STEREOGRAMMETRIC SHAPE MODELING FOR (25143)ITOKAWA, HAYABUSA MISSION.
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Introduction: A telescopic camera on Hayabusa, AMICA (Asteroid Multiband Imaging Camera)[1] brought about 1400 images, 1GB. A part of AMICA science team and GNC team (Guidance and Navigation Control) have made a task team of shape modeling. This team gave two versions for pole orientation and Itokawa's shape on the basis of AMICA images. One is an interim version for beginning rendezvous operation (GNC version), and another is that for its late phase (Aizu version). Global shape of Itokawa shows dichotomy of surface roughness, implication of "binary", and other remarkable features. Here initial results based on the shape model are demonstrated.

Pole orientation:

GCP (Ground Control Points) tracking on AMICA images gave the following pole directions;

"Hayabusa_GNC"

2000EQ (90.6380749, -66.1699955)

2000EC (123.5, -89.53)

"Aizu"

2000EQ (90.5253042, -66.2944343)

2000EC (128.5, -89.66)

These show that rotation axis of Itokawa is perpendicular to the ecliptic plane and this asteroid is "retrograde planet". Previous studies based on ground observations in Proceedings of the Hayabusa Symposium supports the properties. Ostro et al. (2004) shows 2000EQ (92.3292245, -66.2011779) and 2000EC (160, -89)[2], Kaasalainen et al. (2004) shows 2000EQ (87.7789980, -67.0452880) and 2000EC (330, -89)[3]. Although these seems to be different in longitude, they are close each other at the pole in Fig.1.

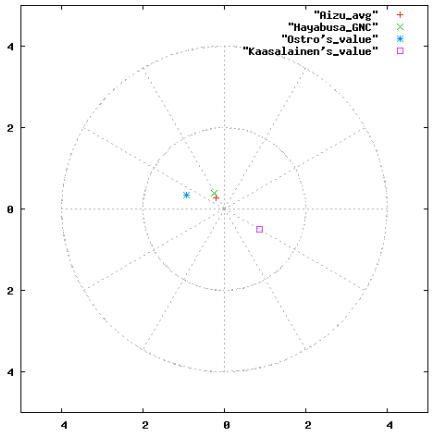

Fig.1 Itokawa's pole

Shape properties of Itokawa: We have established stereogrammetric shape modeling [4][5]. This reconstruction had been upgraded to multiviewpoints' epipolar method by the rendezvous. Because spacing of control points depends on surface texture, Itokawa's image show that its spacing ranges from a few meters to several meters (the original images show about 75cm/pixel). Points in 3D are converted to a polygon model (Fig.2), whose actual resolution is 3 degree in spherical coordinates. Because this Itokawa shows a "peanut-like" constriction, some blind surfaces of the polygon model are corrected with polar images. Shape properties of the polygon model are as follows;

Surface Area: 0.393 km^2

Volume: 1.8378 x 10^{-2} km^3

Three axes: X=0.535 , Y=0.294 , Z=0.209 km

Size of bounding box: 0.550x0.298x0.244 km.

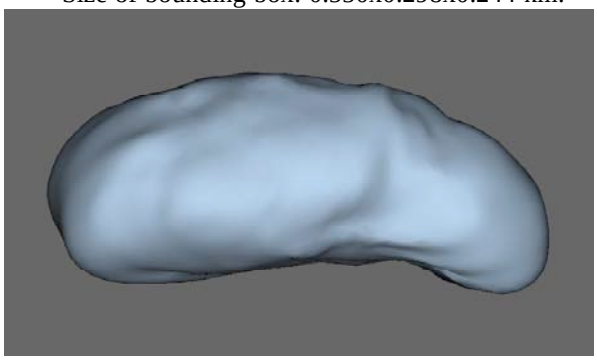

Fig.2 Western side of the shape model

The body-fixed coordinates and the north direction (+Z) follow the right-hand rule [7]. Itokawa seems to be composed of two parts; the right small "Head" and the left large "Body" (Fig.2). They are separated by the constriction, which is called as "the neck". The prime meridian passes through a GCP "the black boulder" on the head, and this gives +X direction with the longest diameter. Then the rest Y-axis is fixed. The head and the tail of the body show many facets and their majority would be impact origin. Map projection of spherical coordinates is also demonstrated as a geographical map.

References: [1] Nakamura, T. et al. (2001) *Earth Planets Space* vol.53, pp.1047-1063. [2] Ostro, S. J. et al. (2004) *Proc. Hayabusa Symposium* (in press) [3] Kaasalainen, M. et al. (2004) *Proc. Hayabusa Symposium* (in press) [4] Demura, H. et al. (2004) *LPS XXXV* abstract#1666 [5] Demura, H. et al. (2005) *LPS XXXVI* abstract#1982 [6] Seidelmann, P. K. et al. (2003) *Celestial Mechanics and Dynamical Astronomy*, vol. 91, pp. 203-215