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Japan Agency for Marine-Earth Science and Technology

The Deep-sea Drilling Vessel CHIKYU Projected measures for the damages on Azimuth Thruster and future schedule

The Deep-sea Drilling Vessel *Chikyu*, operated by the Japan Agency for Marine-Earth Science and Technology (JAMSTEC: Yasuhiro Kato, President), carried out a Drydock Survey, including repair and maintenance work from February until April this year at the Sasebo Shipyard, Sasebo Heavy Industries Co., Ltd in Sasebo City, Nagasaki Prefecture. During the survey, some cracks and chips were discovered on the teeth of some of the Azimuth Thruster (360° swiveling propellers used to maintain ship's position during drilling operations: see [Fig.1](#)) gears.

JAMSTEC and outside experts investigated the cause and found that several factors are involved, including design and manufacture, the gear material, and the assembly and adjustments made to the thrusters. Projected future preventative measures include the use of improved materials, designing, and manufacturing, and more careful assembly and adjustment. Therefore, all six gears will be completely replaced with new ones.

We anticipate that the gear change will be completed by January 2009, and *Chikyu* will conduct IODP (the Integrated Ocean Drilling Program)*1 riser drilling after completing test drilling in the Sea of Kumano, off the coast of the Kii Peninsula.

***1: Integrated Ocean Drilling Program (IODP)**

The Integrated Ocean Drilling Program (IODP) is an international marine research drilling program dedicated to advancing scientific understanding of Earth by monitoring and sampling subseafloor environments. Through multiple platforms, preeminent scientists explore IODP principal themes: the deep biosphere, environmental change, and solid earth cycles. IODP has started since October 2003 led by Japan and the USA. IODP now has 21 member countries.

Appendix

Damage Assessment and projected solutions

Damaged areas were carefully analyzed with technical advisers who identified the following areas:

- The vertical shaft (pinion) gear teeth might contact and induce cracks in the wheel gear teeth

- Lack of strength in the internal shear stress or existing impurities in the gear may have caused the cracks.

The following measures will be taken, in consideration of other possible factors:

- Modify the shape and round off the corners of the pinion gear's teeth to avoid contact with the wheel gear.
- Assemble and adjust gear teeth carefully.
- Modify the design to decrease internal shear stress of the gear and enhance internal strength.
- Advance methods to increase carburizing depth
- Improve the quality of gear material to avoid the inclusion of impurities.

Therefore, all six existing gears will be replaced by new ones with the new modified design.

Reference: Damages of Azimuth thruster

The CHIKYU installs a computer system called Dynamic Positioning System (DPS) to control the power and direction of thruster so that the CHIKYU can maintain a constant position for the deep-sea drilling with 6 Azimuth thrusters (3 on the bow and 3 on the stern: propeller diameter is 3.8m) which is used worldwide.

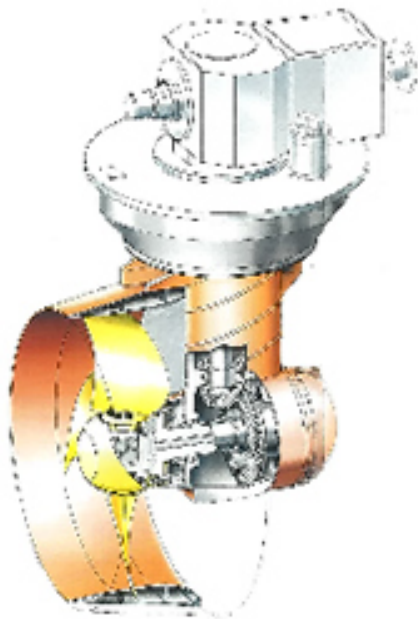


Figure1: Identified damage is shown in the red squared part in the bevel gear (gear used when it turn right angle).

Damage has been identified on 3 out of 6 wheel gears and one of those was replaced (Picture 1 and 2). It was the first overhaul inspection of Azimuth thruster since the CHIKYU's delivery in July 2005.



Picture 1: Wheel gear

Material of gears on the CHIKYU is nickel-chrome molybdenum forged steel treated with carburizing and case-hardening.



Picture 2: Enlarged picture of the gear

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