

MEETING WITH WOLF CREEK NUCLEAR OPERATING CORPORATION (LICENSEE)  
RELATED TO WOLF CREEK GENERATING STATION  
MAIN STEAM AND FEEDWATER ISOLATION SYSTEM (MSFIS) REPLACEMENT PROJECT  
MEETING HELD JUNE 28, 2006  
DOCKET NO. 50-482

Attached is the 20-page handout from the licensee for the meeting.



# **Main Steam & Feedwater Isolation System (MSFIS) Controls Replacement Project**



# Agenda

- Main Steam & Feedwater Isolation Replacement Project
- Current MSFIS Controls
- Replacement MSFIS Controls
- Advanced Logic System (ALS)
- Development Team and Development Process
- Regulatory Process
- Questions



# Project Overview

- Replace existing hydraulically operated MSIV and MFIV actuators with actuators operated by process fluids
- Replace MSIV and MFIV bodies
- Replace existing MSFIS Controls
- Installation of MSIV/MFIVs and controls is scheduled for RF16, April 2008



# **Current MSFIS Controls**

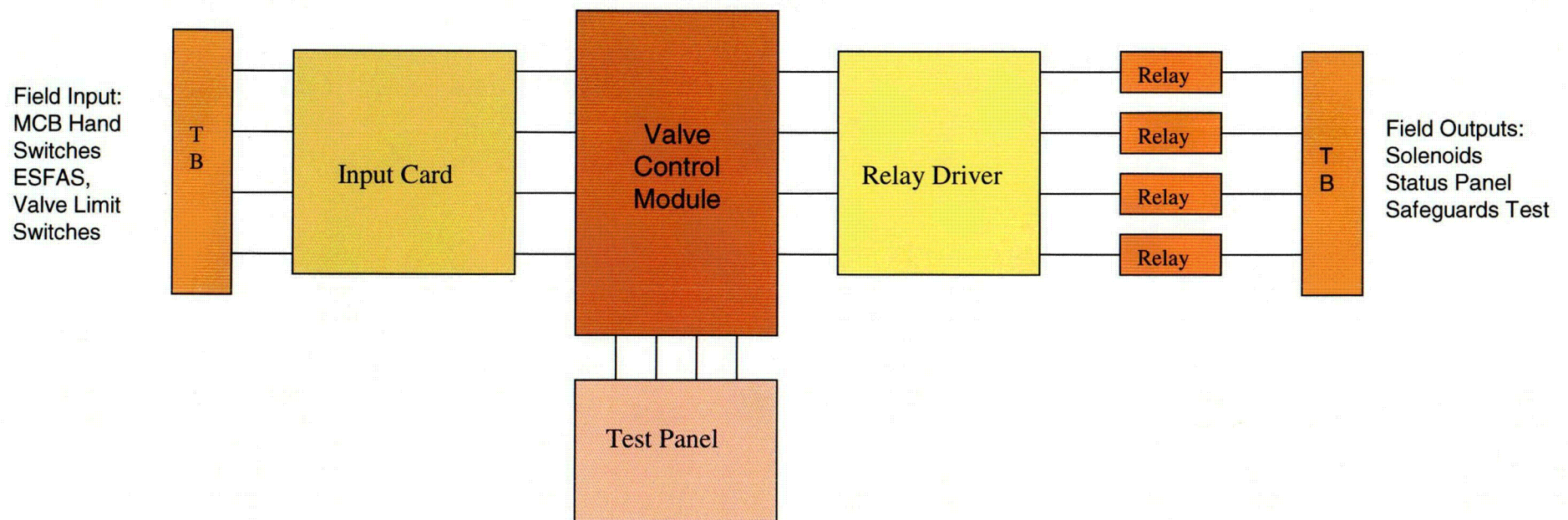


# Current MSFIS Controls

- Current MSFIS Controls are a digital control system
  - Boards are based on discrete logic IC's along with common analog signal conditioning components for interfacing with field I/O
  - Valve Control Module, which is the key module, is custom to the application
  - Board interconnection is custom to the application
  - Test Panel provides limited test capability
- Issues with current MSFIS controls
  - Becoming less reliable
    - Plant Trip due to circuit card failure
    - Recent circuit failures have caused valves to stroke partially closed
  - Troubleshooting requires a significant effort
  - Multiple single point vulnerabilities which can cause plant transients
  - Obsolete components
  - Current Valve Control Module logic will not operate the replacement actuators



