National Aeronautics and Space Administration

Structural Monitoring to Minimize Inspections

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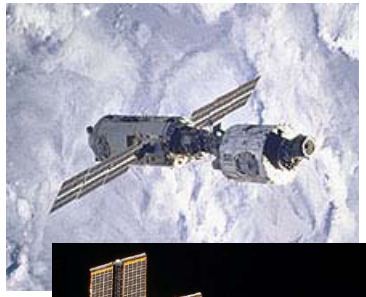
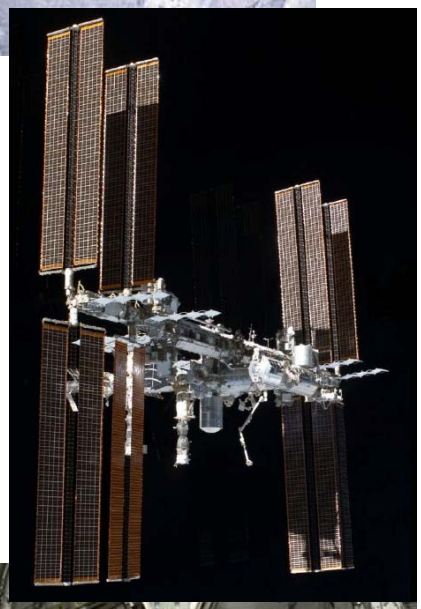
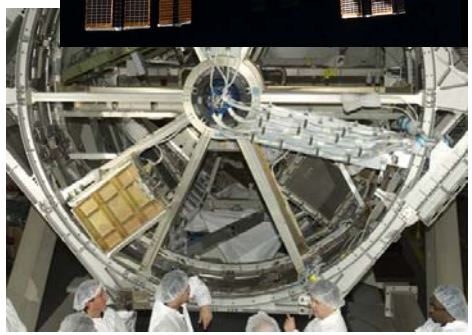
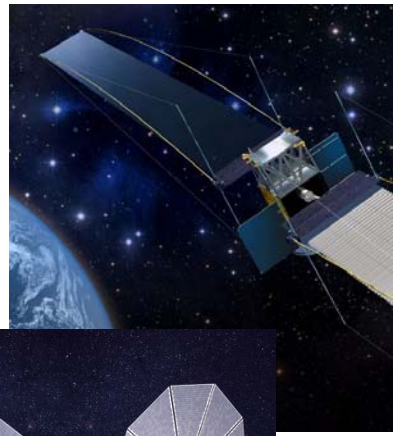
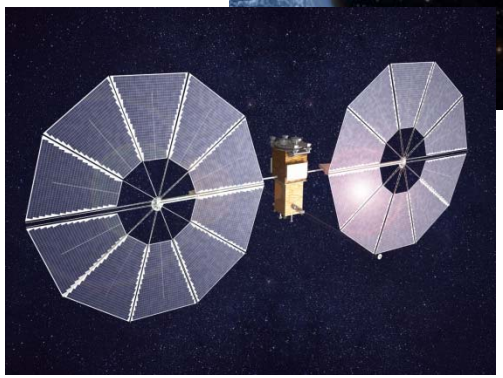
Use of Current ISS Instrumentation Systems

- **ISS structures were certified for a 15-year life.**
- **Zarya launched November 1998, over 15 years ago.**
- **Structural life extension analysis has been performed to certify that ISS structures are good through 2020 and beyond.**
  - Analysis has taken into account load cycles calculated from actual events vs the cycles assumed during design.
  - Re-constructing actual load cycles is performed using telemetry and data from the ISS.
  - Data/Sensor systems have been invaluable to allow proper loads reconstructions, especially for unexpected high-loading events.
  - Data/Sensor systems have been utilized to provide trending information for rotating joints, allowing for longer inspection/lube intervals.
- **Future space vehicles should incorporate smarter, smaller, and power efficient sensor systems:**
  - Monitor structural dynamics and rotating joints, perform on-board processing, alert crew real-time to any high loading events, store only the data ground needs to evaluate structure.







Solar Array Mast Structural Health Monitoring

- **MMOD shielding is designed into the ISS pressurized modules, but not for the truss and appendages.**
  - US Photo-Voltaic (USPV) masts are designed to be 2-fault tolerant, but inspections need to be performed to verify the 1st fault hasn't occurred.
  - Current inspection requires crew time to take detailed photographs of mast on a periodic basis.
- **ISS USPV MMOD impact monitoring**
  - Need a system that could be deployed robotically or via EVA that could monitor for MMOD impacts.
  - This could trigger a detailed inspection.
- **Future vehicles could incorporate this type of system in the design of the solar array support structure itself.**
  - This could trigger a detailed inspection.
  - Monitor dynamic strain and accelerations to assess loading history and alert crew if arrays are experiencing high loads.
  - Monitor for MMOD impacts.
  - Structural health monitoring system would also include a means of locating and assessing damage.