

May 18, 2011

TO: NPEF Working Group

FROM: Mike Londe, Ph.D.

BLM / WY 9574

SUBJECT: Hollomon AFB Open Sky Testing Results of Trimble Mapping and Survey Level GPS Receivers

### **Summary**

The Bureau of Land Management (BLM) arranged to have a number of Trimble Navigation GPS mapping and survey level receivers collect data during the Lightsquared open sky testing at Hollomon AFB. The receivers used were a legacy GeoExplorer 3, a JunoSB, a 2005 series GeoXH, and a 2008 series GeoXH. The survey receivers were a Trimble 5700 L1/L2 GPS receiver and a R8M2 GNSS receiver.

The GeoExplorer 3 is a L1 CA code receiver that represents 15 year old technology. The JunoSB is a newer L1 CA code receiver that utilizes a SIRF GPS chip. The 2005 and 2008 series GeoXH GPS mapping receivers are capable of tracking L1/L2 and carrier phase. The 5700 series dual frequency survey receiver is 10 year old technology while the R8M2 GNSS receiver represents current technology.

These receivers are a representative cross-section of mapping and survey receivers that are currently in use within the BLM, other DOI agencies, and the U.S. Forest Service.

All of mapping the receivers that tested encountered problems with the exception the legacy GeoExplorer 3. Initial checking of the files showed that the collected data on the mapping receivers was only 70 to 75% of the possible yield. The high accuracy GeoXH mapping receivers had the worst point yields on both days of testing. When the data was further checked and compared to the test broadcast times two behaviors were noted. In the first case five or more satellites were tracked but the signal to noise (SNR) strengths of the satellites were below the usable software thresholds and positions were not computed. The second behavior was that the receivers lost lock on all satellites for a portion or the whole test. When the test signal was turned off the receivers would resume normal operation. The major issues with the JunoSB receiver occurred during the Test #1 full power testing on the Hollomon Day 2 schedule and on the Test #5 test with a combination of signal strength decreases or no tracking. Interestingly the only receiver that did not have any tracking problems was the legacy GeoExplorer 3 receivers. It should be noted that data was only collected during Day 2 of the Hollomon AFB testing. Data was not collected on the third day due to the receiver being out of memory.

The Trimble 5700 and the R8M2 survey receivers both exhibited major problems in tracking with all tests. The typical behavior is that when a test signal was broadcast the receivers would lose total lock on the satellites and not track until the signal was turned off. This matches the behaviors seen by other government and industry testers of survey GPS and GNSS receivers.

## **Conclusions**

GPS and GNSS technology is a major field data collection tool used by all resource management agencies. If the Lightsquared implementation plan goes forward as proposed it will have a severe negative impact on the agencies' ability to efficiently and effectively collect data to manage our nation's resources. We will be forced to either use older and less capable mapping receivers for field data collection. We will be severely limited in our use of GPS / GNSS real time survey receivers. We could potentially be forced to go back to total station surveys which will add costs in terms of operation and personnel. In addition the Lightsquared plan could result in the the Continually Operating Reference Station (CORS) GPS/GNSS network being able to collect data and providing access to the National Spatial Reference System (NSRS). This will hamper our ability to collect or reference accurate geospatial data.