

Report on future satellite mission in Taiwan

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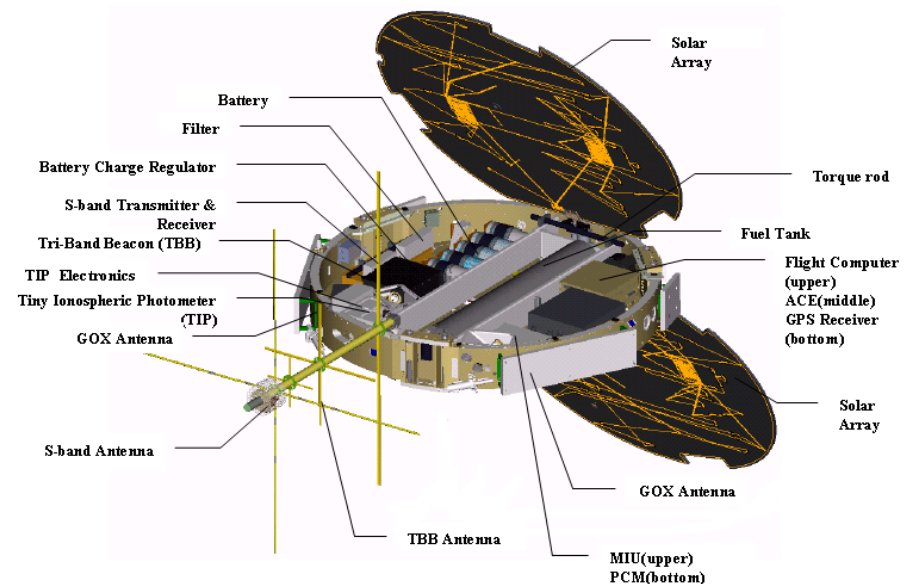
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Towards a roadmap for future satellite gravity missions

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Overview of geodetic satellite mission in Taiwan

- In Taiwan, the only satellite mission that can be used for geodetic applications, including gravity recovery, is the FORMOSAT-3/COSMIC (COSMIC) mission.
- The potential of geodetic application of COSMIC was reported in Chao et al. (2000), Hwang et al. (2009).
- COSMIC satellites do not have an onboard accelerometer to measure surface forces ; they must modeled using standard orbit dynamics



A COSMIC spacecraft and its payloads

Status of precise orbit determination in Taiwan

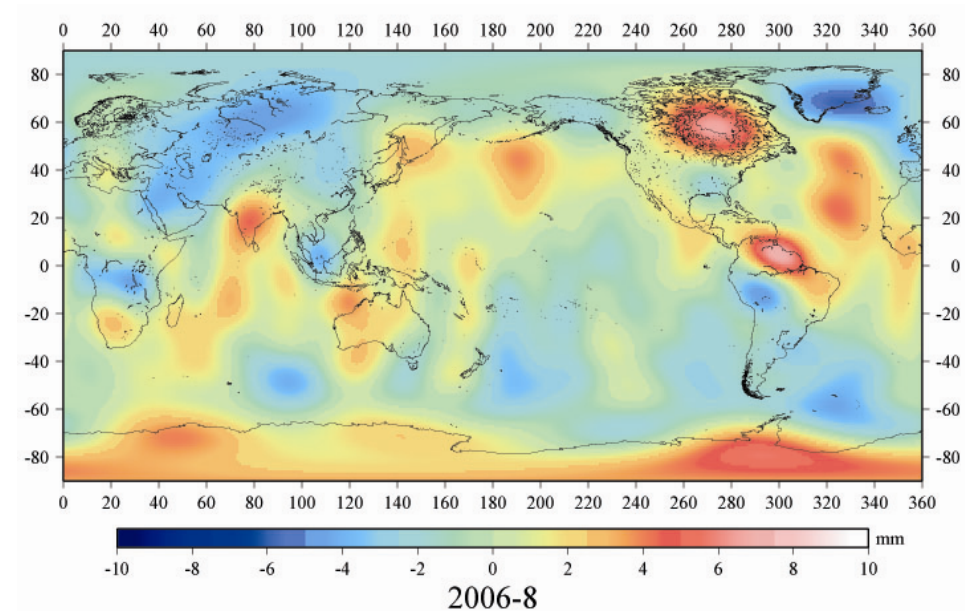
- An optimal algorithm POD of COSMIC satellites has been developed by the COSMIC team (Hwang et al., 2009), based on Bernese, with the help from TU Munich.
- Orbit accuracies from the reduced dynamic and kinematic solutions are nearly identical and are at the 2-3 cm level.

Table 1: RMS overlap differences of orbits based (in cm) on 5-h and 6-h overlaps using dynamic approach for 25 days

	Radial		Along-track		Cross-track (cm)	
	5-h	6-h	5-h	6-h	5-h	6-h
FM1	2.68	2.86	2.70	3.07	2.81	3.19
FM2	2.37	2.42	2.29	2.40	2.05	2.10
FM3	2.67	2.72	2.85	2.88	3.05	3.17
FM4	2.92	3.00	3.27	3.32	3.23	3.29
FM5	2.35	2.58	2.40	2.43	3.14	3.16
FM6	2.65	2.66	2.51	2.57	3.35	3.44

Status of satellite gravimetry in Taiwan

- The kinematic orbits of COSMIC were treated as three-dimensional ranging data to determine the long wavelength temporal variation of the earth's gravity field
- Surface forces such as atmospheric drag and solar radiation are determined using COSMIC's effective area-to-mass ratios, and the relevant coefficients are estimated using kinematic orbits over short arcs (1.5 hours) by GEODYN II.
- Enhancement of GRACE gravity solution due to use of COSMIC data is seen in central Africa, Russia and Greenland, North America, India and northern Amazon.



Geoid variation to spherical harmonic degree 25 from the combined COSMIC and GRACE gravity solution.

Development of COMIC-Follow-On mission: possible geodetic payloads

- The COMIC-Follow-On mission (COSMIC2) is under planning. COSMIC2 will be a constellation of 12 satellites, in multiple launches. The geodetic team in Taiwan proposes to install several geodetic sensors on COSMIC2 for orbit and gravity sciences.
- Possible geodetic payloads:
 - Laser retro-reflector
 - Star camera assembly
 - Better GPS POD receiver (than COSMIC GPS receiver)
 - A satellite-satellite ranging device for two of the 12 satellites to produce GRACE-like observables