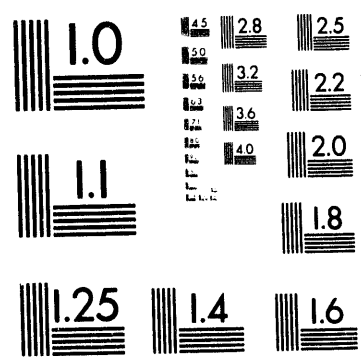
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SP-100 Reacto. Disassembly Remote-Handling Test Program

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SP-100 REACTOR DISASSEMBLY REMOTE HANDLING TEST PROGRAM

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Abstract

This paper is presented as an overview of the remote handling equipment validation testing, which will be conducted before installation and use in the ground engineering test facility. This equipment will be used to defuel the SP-100 reactor core after removing it from the Test Assembly following nuclear testing. A series of full scale mock-up operational tests will be conducted at a Hanford Site facility to verify equipment design, operation, and capabilities.

INTRODUCTION

The SP-100 Ground Engineering System (GES) Test Site has the responsibility to dismantle the SP-100 reactor following the completion of nuclear testing. Once apart, the spent fuel will be packaged and shipped to a storage facility.

A disassembly feature-testing and equipment-verification program is part of the ongoing work at the SP-100 Hanford GES Site to accomplish the disassembly task. This paper is presented as an overview of this feature-testing program to highlight the complexity of both the disassembly task and the ongoing efforts for ensuring that the SP-100 reactor can be successfully disassembled.

PURPOSE OF THE EQUIPMENT FEATURE TESTING PROGRAM

The equipment-testing program was configured to test several of the complex remote-disassembly components that will be used to defuel the SP-100 reactor. A conceptual picture of the SP-100 reactor test assembly is presented in Figure 1. From a systems approach, testing of these components in a non-radioactive environment will lower the risks of failure during actual operation. The risk areas that will be addressed by the SP-100 full-scale feature testing program are associated with the following needs.

- The need to design and demonstrate the remote tooling required to disassemble and defuel the SP-100 reactor. This tooling consists of equipment to dismantle the nuclear assembly test (NAT) piping systems, separate the reactor from the flight shield, hold and dismantle the reactor vessel, and package the spent fuel/waste in canisters.

- The need to provide technician training before hot-cell operation to ensure cost-effective demolition. As in most unique hot-cell operations, mocking up the equipment and testing and training the operators is very desirable. Hands-on training in a nonradioactive work environment is essential to evaluate the performance of both workers and machines.

