Conf-821103--49

# THREE EQUIPMENT CONCEPTS FOR THE FUSION ENGINEERING DEVICE*

CONF-821103--49

DE83 003454

P. T. Spampinato[a]
L. S. Masson[b]
K. D. Watts[b]
N. R. Grant[c]
D. P. Kuban[d]



## Introduction

Maintenance-related studies for the Fusion Engineering Device (FED) have assumed that the equipment necessary to remotely handle major components could be made available using present technology. Furthermore, results of the FED Maintenance Equipment Workshop[1] held in January and March of 1981 indicated that existing technology, and even certain existing equipment, could fulfill the requirements for maintenance and disassembly in a fusion device. To begin to quantify equipment needs a detailed study of one major component replacement was undertaken, namely, the replacement of a torus sector. The purpose was to identify specific equipment needed, functional specifications, and operational specifications.[2] With this information, the conceptual design for the equipment could be developed, along with more accurate cost estimates. As a result of this effort, three major pieces of equipment were identified for further development: (1) a sector handling device (SHD), (2) a mobile manipulator system (MMS), and (3) an in-vessel manipulator system (IVMS).

---

950 0397

950 0397

[a]Fusion Engineering Design Center/Grumman Aerospace Corporation.
950 2158 [b]Idaho National Engineering Laboratory/EG&G.
483 2000 [c]Oak Ridge National Laboratory.
643 3000 [d]Union Carbide Corporation-Nuclear Division.



*Research sponsored by the office of Fusion Energy, U.S. Department of Energy, under contract W-7405-eng-26 with the Union Carbide Corporation.

## Sector Handling Device

Six concepts were envisioned to handle the 375-tonne torus sector in the FED design. Of these, three were configured in order to assess their pros and cons in terms of mechanical feasibility and reliability. A roller-link conveyor system was chosen.

A significant equipment requirement identified in the torus replacement scenario is to contain contaminated particulate matter. This requirement is derived from the overall FED maintenance approach which permits personnel entry into the reactor cell when the activity level decreases to 2.5 mr/hr, which occurs about 24 hours after shut-down; hence, contaminated material may not accumulate in the reactor cell. Two basic approaches for containment were considered: the use of soft-bagging techniques and the use of a secondary shell. A secondary shell with a sealable overhead door was chosen as the containment method. It is being integrated with the conveyor device into a total handling system. The containment shell will accommodate a sector 7 x 5 x 4 meters.

## Mobile Manipulator System

The mobile manipulator system is a general purpose handling device which plays a significant role in sector replacement. It incorporates bilateral, master-slave manipulators on an articulated boom, has a reach of 10 meters and a 10-tonne lift capacity at a 45° angle. The end-effector of the boom can be a power arm or interchangeable power tools. Remote lighting and viewing systems are mounted on the boom. Because of expected space limitations around the FED, it is assumed that the MMS will be hoisted into an allocated work area. It is not anticipated that this device will be driven around the reactor cell in either its manned or remote mode of operation because of the large right-of-way required.

## In-Vessel Manipulator System

In-situ operations were also investigated in lieu of sector replacement for some maintenance operations (i.e., armor tile replacement). Favorable results with regard to reduced machine downtime and flexibility of maintenance operations were responsible for the interest in the IVMS. Specifications for such a device were established around the present FED baseline design, which include: three access ports into the torus, 70° of torus arc for maximum reach, and operation in high-radiation fields.

From the list of potential in-vessel operations and the geometry constraints of the baseline, the kinematics and the key dimensions for an IVMS concept have been established and will be used to develop a conceptual design with sufficient detail for costing.

## Conclusions

Maintenance equipment which is needed to remotely handle fusion device components is being conceptually developed for the Fusion Engineering Design Center. This will test the assumption that these equipment needs can be satisfied by present technology. In addition, the development of equipment conceptual designs will allow for cost estimates which have a much higher degree of certainty. Accurate equipment costs will be useful for assessments which trade off gains in availability as a function of increased investments in maintenance equipment.

References

1. P. Sager, et al., "Proceedings of FED Remote Maintenance Equipment Workshop," ORNL/TM-7769, Oak Ridge National Laboratory (November 1981).

2. P. T. Spampinato, "Remote Maintenance Equipment for the Fusion Engineering Device," RSTD, Proceedings of the ANS Annual Meeting, June 1982.