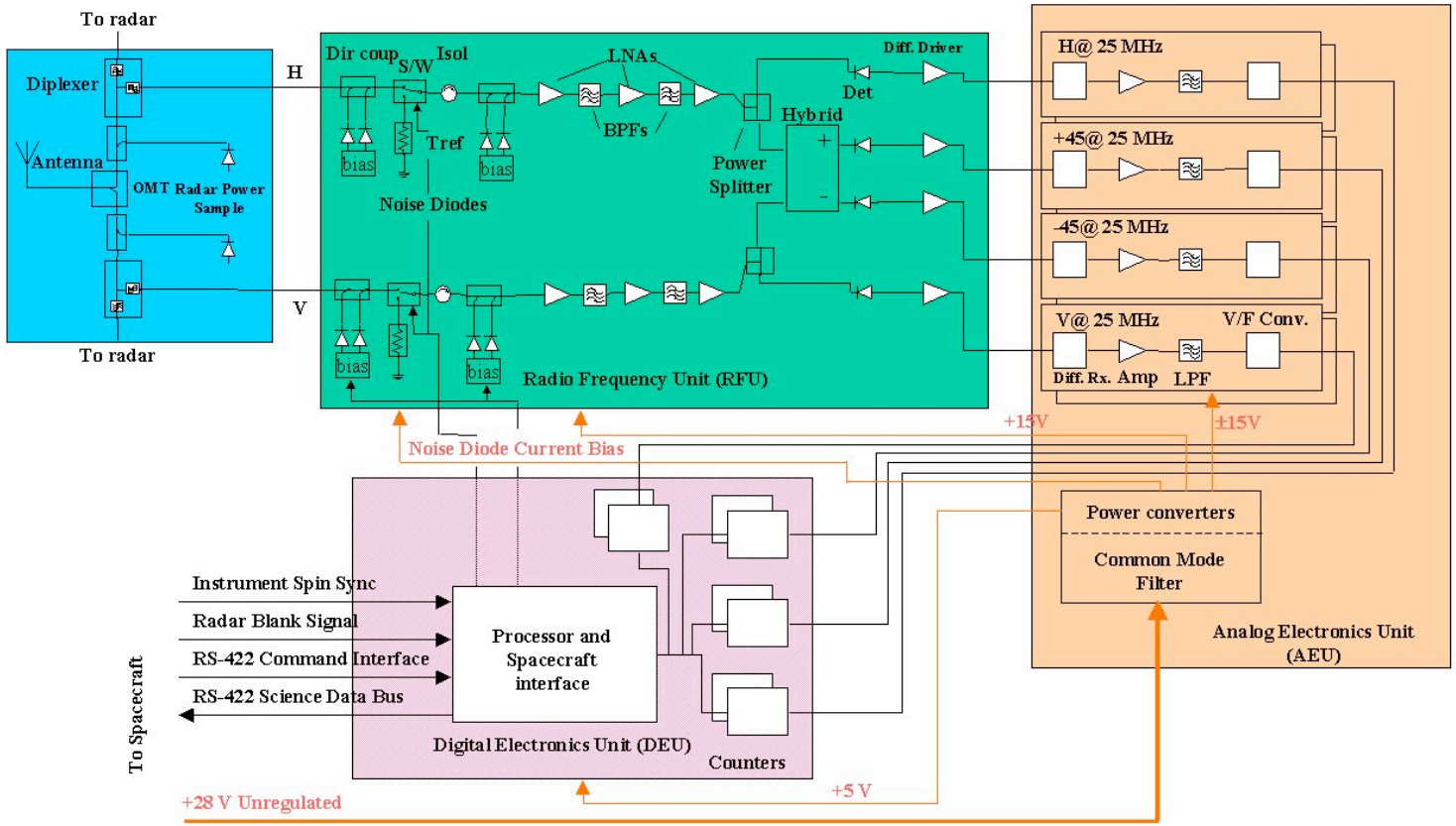
- **Science**
  - Baseline science algorithms were documented and reviewed; they can satisfy the science requirements
- **Instrument**
  - The high-level design of the feed assembly, radar and radiometer was documented and reviewed.



Radar Block Diagram

The Hydros radar design is mostly based on the heritage design. The spacecraft interface was well understood.

Hydros Contributions to SMAP (3)

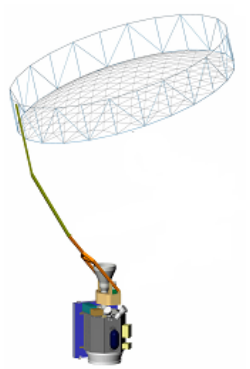


Radiometer Block Diagram

Both RFU & AEU can use the Aquarius design with minor modifications. The spacecraft interface was well understood.

Hydros Contributions to SMAP (4)

- Dynamics study of a large rotating antenna
  - During the formulation phase, two antenna vendors (Harris and NGST Astro) completed the preliminary design to be ready for the Hydros antenna RFP (Request for Proposal).
    - The RFP was ready for release.