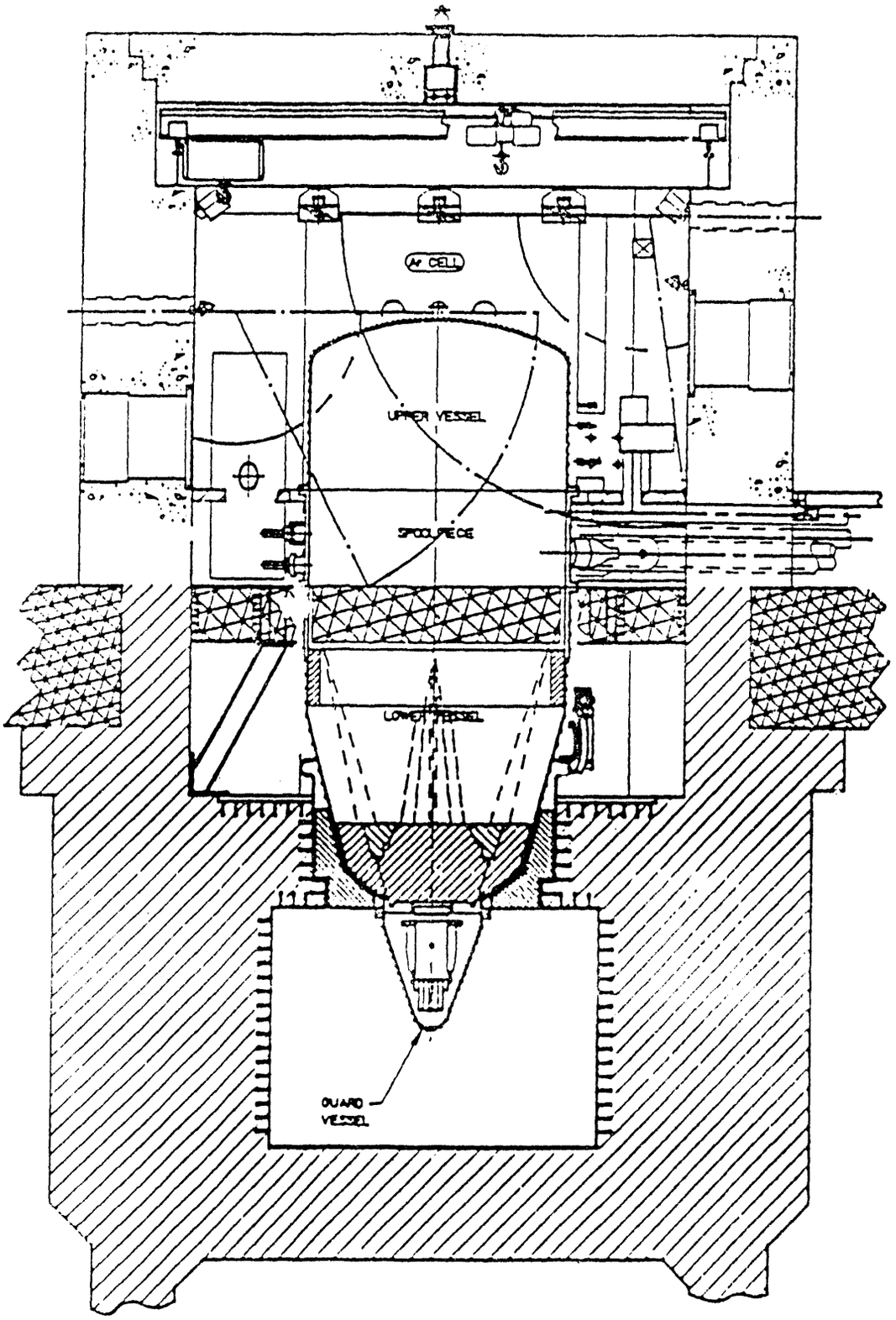


FIGURE 1 GES Operations Hot-Cell Layout

- The need to provide an opportunity to modify and re-test tooling before in-cell use. The SP-100 test program will give the equipment designers the opportunity to modify and enhance the disassembly equipment prior to hot cell installation.

- The need to ensure that hot demolition is accomplished as planned without any off-normal events. To minimize any risks associated with this operation, it is critical to discover tolerance interferences, blind working zones, and failure of equipment to meet requirements. The mock-up test program will aid the development of effective work procedures, so that disassembly is carried out in the most effective manner.

PHASES OF THE FEATURE TESTING PROGRAM

There are six phases of the SP-100 remote equipment testing program. Each of these phases is structured to address and complete a distinct work scope.

Phase 1 - Design of the remote disassembly equipment

This area is proceeding on schedule. Detailed design drawings of the remote-disassembly tooling, reactor handling and disassembly machines, and other in-cell equipment will approach completion by the start of calender year 1991. Figure 2 presents a conceptual layout of the reactor handling machine in position while the reactor is being separated from the flight shield. Figure 3 presents a layout of the reactor disassembly station at which the reactor will be defueled. Critical interfaces with the facility structure and reactor systems were established in 1989 and early 1990, which allowed the equipment design to proceed parallel with other project design areas.

