

LOOKING TOWARD THE FUTURE: TESTING NEW CONCEPTS

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Abstract. The Origins Billions Star Survey (OBSS) is a space astrometry mission that was funded by NASA in 2004 to perform an eight-month concept study. Although the OBSS mission was not selected for further development beyond the concept study phase, OBSS spawned a smaller-scale mission, called the Joint Milli-Arcsecond Pathfinder Survey (JMAPS), which is currently funded for launch in early 2014. JMAPS is a small, space-based, all-sky visible wavelength astrometric and photometric survey mission for 0th through 14th magnitude stars. The primary objective of the JMAPS mission is the generation of an astrometric star catalogue with better than 1 milliarcsecond positional accuracy and photometry to the 1% accuracy level, or better, at 1st to 12th magnitude.

1 The Origins Billions Star Survey

The Origins Billions Star Survey (OBSS) (Johnston *et al.* 2006) is a space astrometry mission that was funded by NASA in 2004 to perform an eight-month concept study. The programme, led by Dr. Kenneth Johnston, was a collaboration between several research labs, academic institutions, and industry. During the concept study, several implementations of the mission were studied, including a multiple-aperture spinning and precessing concept, not unlike Hipparcos and Gaia, a step-stare concept, and a dedicated infrared or radial velocity concept. During the concept study, a step-stare implementation was chosen (Zacharias & Dorland 2006). Figure 1 depicts an artist's concept of the OBSS spacecraft on-orbit, based upon the concept study implementation. The OBSS baseline included a single-aperture TMA telescope with a 1.5 m primary mirror and a 50 m focal length. The astrometric instrument had a FOV of 1.2 degrees with a 9 gigapixel CCD-based focal plane. Instrumentation also included a low resolution spectroscopic instrument (LRSI) intended to obtain stellar spectra and colours. Although the

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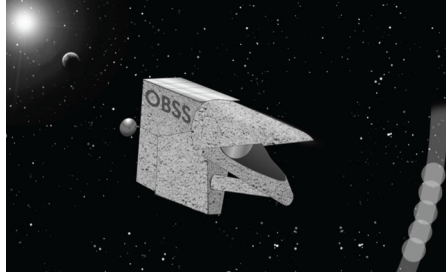


Fig. 1. Artist's concept of the OBSS spacecraft on-orbit at L2.

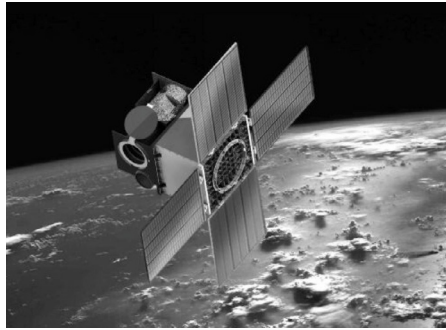


Fig. 2. Artist's concept of the JMAPS spacecraft in low earth orbit.

OBSS mission was not selected by NASA for further development, OBSS spawned a smaller-scale mission, JMAPS, which will provide the proof of concept for many aspects of the OBSS mission.

2 The Joint Milliarcsecond Pathfinder Survey

The Joint Milliarcsecond Pathfinder Survey (JMAPS) is a small, space-based, all-sky visible wavelength astrometric and photometric survey mission for 0th through 14th magnitude stars (Gaume *et al.* 2009). The primary objective of the JMAPS mission is the generation of an astrometric star catalogue with better than 1 milliarcsecond positional accuracy and photometry to the 1% accuracy level, or better, at 1st to 12th magnitude. Figure 2 depicts an artist's concept of the JMAPS spacecraft on-orbit in its planned 900 km sun-synchronous low earth orbit. JMAPS is a funded mission, currently in development for an early 2014 launch. Development of the mission involves both the U.S. Naval Observatory and the U.S. Naval Research Laboratory together with multiple industry partners. The JMAPS telescope consists of a 19 cm primary mirror with a f/20 SiC telescope. The focal plane utilizes a two by two array of CMOS-Hybrid detectors, each detector containing 16 megapixels. The USNO is responsible for tasking the satellite along

Table 1. Comparison of Hipparcos and JMAPS.

Hipparcos	JMAPS
Two Apertures	Single aperture
Scanning	Step-stare
Complete to 7 th mag	Complete to 14 th mag
3 years for Proper Motions	20 years (combination with Hipparcos/Tycho)
	3 years Proper Motions for non-Hipparcos stars
Highly eccentric Orbit	Low earth, approximately circular

Table 2. Principal goals of JMAPS mission.

Update Bright Star Catalog	Technology Development & Concept Demonstration
1 mas 0.5 to 12 th mag (<i>I</i> -band)	CMOS-Hybrid Focal Plane
Reduced accuracy 12 th to 14 th	High-accuracy SiC optics
Catalog 2016 epoch	Low resolution grating for colour sensing
Direct observations of ICRF2 quasars	10 mas attitude sensing
1% photometry	50 mas microsat pointing stability

with calibration and reduction of the JMAPS data. The JMAPS star catalogue will be completed in 2018. Table 1 indicate some of the similarities and differences between the highly successful Hipparcos mission and JMAPS. Table 2 lists some of the principal goals of the JMAPS mission.

3 Summary

OBSS is an astrometric space mission that was funded by NASA for concept study in 2004. Although OBSS was not funded for further development beyond the concept study phase, the JMAPS programme, a smaller-scale astrometric microsatellite, evolved from the OBSS concept. JMAPS is currently in development for launch in 2014. The goals of the JMAPS programme are to update the bright star catalogue together with the development and demonstration of new space technology such as CMOS-Hybrid focal planes, precise attitude sensing and microsatellite pointing stability.

References

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