



Update on the GPS III Laser Retroreflector Array

Dr. Linda M. Thomas, NRL
Dr. Stephen M. Merkowitz, NASA GSFC

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“Celebrating 50 years of SLR”



Overview



- NASA-NRL Partnership
- GPS III SV Status
- LRA Status
- Mission support planning



NASA – NRL Partnership



- NASA GSFC – Space Geodesy Program
 - Principal Investigator/Project Management for the GPS III laser ranging project
 - Leads coordination among the user community
- NRL Naval Center for Space Technology
 - Design, build and test the GPS III laser retroreflector array
 - Provide support to NASA in the areas of laser ranging requirements, components, link budget analysis, and data collection optimization.
 - Leverage experience in active optical components, timing, orbit determination, modeling and simulation



GPS III Space Vehicle



- First GPS III launch scheduled for 2016
- LRAs will not be flown until a later launch, date to be determined
- NRL and NASA continue to engage the GPS III team

- Orbit: Six orbit planes at 55 degree inclination
- Altitude: 10,898 nautical miles
- Photo of the GPS III pathfinder Nonflight Satellite Testbed at Cape Canaveral , GPS World



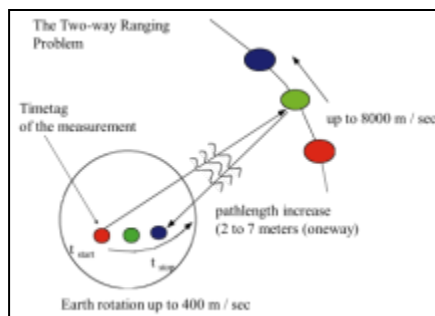


Design Considerations



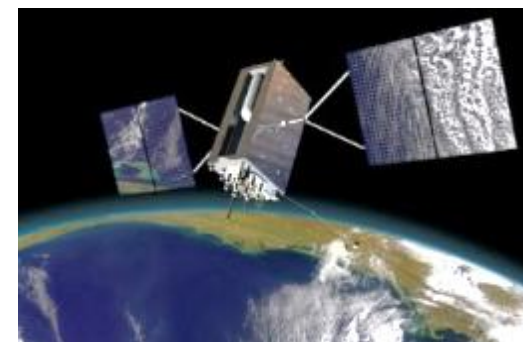
Tracking Mission

- Day/Night
- Elevation



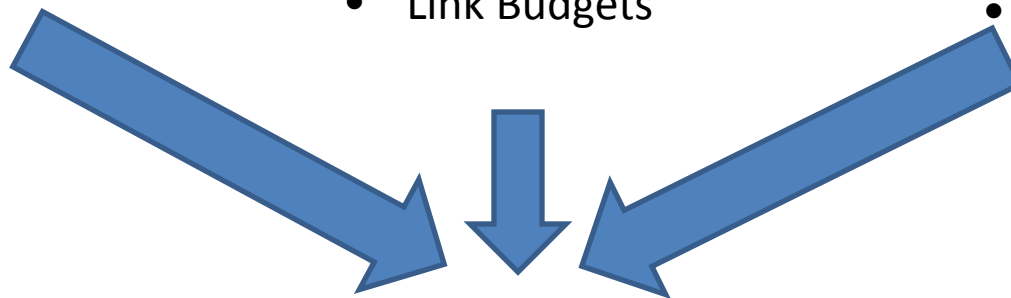
Fundamental

- Velocity Aberration
- Link Budgets



Space Vehicle

- Interfaces
- Environment



LRA design driven by multiple sources



LRA Risk Reduction Work



- Designed a 7-aperture subarray
 - Incorporate mission, SLR, and vehicle requirements
- Fabricate and test subarray
 - Evaluate mechanical performance
 - Validate assembly methods
 - Ensure EMI/EMC compatibility



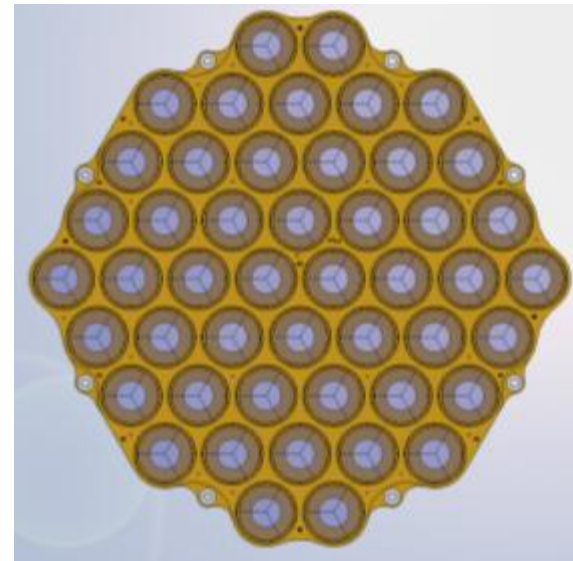


Flight Array and Modeled Cross Section



Cubes	Wavelength	Orientation	Polarization	Cross Section
48 x 1.6"	532nm	0 deg	Horizontal	140MSM
48 x 1.6"	532nm	12 deg	Horizontal	105MSM

- Cube selection supports ILRS GNSS cross section specification
- FFDPs validated in Zemax
- On and off-axis performance evaluated



Rendering of flight model



Ongoing Work

- GPS III EQM Hardware:
 - Risk reduction work completed
 - Engineering Qualification Model integration and test underway
 - Flight check with SV integrator planned in 2015
 - Launch of first vehicle equipped with GPS III LRA no earlier than 2019
- NASA, NRL, and USAF continue to work together to solidify GPS III LRA integration plan
- NASA and NRL continue to participate in ILRS LARGE working group
 - Consider GPS timelines in the development of a unified GNSS tracking strategy
 - Assess any pilot tracking project results; make recommendations as they pertain to GPS III
- Complete optical modeling of GPS III EQM
- Expect delivery of EQM to NASA in early 2015



LRA and Mission Planning Information



- Mission support request information will be addressed prior to launch
 - Location of SV center of mass before launch
 - Location of the LRA on the SV
 - Optical phase center to CoM
 - Corner cube specification (DAO, flatness, etc)
 - Corner cube material
 - Coating specification
- Given the large number of LRA-equipped GPS satellites and to ensure maximum data utility, all tracking will be pre-coordinated with NASA



Thank you!