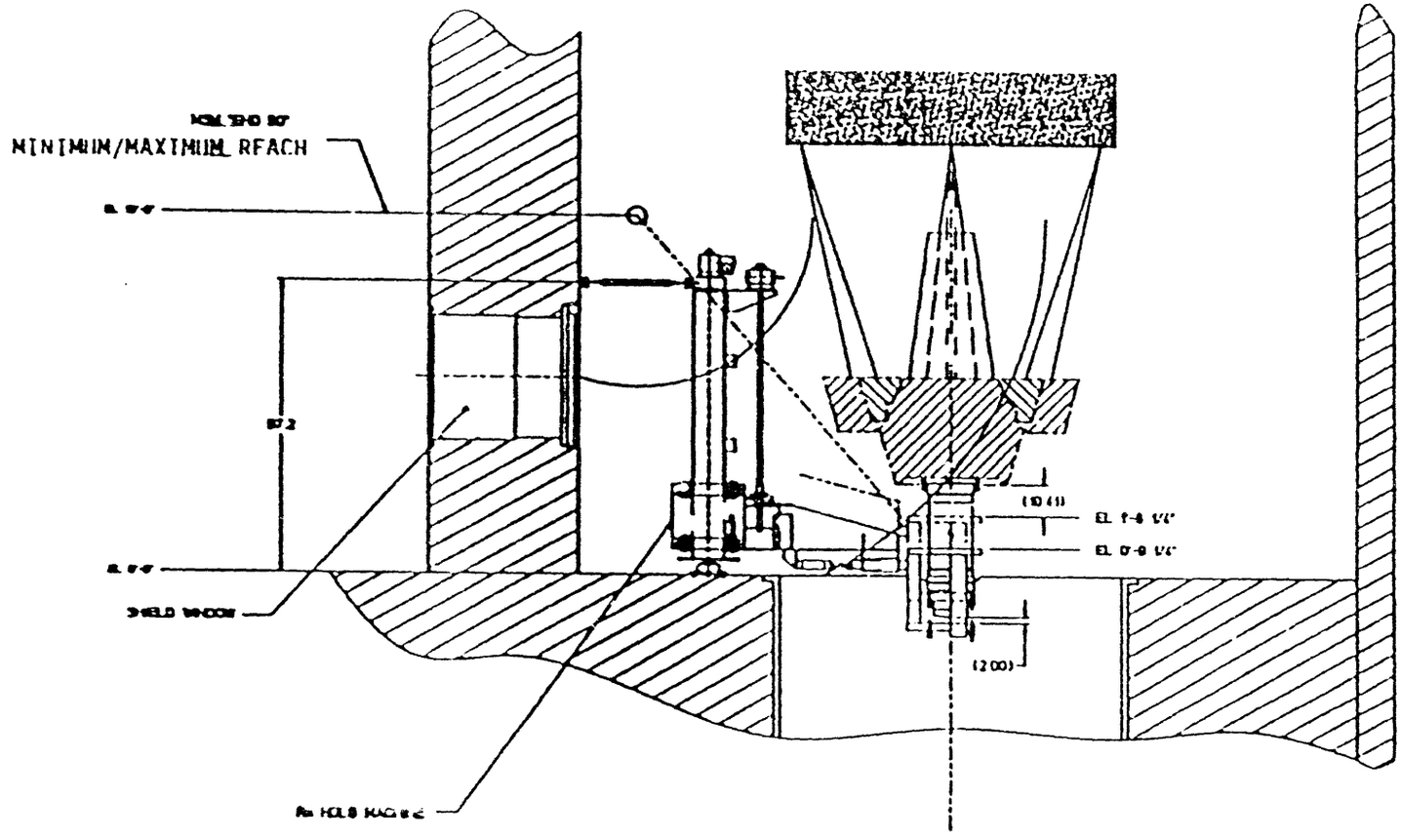
Phase 2 - Feature testing of selected demolition tools

Several remote-demolition tools were fabricated and tested in 1989. These tools will be the primary demolition implements and needed to be evaluated early in the overall equipment design program. A hydraulic scissors shear will be used to cut piping, plate, cables, and any other in-cell items. Remote air chisels and impact wrenches are other tools that were feature tested. Figure 4 presents some of these tools for review.

One problem area that is addressed by a remotely-operated balance beam is the difficulty in getting the tools and end effectors into the NAT structure. The balance beam provides a platform supported by the in-cell crane-guided by the manipulators. Using the balance beam allows the shear, impact wrench, and air chisels to be placed anywhere inside the hot cell.

