# JPL Scatterometer Project Activities and Opportunities

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- QuikSCAT Mission Status
- QuikSCAT Follow-on Mission



- QuikSCAT instrument and spacecraft are healthy, but aging
  - June 19, 2009 will be the 10 year launch anniversary
- We've had two significant anomalies during the last year
  - Weak cell in the battery required some special operations during eclipse season last winter
  - An anomaly with the star tracker CCD (probably single event upset) caused a fault protection reset of the flight computer
- Otherwise QuikSCAT mission operations are relatively uneventful
- Senior Review 2009
  - We will propose 4 more years of operations



- Attitude control system
  - Star tracker CCDs may be showing minor age effects
  - GPS receiver operates on 6 channels
    - Backup receiver appears to have failed
    - Ground tracking backup plan is ready, but expect some science data degradation if plan is implemented
- Command and telemetry system
  - Operating on the backup science data transmitter since July 2006
  - If backup transmitter fails, science data can't be downlinked
- Electrical power system
  - Spare battery cell has been connected to overcome weak cell
- Scatterometer Instrument
  - Continues to operate on the primary string
  - Antenna bearings are showing their age

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#### Antenna Motor Torque Trend June 1999 to November 2008





### **QuikSCAT Follow-on Mission**



- NOAA operational objectives drove the design
  - high resolution, all wind, all weather capabilities
  - Temporal resolution was addressed by an optional tandem system
- Instrument concept evolved from earlier studies that had been funded by NASA
  - Specific issues that were identified at the "Instrument Concept Peer Review" held in May 2007 helped us set priorities for the study
    - Key feasibility questions were resolved
    - Instrument configuration (mechanical and electrical)
    - Performance analysis and simulations
    - Cost
- JPL's technical concept, plans, schedule and cost were thoroughly reviewed before submitting the study report
  - Table top peer reviews
  - Formal Technical, Management and Cost (TMC) review including NOAA representatives
- Study concluded that the concept is mature and ready to proceed into phase A immediately

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## XOVWM Flight System



- Instrument:
  - Ku-band SAR scatterometer
  - C-band scatterometer
  - X-band radiometer
  - Effective aperture is 3.5m in diameter
  - 800 km altitude, sun-synchronous orbit
- Performance Capabilities:
  - 1800 km swath
  - Accuracy for 3-80 m/s winds:
    - RMS Speed: 2 m/s or 10%
    - RMS Direction: 20°
  - Spatial Resolution:
    - Ku-band 5 km
    - C-band 10 km
  - Coastal mask: < 5 km</p>
  - Coverage: 90% of global oceans every 24 hours
  - Latency: Delivered to operational users within 3 hours of measurement 85% of the time



- GCOM-W2 is the third launch of JAXA's Global Climate Observation Mission program
- DFS is less capable than XOVWM but a significant improvement over QuikSCAT
- GCOM-W2 will also carry an AMSR2 instrument
- Intended to launch January 2016
  - DFS instrument delivery is required by May 2014
- This mission is shaping up to be an affordable alternative for NOAA
- Through international cooperation between JAXA, NOAA and JPL a viable mission approach has evolved
  - There have been two meetings; JPL and JAXA have agreed on the key spacecraft resources (mass, power, data rate, etc.)
  - DFS has been baselined as a second mission sensor for the GCOM-W2



- Spacecraft resource availability drives the DFS concept
  - JAXA concluded that the XOVWM instrument could not be accommodated
  - Mass limitation (275 kg allocation)
  - Plenty of power Is available (640 W allocation)
  - Volume is limited by launch vehicle fairing and by the field of view requirements for spacecraft sensors and communications antennas
- Maximum reflector dimension that fits the available volume is 2.1m
- Significant improvements relative to SeaWinds on QuikSCAT are achieved



### **DFS Instrument for GCOM-W2**



- 2 C-band and 2 Ku-band channels
  - 1800 km Swath
- 2.1 m antenna fits within allowable volume
- 4 channel RF rotary joint
  - Only the antenna and feeds rotate
  - Minimizes angular momentum that must be compensated
- 220 W TWTA transmitters capitalizes on the available DC power
- Performance advantages include resolution, all-weather and high winds capabilities



- QuikSCAT has exceeded all expectations, but is becoming more vulnerable as time passes
  - Nonetheless, we believe 4 more years of operations are possible and will propose that in the 2009 Senior Review
- A NOAA/JAXA partnership on GCOM-W2 is the most promising opportunity to fly a QuikSCAT Operational Follow-on mission
  - NOAA and JAXA are working on a letter of intent to describe the planned partnership
    - Enables both agencies to work toward approval of the necessary budgets
  - An instrument Mission Concept Review is being planned for next September or October
    - A portion of the funding to support this effort is already in place and NOAA plans to provide the rest later this year
  - JPL will support JAXA's Mission Definition Review for GCOM-W2 next December