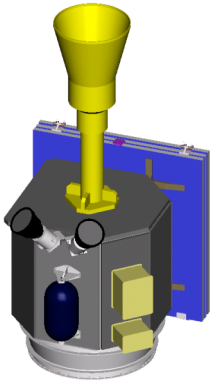
NGST Astro

Harris

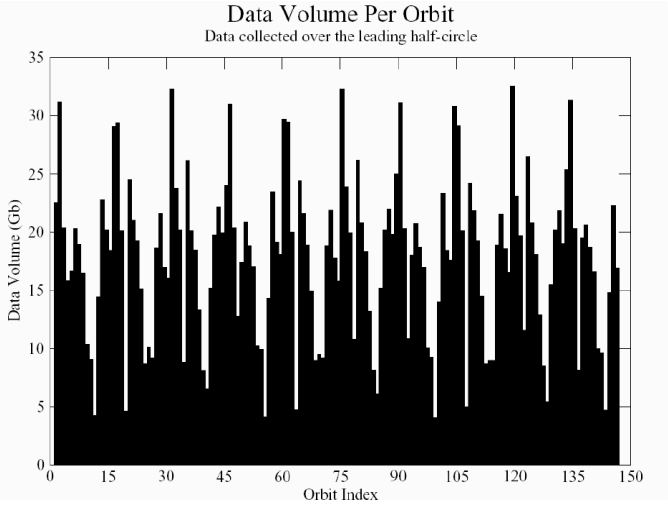
  - Boeing and JPL studied the antenna dynamics in detail; the study results were reviewed by independent reviewers.
    - Review conclusions
      - Both antenna designs can meet the pointing and stability requirements
      - There is low risk to the Hydros observatory operations; normal ACS response should be adequate to maintain 3-axis stabilized posture
  - Currently, JPL is investigating the interaction between the rotating antenna and the ACS system

Hydros Contributions to SMAP (5)

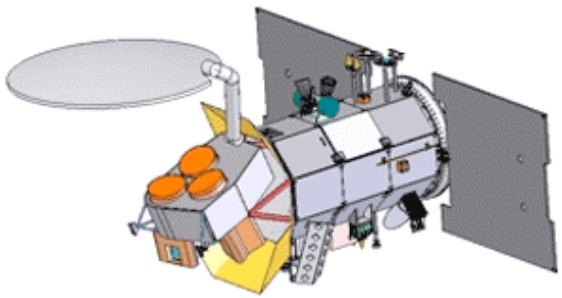
- Spacecraft
  - The Hydros project demonstrated that a commercial spacecraft can be modified to satisfy the Hydros requirements.



- Mission Operations & Ground Data Processing
  - A preliminary MOS/GDS design was completed
  - IPO ground system was proposed for the Hydros data downlink.



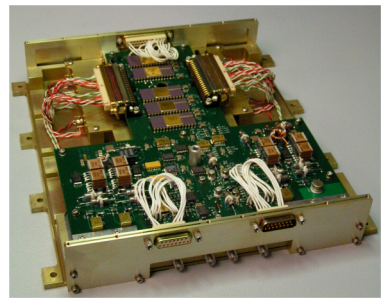
SMAP & Aquarius: Risk Reduction & Synergy

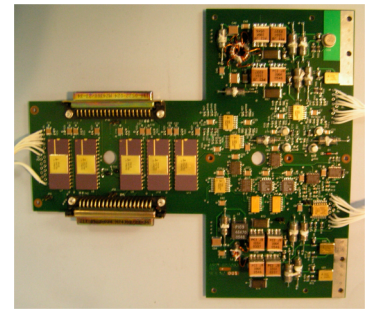


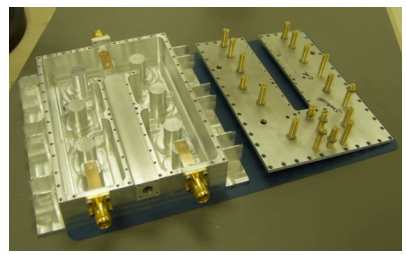
100 km Resolution
7 Days Revisit

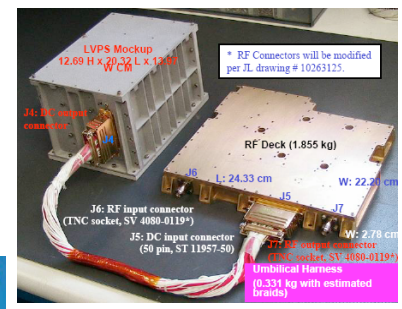
L-Band Radiometer and Scatterometer

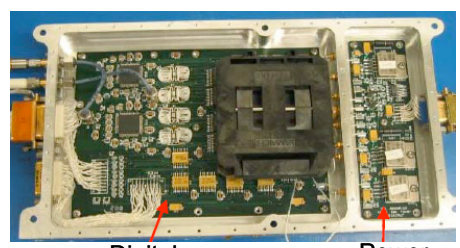
- **<u>Examples of Risk Reduction</u>**
  - What are the space and time patterns of RFI (RF Interference) incidents over land?
  - What is the best algorithm for Faraday rotation correction?
  - How well the ocean can be used to calibrate soil moisture sensor?











- *L-band JPL radar and GSFC radiometer have significant design heritage/validation from Aquarius*