



Update: Laser Ranging of GPS III Satellites

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The Bottom Line

- General Shelton, Commander Air Force Space Command, has determined that Laser Retro-reflector Arrays (LRAs) will be mounted on all GPSIII satellites following SV 8
- General Kehler, USSTRATCOM, and NASA Administrator Charles Bolden have provisionally concurred.
- An MOU is in the final phases of review for signature by these principals of the AFSPC, USSTRATCOM, and NASA.



The Multi-agency Mitigation Study

Gen. Whelan, Director of Requirements AFSPC, and Mr. Chris Scolese, Director GSFC convened a multi-agency study to determine whether Laser Ranging can meet NSPD-39 requirements.

Participating Agencies:

- DoD (Various Agencies and Commands),
- NASA
- DOE
- DOS
- USGS

The Aerospace Corporation conducted an independent study.

Full study to be documented in a NASA technical report.



Mitigation Study Report Conclusions

- The overall assessment of this study is that **“cooperative laser ranging and other hosted payloads mission can coexist on GPS III.”**
- **“While it is undetermined if materiel and non-materiel solutions are required for cooperative ILRS lasing at current and anticipated future power levels, the solutions should be considered together to help mitigate uncertainty...”**

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2012 Global Positioning System Satellite Laser Ranging Mitigation Study

Final Report

19 April 2013

Executive Summary

The goal of this final report is to capture efforts leading to viable options in mitigating the potential effects of Satellite Laser Ranging (SLR) on a Global Positioning System (GPS) hosted payload. Both materiel and non-materiel solutions shall be considered in mitigating the potential effects of International Laser Ranging Service (ILRS) operations on the validated mission requirements as defined in the 2004 Operational Requirements Document (ORD) Key Performance Parameters (KPPs). Non-materiel solutions will involve the NASA SLR Data Operations Center (NSDOC) at the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) to efficiently manage and coordinate the planning, permissions, scheduling, operations, and data distribution of GPS III SLR activities. Materiel solutions may include modifications to the hosted payload optical sensor and/or specified engineering to the hosted payload digital processing mechanisms on-board the spacecraft.

Previous GPS Interagency Forum for Operational Requirements (IFOR) study efforts have determined that the best method of achieving U.S. Geodetic accuracy requirements is through SLR. SLR operations would be administered by NASA through an international network of ground tracking stations governed through the ILRS.

The overall assessment of this study is that cooperative ILRS ranging is unlikely to pose a damage or denial threat to the GPS III hosted payload optical sensors, and that both cooperative laser ranging and the hosted payload mission can coexist. While it is undetermined if materiel and non-materiel solutions are required for cooperative ILRS ranging at current and anticipated future power levels, these solutions should be considered together to help mitigate uncertainty in both design and performance of the future hosted payload optical sensor.

A differentiation was made between cooperative ILRS operations and hostile lasing. Although this study did not consider the potential impacts of hostile lasing to the hosted optical sensor, the speculation that Laser Retro-reflector Arrays (LRAs) would invite rogue lasing was addressed during multiple Senior Advisory Group meetings. An investigation of lasing events for the LRA-equipped GPS IIA Space Vehicles (SVs) 35/36 were all attributable to authorized ILRS activities. Thus, there is no empirical evidence to substantiate this contention. At the outset, hostile lasing was determined to be outside the bounds of this study.

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A NASA-funded complementary and independent study was conducted by the Aerospace Corporation to provide a top level assessment of the risks and impacts that could result from ILRS laser tracking of GPS-III-9+ satellites (Appendix B).

The three senior decision-makers provisionally endorsed the plan to install LRAs on GPS III SV 9+. In addition, they requested continual updates on any changes to the current and future architecture studies for the hosted payload.

An MOU will be written to document the agreements made by the decision makers with regards to the scope of this study. This memorandum shall be signed by CDR USSTRATCOM, AFSPC/CC and NASA Administrator to give it the proper level of visibility.

Approved and authorized on behalf of each Party by:

MARTIN WHELAN
Major General, USAF
Air Force Space Command
Director of Requirements

Date: 29 Apr 13

CHRISTOPHER COLESE
Director, Goddard Space Flight
Center,
National Aeronautics and Space
Administration

Date: 29 APR 2013

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LRA Development Program

- NRL is developing the LRA design requirements;
- April 3-4, 2013: GPS III SV 9+ dPDR;
- April 25, 2013: LRA PDR
- GPS III SV 9+ CDR postponed to mid 2015
- NASA and NGA will continue to move forward with procurement of LRA engineering and flight models and to conduct appropriate testing as per the mitigation study and MOU recommendations.



LRA Performance

- An excellent location on GPS III has been identified.
- Current GPS III LRA design will meet or exceed ILRS standards and surpass the performance of the GLONASS, Galileo, and Compass LRAs.
- The design will provide optimal tracking capability for GPS III to low elevation angles.
- Funding is identified to conduct testing, procurement, and integration of the GPS III LRAs.



To the PNT ExCom Advisory Board

- Thank-you for your careful review, recommendation, and on-going support of laser ranging to GPS III. Your efforts will help to insure that GPS remains the gold standard for defense, science and societal applications.
- Special thanks also goes to the many partnering agencies and organizations who worked to get us to this point.
- We are about to pass a critical milestone but much still needs to be done before reaping the benefits of GPS III laser ranging.