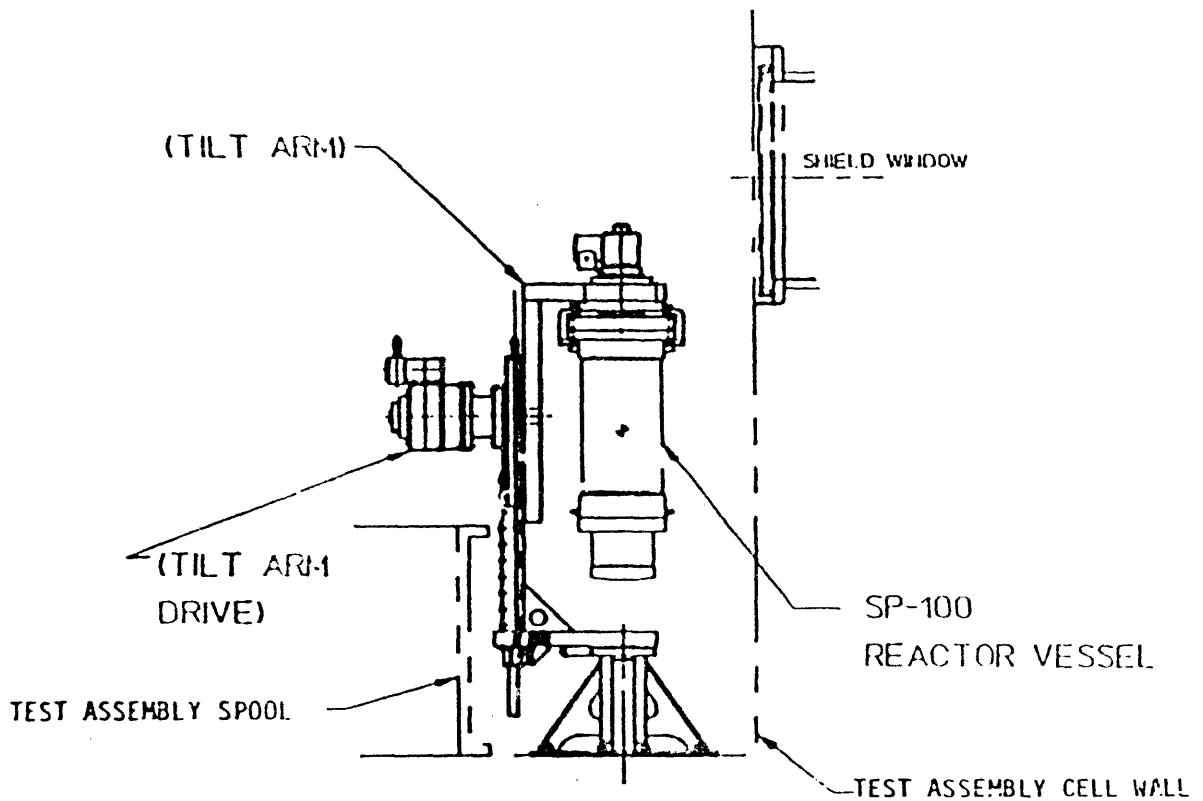
Phase 3 - Fabrication of the Facility Remote Disassembly Equipment

Following the completion of detailed design, all of the remote in-cell disassembly tooling and equipment will be fabricated (including the reactor handling, disassembly, canister welding, and polar crane extension rod). This equipment, not prototypes, will be utilized during subsequent testing.



