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# Deep Sea Sediment Resuspension System Used for the Japan Deep Sea Impact Experiment

*B. Barnett*
**Sumiko Consultants Co., Ltd.**
**Tokyo, Japan**

*H. Yamauchi*
**Metal Mining Agency of Japan**
**Tokyo, Japan**

## ABSTRACT

The second generation Deep Sea Sediment Resuspension System (DSSRS-II) was designed to simulate the deep sea sediment disturbances that will result from the future operation of manganese nodule mining collectors on the seafloor. In August and September 1994 the DSSRS-II was used to create the artificial resedimentation disturbance required for the Japan Deep Sea Impact Experiment (JET). This paper briefly describes the history of the DSSRS-II, its principal design and operational features and its performance during the JET study.

**KEY WORDS** : deep sea, sediment, resuspension, environmental impact, benthic disturber

## INTRODUCTION

The Japan Deep Sea Impact Experiment (JET) is an environmental impact study being performed by the Metal Mining Agency of Japan (MMAJ) as part of the Ministry of International Trade and Industry's project entitled Environmental Research for Manganese Nodule Development. JET is aimed at studying the chemical, biological and physical responses expected to result from deep sea mining of manganese nodules. As part of this study an artificial resedimentation disturbance was created in an experimental area in which numerous surveys were carried out to determine pre- and post-disturbance conditions. The device used to create the resedimentation (known as DSSRS-II) is a passively towed, sled mounted, hydraulic dredging machine.

## BACKGROUND

A prototype Deep Sea Sediment Resuspension System (DSSRS-I) was designed and constructed in 1991 by the National Oceanic and Atmospheric Administration of the USA (NOAA). This special purpose passively towed vehicle, designed to simulate the sediment disturbance created by a seafloor nodule collector, was used in NOAA's 1991 and 1992 BIE (Benthic Impact Experiment) studies. Its design and operation are described by McGinnis and Petters (1993).

At the end of 1992 the Metal Mining Agency of Japan (MMAJ) provided technical support for the redesign of the system and the construction of the second generation, DSSRS-II. The conceptual design of DSSRS-II was based on that of DSSRS-I and most of the principal electrical and mechanical elements are common to both devices. Despite these similarities there are fundamental design differences between the prototype and second generation machines. These differences include the height at which sediment is discharged, the shape and number of dredge heads, the method of loosening or fluidising the sediment and the number of lift pumps.

DSSRS-II is specifically designed to be operated from the *R/V Yuzhmorgeologiya* which is owned and operated by the Central Marine Geological and Geophysical Expedition (CGGE) of Gelendzhik, Russia. A description of the design of DSSRS-II and its operation and performance in the 1993 BIE experiment is provided by Brockett and Richards (1994).

The DSSRS-II was loaned to MMAJ to create the deep seafloor disturbance required for the JET studies. Between April and June 1994 MMAJ commissioned a number of minor modifications and repairs to DSSRS-II that were considered necessary for successful operation in the JET project site which is both deeper than the BIE site and has a greater abundance of nodules.

## DSSRS-II DESIGN

Design sketches of DSSRS-II are presented in Figures 1 and 2. The device incorporates two functions; namely the fluidising or loosening of the shallow sediments and their subsequent lift and discharge some 4 to 5 metres above the seafloor. The fluidising function is performed by a 5.7 kW, single phase centrifugal pump located on the forward section of the sled. This "fluidising pump" delivers about 18 l/s at a head of 12 m. It has a coarsely filtered intake to reject solid particles and small fish and discharges through two 150 mm diameter manifolds which each contain an array of twenty-two 9 mm diameter downward-pointing nozzles. The forwardmost manifold is removable to accommodate the use of an alternative fluidising pump with different characteristics (ie. 63 l/s at 5 m of head). The height of the nozzles above the seafloor can be adjusted from 0 to 600 mm by lifting or lowering the entire fluidising assembly in 50 mm increments.