

FORMOSAT-3/COSMIC Constellation Mission

Prospects and System Performance

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ABSTRACT

The FORMOSAT-3/COSMIC spacecraft constellation consisting of six LEO satellites is the first operational GPS radio occultation mission in the world. The mission is jointly developed by Taiwan's National Space Organization (NSPO) and United States' UCAR in collaboration with NASA's Jet Propulsion Laboratory and Naval Research Laboratory. The mission is for global earth weather forecast, climate monitoring, and atmospheric, ionospheric and geodesy researches by carrying three onboard payloads including GPS Occultation Receiver (GOX), Tri-Band Beacon (TBB), and Tiny Ionospheric Photometer (TIP).

Introduction:

The FORMOSAT-3/COSMIC mission was launched successfully from Vandenberg on April 15, 2006 into the same orbit plane of the designated 516 km circular parking orbit altitude. All six FORMOSAT-3/COSMIC satellites are maintained in the good state of health and are on their way toward the final constellation of six separate orbit planes with 30-degree separations. Three satellites have entered into their final mission orbit of 800 km by the middle of February 2007. The FORMOSAT-3/COSMIC mission requirement is to collect 2500 globally-distributed GPS radio occultation events per day. Refer to figure 1 we have processed 1800 to 2200 good atmospheric sounding profiles (~900 mostly above the land mass) which have over the number of worldwide radiosondes launched per day. The atmospheric radio soundings data are assimilated into the Numerical Weather Prediction (NWP) models for real-time weather prediction and typhoon/hurricane forecast. The global and nation's weather prediction centers have shown significant positive impact and the forecast result will be also adapted into the nation's disaster warning and relief system once constellation deployment completed by end of year 2007. This paper describes the mission overview, spacecraft constellation design overview, on-orbit spacecraft performance data evaluation result (ref. figure 2), the state-of-the-art

mission operation achievements and results during various science campaigns, and the prospects for future follow-on mission (see Figure 3.). NSPO has demonstrated the world-class capability with the constellation system deployments and operations. The ultimate success of a real-time operation of the FORMOSAT-3/COSMIC mission in the final constellation formation can be anticipated.

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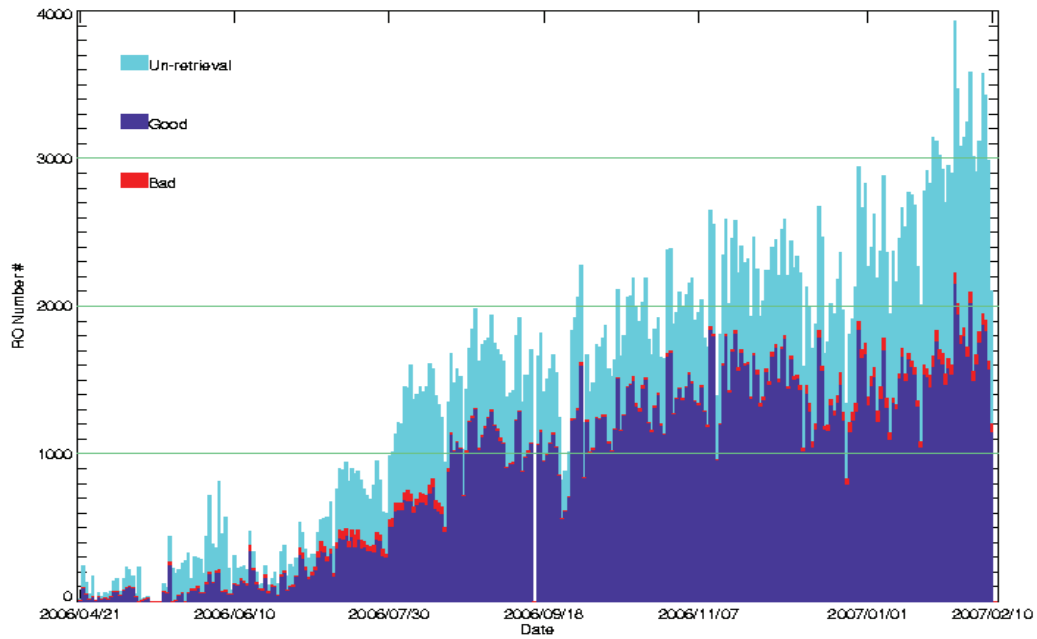


Figure 1 Total GPS RO numbers since launch as-of-10 February 2007. The blue colors represent the RO number observed by FORMOSAT-3, the dark blue colors represent the RO numbers retrieved to vertical atmospheric profiles and red colors represent bad profiles.