# Current MSFIS Controls Architecture





# Replacement MSFIS Controls





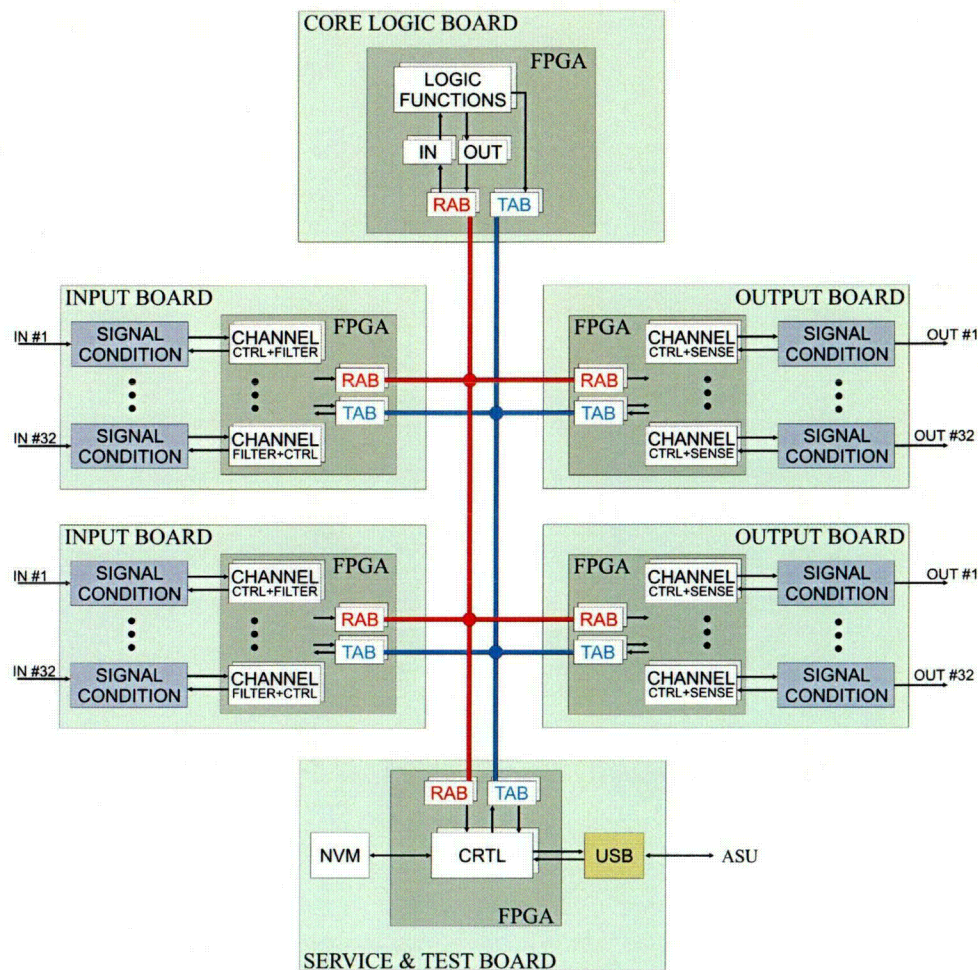
# Replacement MSFIS Controls

- Goals of the Replacement MSFIS Controls
  - Operate replacement actuators
  - Eliminate single point vulnerabilities within the control system
  - Improve testability to both improve test coverage and reduce manpower required for maintaining the system
  - Improved diagnostics to enhance troubleshooting capabilities
  - Mitigate future obsolescence issues
  - Implement a scalable architecture to allow future systems to be replaced with a common platform
  - Retain existing safety system architecture, maintain a low level of complexity



# Advanced Logic System (ALS)

- **Deterministic** – The system behaves the same all the time, it's fully predictable
- **Single Failure Proof** – System architecture is designed such that no single failure will cause a false actuation
- **Fault Tolerant** – Detects a fault and places system in a safe state and notifies the control operators
- **Modular** – Boards are autonomous, a failure of one board does not cause failures in other boards
- **Scalable** - The system is built from standard modules, no module is designed specific to a particular application
- **Advanced Diagnostics** – Plant personnel can interface with the system for troubleshooting and other diagnostics activities