TEST ASSEMBLY IN RAISED POSITION

FIGURE 2 SP-100 Reactor Handling Machine



Rx DISASSEMBLY WORK STATION

FIGURE 3

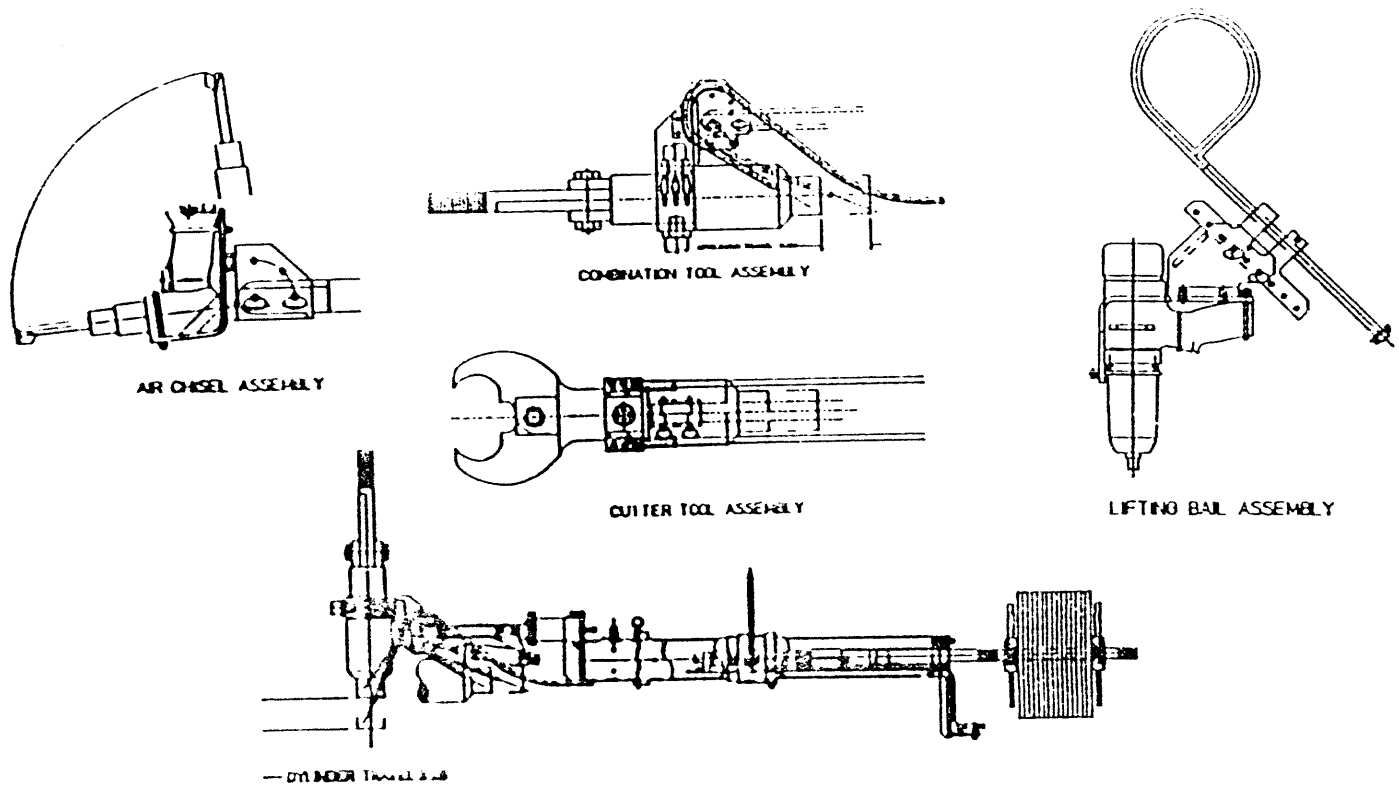


FIGURE 4. Remote-Assembly Tools

Phase 4 - Mock-up Facility Modification and Equipment Installation

The 305 Building, which will be the site of the hot cell disassembly tests, is located near the ground test site facility. The facility is equipped with overhead bridge cranes, manipulator walls and sets, and staff experienced in prototype testing. A full-scale cell mock-up will be constructed and installed in this facility to simulate the post-test NAT cell environment. The reactor handling and disassembly station, and the canister welding station will be installed and operated.

Methods to defuel the reactor will be evaluated following the first series of tests. Disassembling the reactor vessel, accessing the core, and pulling the fuel assemblies out of the core will be the focus of the second series of tests. The remote-welding equipment will be tested. Numerous canisters will be welded, leak tested, and examined to verify the quality of the welding process.

Phase 5 - Incorporation of Test Data

Test data obtained during the mock-up feature tests will be analyzed to determine if any equipment modifications are justified. Design changes will be initiated to ensure that the in-cell equipment performs without failure.

Phase 6 - Demolition of the NAT and Reactor Defueling

After the SP-100 system completes nuclear testing, the upper test cell will be cleaned and all NAT components will be removed and packaged for burial. The reactor disassembly equipment that was tested during the mock-up tests will then be installed in the upper test cell. When final component checkout is completed, the cell will be sealed and the disassembly of the SP-100 reactor will begin.

CONCLUSION

The remote-handling equipment testing program was configured to ensure that the disassembly and defueling of the SP-100 reactor system is accomplished on schedule with minimal difficulty. The equipment components that will be used to handle and defuel the reactor will be extensively tested in a prototype test facility before their installation in the SP-100 test cell.

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