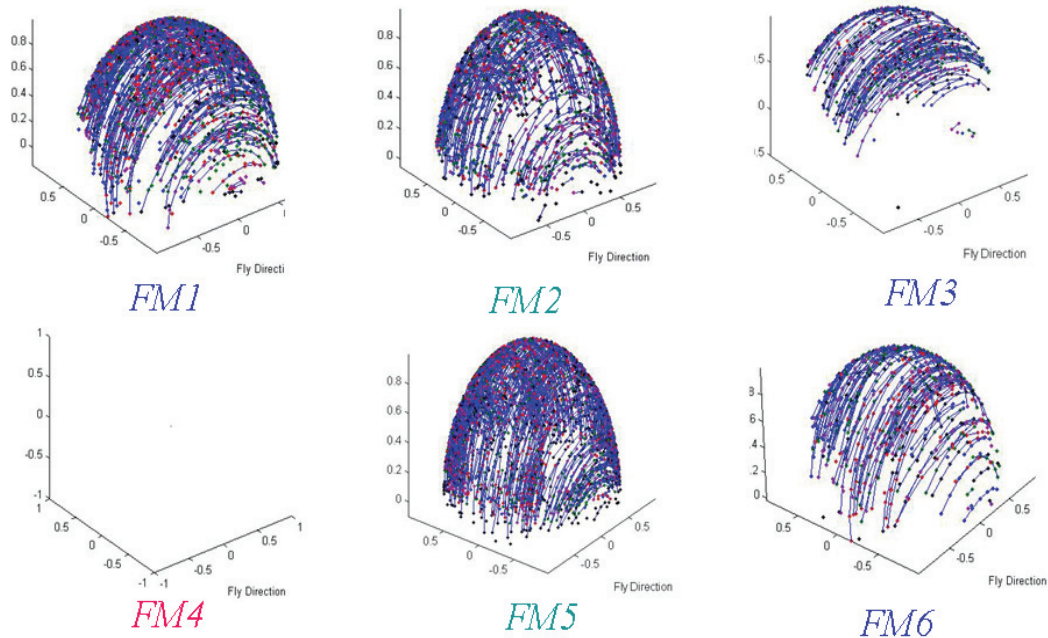


Figure 2. Bus GPSR GPS 3D Tracking Coverage. It was observed that some receiving gaps in the low elevation angle in certain azimuth direction of FM1, FM3 and FM6 bus GPSR.

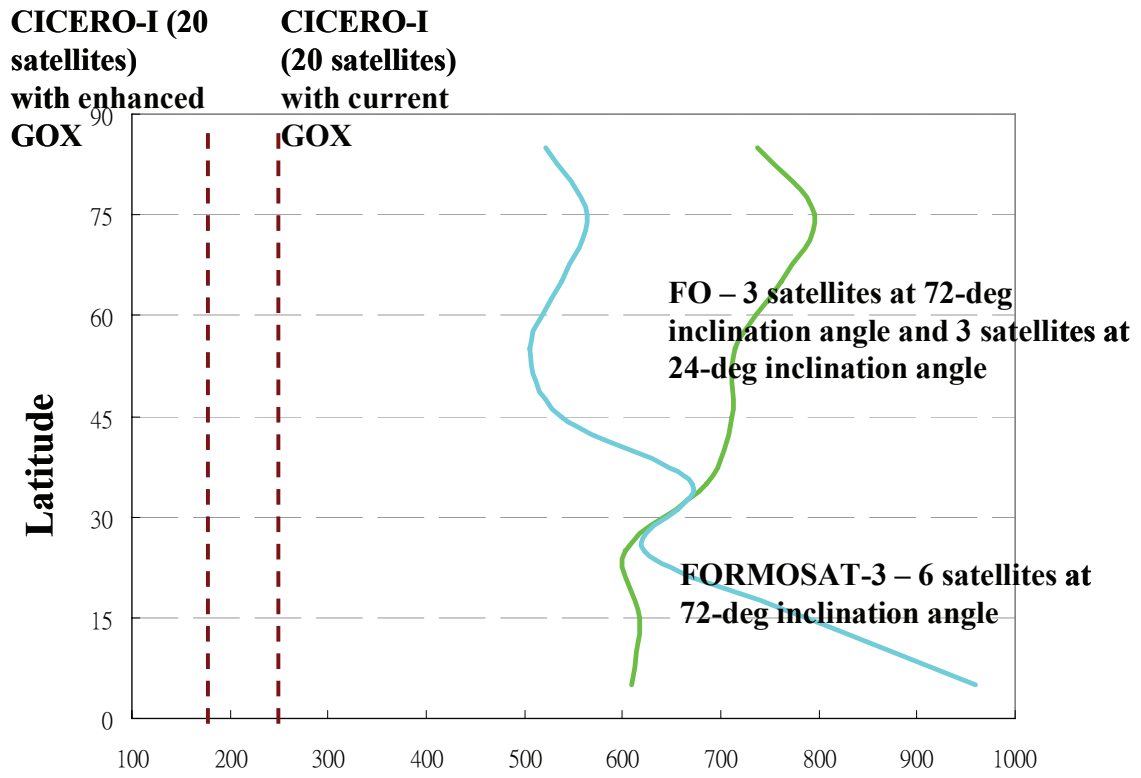


Figure 3. Preliminary FORMOSAT-3 Follow-on Analysis Result.