Final Technical Report

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# Upgrade of the NCSU PULSTAR Instrumentation Power Channels

01 September 1992 - 31 August 1994

University Reactor

Instrumentation Program

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## DISCLAIMER

# ABSTRACT

The Nuclear Reactor Program at North Carolina State University initiated an upgrade program at the NCSU PULSTAR Reactor in 1990. The originally supplied instrumentation has been replaced with solid-state and current technology equipment. The financial assistance from the United States Department of Energy has been the primary source of support. This is the final report for the Instrumentation Upgrade.

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# 1.0 INTRODUCTION

The Nuclear Reactor Program (NRP) is administratively a part of the Department of Nuclear Engineering where there is close collaboration between the faculty and the NRP staff. Nuclear Engineering courses and associated laboratories use the PULSTAR Reactor as a teaching tool. Both undergraduate and graduate students engage in a variety of projects involving the PULSTAR Reactor as part of the general requirements to obtain their academic degrees. The published Mission Statement for the NCSU PULSTAR Reactor is as follows:

> *The Nuclear Reactor Program (NRP) was instituted to provide specialized nuclear facilities to the North Carolina academic and industrial communities for the purpose of teaching, research and service. In addition, these nuclear facilities are made available to provide services to the state and federal agencies to support governmental activities.*

The one megawatt PULSTAR Reactor continues to meet its mission of teaching, research and service by having provided over 22,500 megawatt·hours of full power operation since initial criticality in September 1972.

The PULSTAR Reactor has operated quite successfully over the past twenty-five years with minimal operating time lost to equipment failure. However, the probability of equipment problems increase as the equipment ages. The PULSTAR Reactor facility began a multi-phase facility upgrade program in 1990. Because of the instrumentation upgrade program, the excellent facility availability which has been provided during its first twenty-five years will be able to continue. The equipment purchased with the DOE and NCSU matching funds was multi-phased and prioritized to upgrade systems based on importance to safe operation and facility availability. The upgrades have also enhanced the role of the facility in teaching, research, training, and services.

## 2.0 DISCUSSION

When it was learned that additional grant monies would become available through the DOE for equipment upgrades, the NRP staff met to discuss the various options based on need and safety after the initial instrumentation upgrade was completed. The equipment ordered and installed was the result of that meeting. The upgrade program provided funds for new source, intermediate, and power range instrumentation for the PULSTAR Reactor facility. See Figure 1 for a picture of the PULSTAR Control Console.

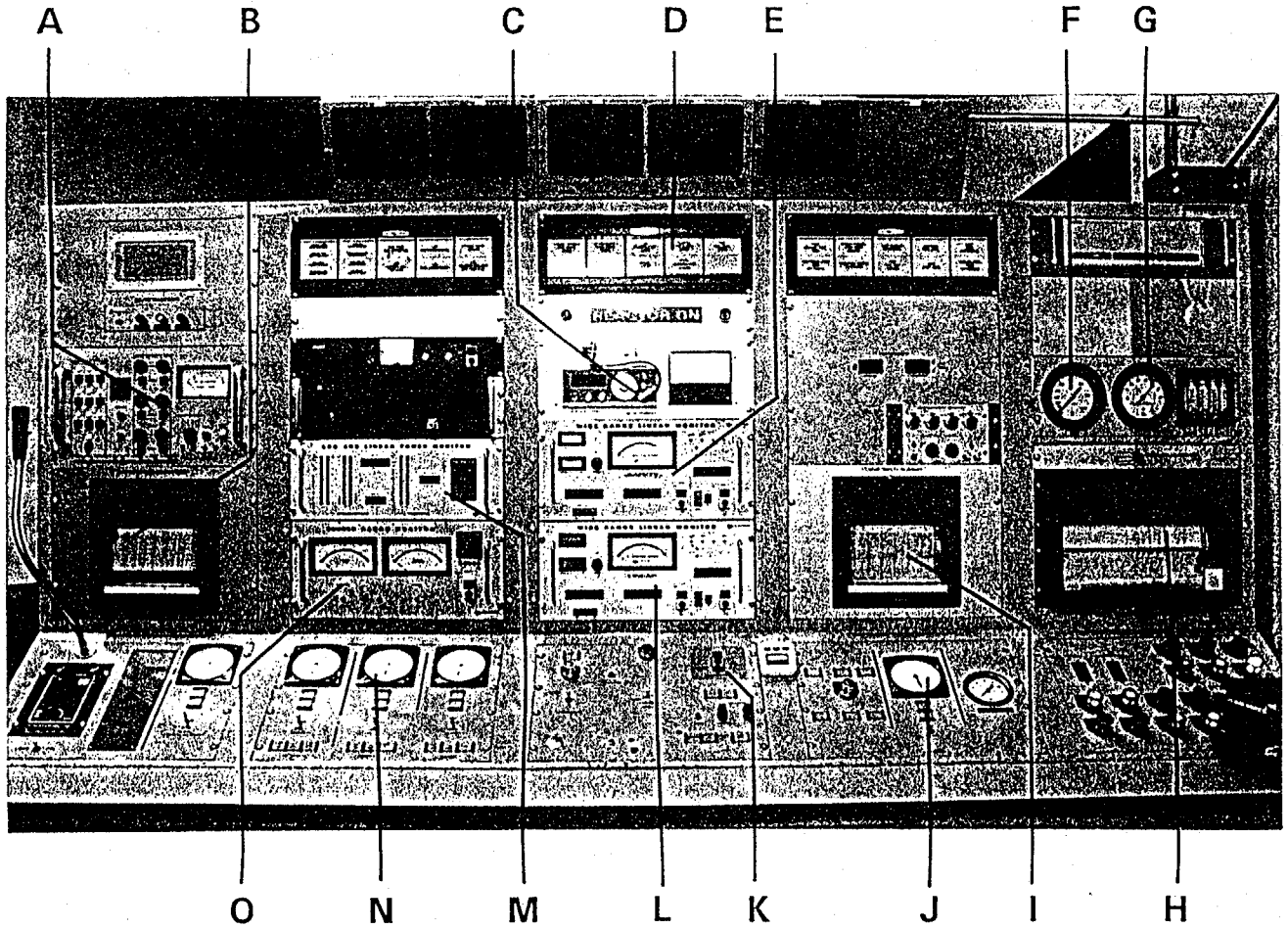
KEY

A - SCRAM Logic Unit
B - Source/Log and Linear Recorder
C - N-16 Monitor
D - Annunciator Panel
E - Safety Channel Monitor
F - Primary Coolant Flow Gauge
G - Pool Water Level Gauge

KEY

H - Temperature Recorder
I - Linear and Safety Recorder
J - Shim Rod Position Indicator
K - Flux Controller Demand Potentiometer
L - Linear Channel Monitor
M - Log and Linear Channel Monitor
N - Control Rod Position Indicators
O - Source Range Monitor

PULSTAR Control Console



## 3.0 CONCLUSION

All the original phases of the PULSTAR Instrumentation Upgrade Program are now complete. The equipment upgrades described in this report are functional and are supporting reactor operations. Undergraduate, graduate, and researchers now have a valuable asset with which they can continue teaching laboratories associated with Nuclear Engineering and reactor operations.