# Advanced Logic System (ALS) Overview

- Logic Based Architecture
  - Standard logic implemented in field programmable gate array (FPGAs)
  - Logic elements are pre-built, FLASH cells 'wire' the logic elements together similar to discrete logic on a printed circuit board
  - Logic and test vectors are portable, providing protection to future obsolescence
- Testable
  - System allows for thorough testing during the development process
  - Deterministic testing – same behavior every time
  - Run-Time testing – applied to continually verify system integrity
  - FPGA logic incorporates Built-In Self Test (BIST) engines
- Reliable
  - Simple and stable architecture
    - No Stack/Heap/Interrupt overflow/underflow/overwrite
  - Only deploys digital flip-flop's and protected FLASH cells' for storage
    - No SRAM or program FLASH issues
  - Boards are a simple design with a small number of components (as compared to current discrete system or a microprocessor based system), which means there are less components to fail



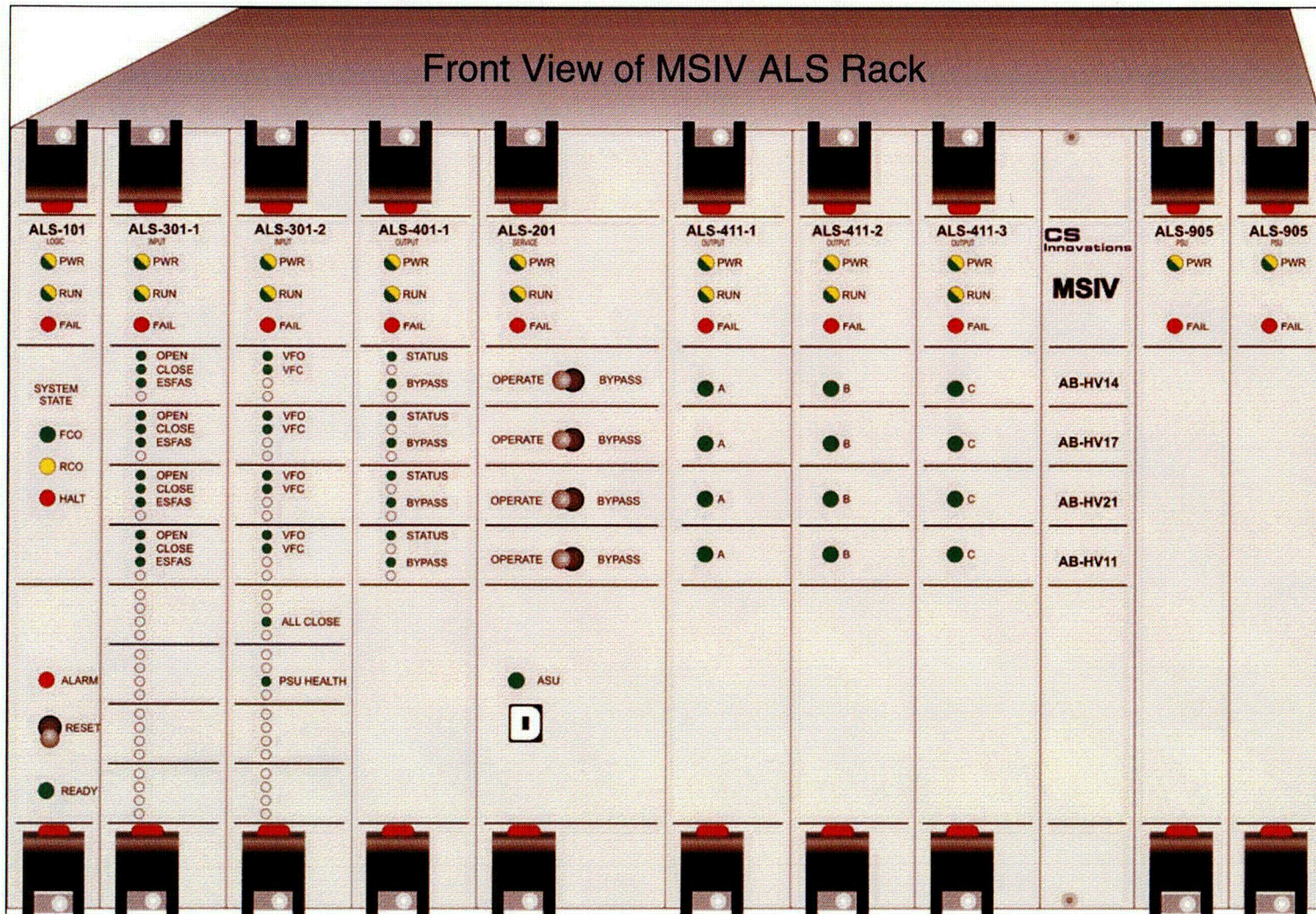
# Advanced Logic System (ALS) FPGA's

- FPGA Types
  - FLASH – rad tolerant, highly reliable, reprogrammable
  - Anti-FUSE – rad hard, highly reliable, one time programmable
  - SRAM – complex system-on-chip high speed, commercial applications
- ALS utilizes the Actel FLASH FPGAs
  - Application is low gate count implementing only standard logic
  - Implements simple design practices
  - High radiation survivability is not critical, as in Space applications
- Actel FPGA's
  - Products focused on high reliability applications
  - Widely used in Military, Avionics, and Aerospace Industry's
  - Proven development tools with qualifications meeting Military, Avionics, and Aerospace requirements

