

# Global SLR Tracking Support for HY-2 Satellite Precise Orbit Determination

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## Abstract

The HY-2 Satellite, which will be launched in August 2011, is the first satellite for State Oceanic Administration of China with the microwave altimeter, remote sensing systems for the oceanic environmental monitoring and related scientific researches. For the application of the microwave altimeter measurement, the precise orbit determination of the satellite is a key support. HY-2 satellite will equip with Laser Retro Reflector Array (LRA), Doppler Orbit graph and Radio-positioning Integrated by Satellite (DORIS), Global positioning System (GPS) to implement the precise orbit determination. HY-2 satellite will be tracked by the Chinese SLR network and international SLR network to precisely determinate its orbit and that is very important for environment monitoring and scientific research. This paper will introduce HY-2 satellite, its LRA and the plan of laser tracking.

## 1 Introduction

China has launched two oceanic satellites, HY-1A and HY-1B, on 15 May 2002 and 11 April 2007 respectively. Those two oceanic satellites have played an important role in surveying the variety of Chinese ocean in the passed years. The HY-2 satellite will be launched in August 2011, which is the first satellite for State Oceanic Administration of China with the microwave altimeter, remote sensing systems for the oceanic environmental monitoring and related scientific researches. HY-2 satellite will equip with Laser Retro Reflector Array (LRA), Doppler Orbit graph and Radio-positioning Integrated by Satellite (DORIS), Global positioning System (GPS) to implement the precise orbit determination. One of the measuring techniques, SLR will provide the laser tracking data with the better than 2cm for single shot. So, the Chinese SLR network will track HY-2 satellite and Shanghai Observatory as an organizer for the measurement will also call for ILRS to organize International Laser Ranging Tracking Network to observe HY-2 satellite after launched. HY-2 satellite will become the second Chinese satellite tracked by international SLR network following Compass M1. This paper will introduce HY-2 satellite, its LRA and the plan of laser tracking.

## 2 HY-2 satellite Overview

Figure 1 shows the view of HY-2 satellite and the main orbit parameters is following:

- Altitude: 971km
- Eccentricity: 0.00117
- Inclination: 99.35 degree
- The orbit is sun-synchronous: the first 2 years with a 14-day cycle, then one year with geodetic orbit (168-day cycle, 5 day approx. subcycle)

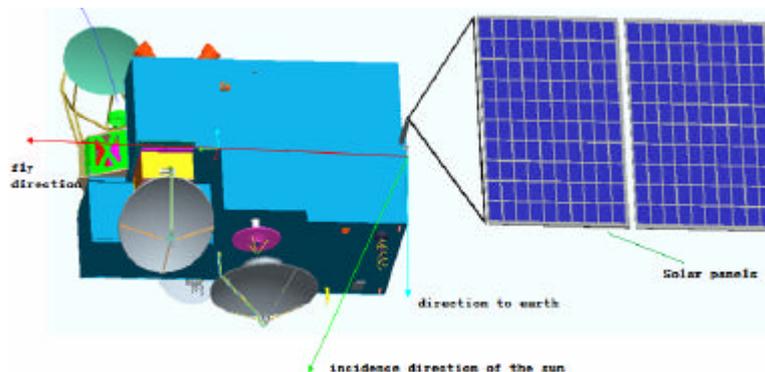


Figure 1 The view of HY-2 satellite

HY-2 will have the following instruments onboard:

- microwave altimeter for sea level change monitoring
- microwave scatterometer for sea surface wind measurement
- scanning radiometer for sea surface temperature measurement
- microwave radiometer for measurement of the integrated atmospheric water vapour correction
- GPS receiver for orbit determination with dual frequencies code and phase measurement
- Doris system for orbit determination by CNES
- LRA( Laser Retro-reflector Array) for orbit determination

### 3 Laser Retro-reflector Array for HY-2 satellite

The laser retro-reflector of HY-2 satellite adopted the structure of eight pyramids and the corner cubes made of fused quartz are symmetrically mounted on a hemispherical surface with one nadir-looking corner cube in the center, similar to Envisat, ERS-2, Jason-1/2. The angle between the normal of the center reflector and the side ones is 48 degrees. The size is 250mm × 88.5mm and the weight is about 1.41kg. The photo of the LRA is shown in Figure 1.

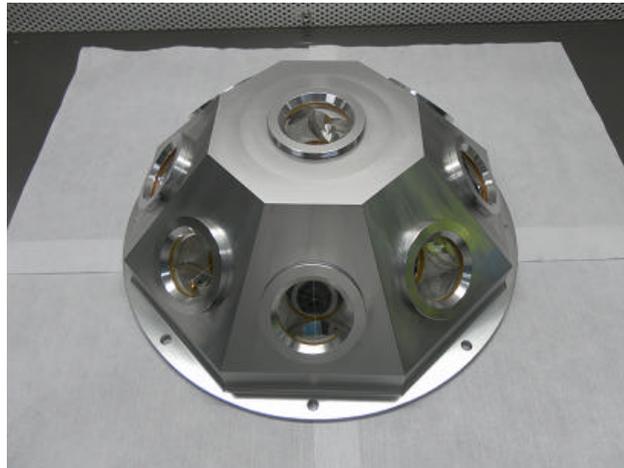


Figure 2 The photo of LRA for HY-2 satellite

### 4 Support from China and ILRS SLR network

At last workshop Yang Fumin reported that All of Chinese stations planed to develop kHz ranging under the support of CMONOC (Crustal Movement Observation Network of China). Four stations (Shanghai, Changchun, Beijing, Kunming) in China have been the capability of kHz ranging up to MEO satellites and daylight tracking since last year. Other three stations have been implementing kHz ranging. National Astronomical Observatory of China (NAOC) has got the funding for kHz improving of San Juan SLR station and the upgrading is in process.

In 2008, Chinese Compass M1 satellite was successfully tracked by international SLR stations and the routine SLR tracking data are being provided to precisely determinate its orbit. So, the SLR technique will be also regarded as one of important methods of precise orbit determination for HY-2 satellite.

At the end of 2010, most of Chinese SLR stations finished the systematic improvement and upgrade and the performances were advanced to a great extent. After HY-2 satellite launched, Shanghai Observatory will organize the Chinese SLR network to track it and call for ILRS stations to support global SLR tracking for HY-2 satellite.

Shanghai Observatory will also be the data center of HY-2 satellite to process and analyse the laser tracking data and provide the orbit prediction to SLR stations.

## 5 Summary

HY-2 satellite is the first one with the microwave altimeter, remote sensing systems for the oceanic environmental monitoring and related scientific researches for State Oceanic Administration of China and the accurate orbit parameters are necessary. So, several measuring techniques are adopted on HY-2 satellite to perform the precise orbit determination, such as Laser Retro Reflector Array (LRA), Doppler Orbit graph and Radio-positioning Integrated by Satellite (DORIS), Global positioning System (GPS). And Shanghai Observatory will organize the Chinese SLR network and call for ILRS committee to support global SLR tracking for HY-2 satellite after it launched. HY-2 satellite will become the second Chinese satellite tracked by international SLR network following Compass M1.

## Reference

*Yang Fumin, 2008: Upgrading Plan of the Chinese SLR Network, Proceedings of the 16th International Workshop on Laser Ranging*

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