FORMOSAT-7/COSMIC-2 GNSS Radio Occultation Mission: From Research to Operations

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The FORMOSAT-3/COSMIC (Constellation Observing System for Meteorology, Ionosphere, and Climate) mission consisting of six Low-Earth-Orbit (LEO) satellites is an experimental "Research Mission" for demonstrating the usefulness of Global Positioning System (GPS) RO in operational numerical weather prediction, climate monitoring, and space weather forecasting. The near-real time Global Navigation Satellite System (GNSS) retrieved Radio Occultation (RO) weather data providing to the global user community has been proven to increase the accuracy of the predictions of hurricane/typhoon/cyclone behavior, significantly improve long-range weather forecasts, and monitor climate change with unprecedented accuracy. The success of the FORMOSAT-3/COSMIC mission has initiated a new age for operational GPS RO soundings. The World Meteorological Organization (WMO) has recommended the continuing RO observations operationally and urged the international collaboration on the GNSS RO missions. With the success of the FORMOSAT-3/COSMIC and in response to the WMO's call for the international GNSS RO missions, NSPO of Taiwan and the National Oceanic Atmospheric Administration (NOAA) of the U.S. took the initiative effort to begin the implementation of FORMOSAT-7 / COSMIC-2, a future GNSS RO "Operational Mission". The FORMOSAT-7/COSMIC-2 mission design calls for 12 Low-Earth Orbiting (LEO) satellites, tracking GPS, GALILEO, and/or GLONASS navigation systems, which can potentially provide more than 8,000 RO soundings per day in the Full Operation Capacity (FOC) globally when all mission satellites are fully deployed into the constellation formation. The improved operational constellation system consisting of 6 satellites at low inclination angle and 6 other satellites at high inclination angle will produce a significantly higher spatial and temporal density of profiles. These global data will be much more useful for weather prediction models and also severe weather forecasting, as well as for related research in the fields of meteorology, ionosphere and climate. This paper will describe the FORMOSAT-7/COSMIC-2 mission objectives, mission baseline, Initial Operational Capability (IOC), Full Operational Capability (FOC), program milestone progress, as well as the constellation configuration and technology that will be used to meet those "Operational Mission" objectives.