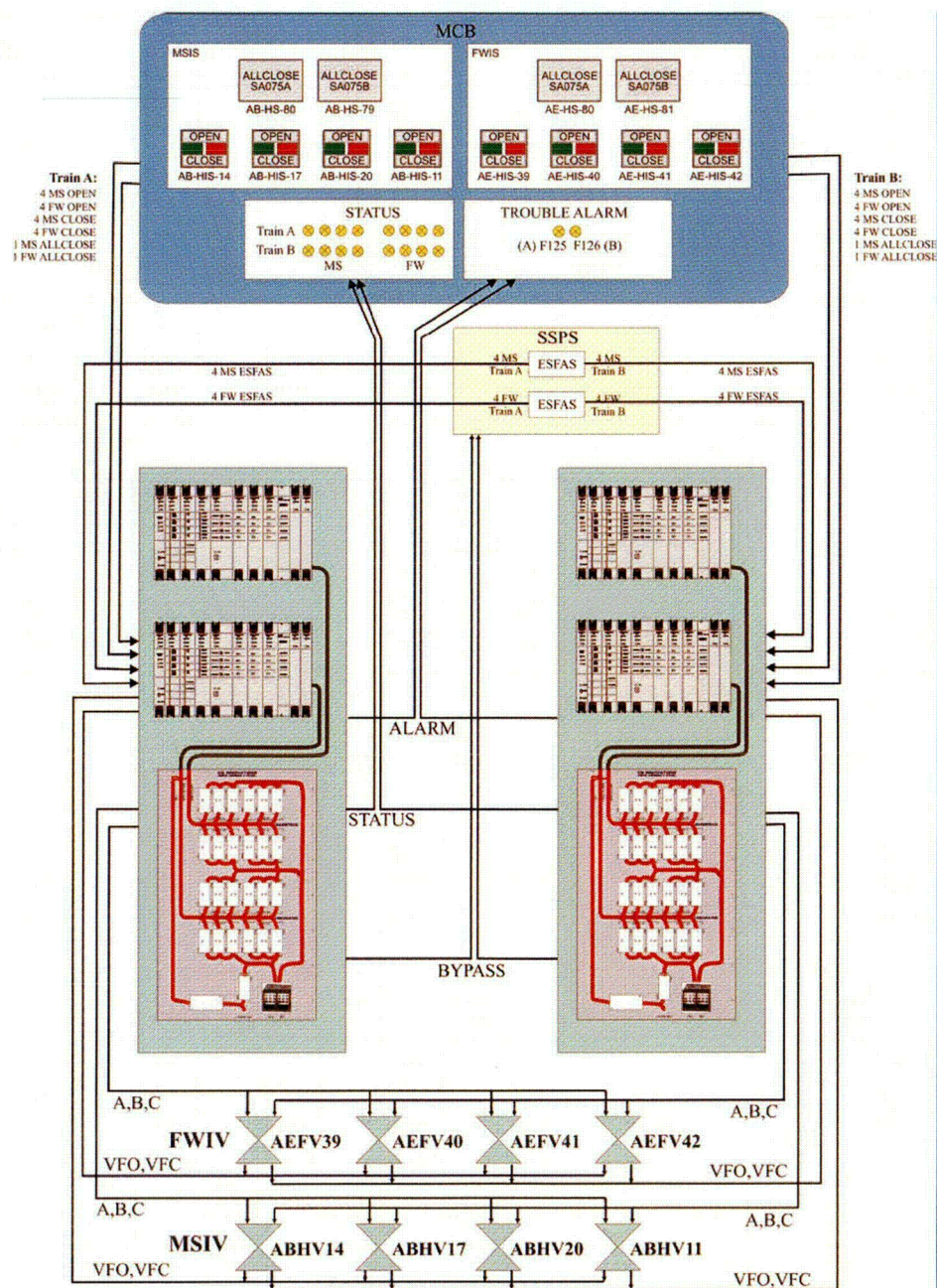




# ALS Rack for MSIV







28 June 2006

Wolf Creek Generating Station

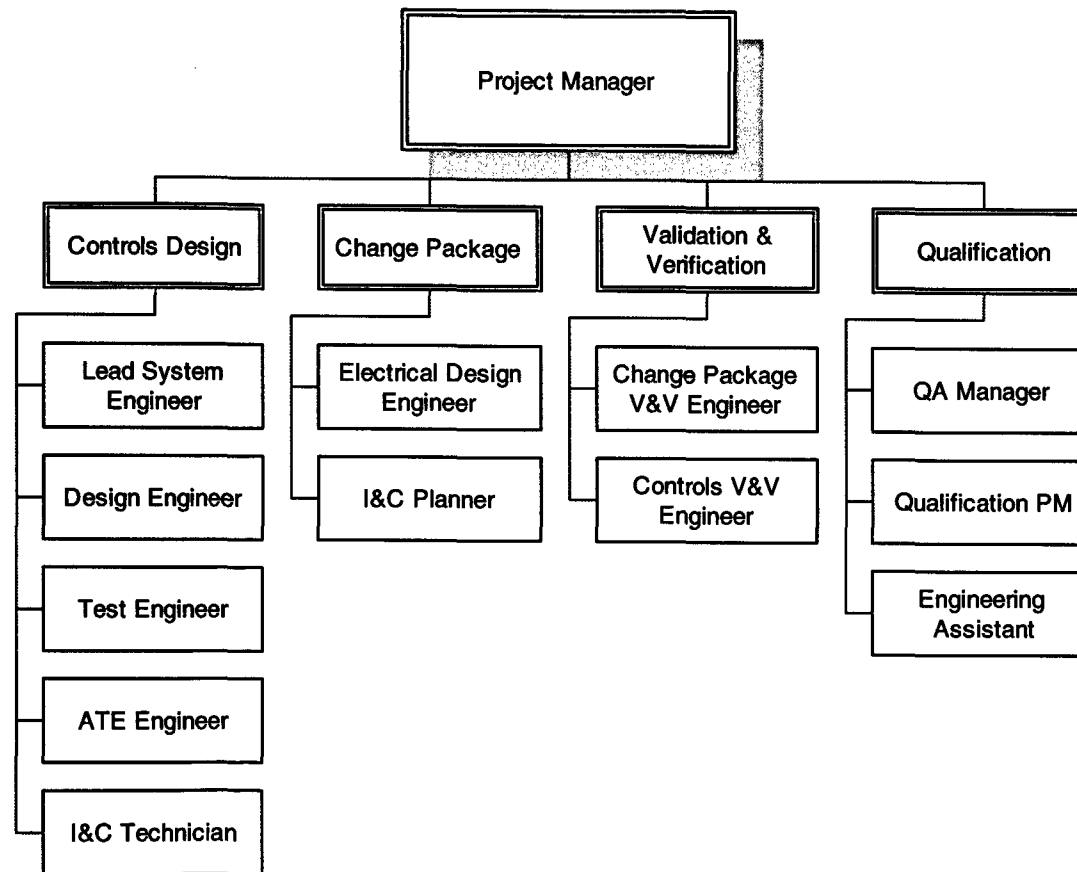
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# Development Process



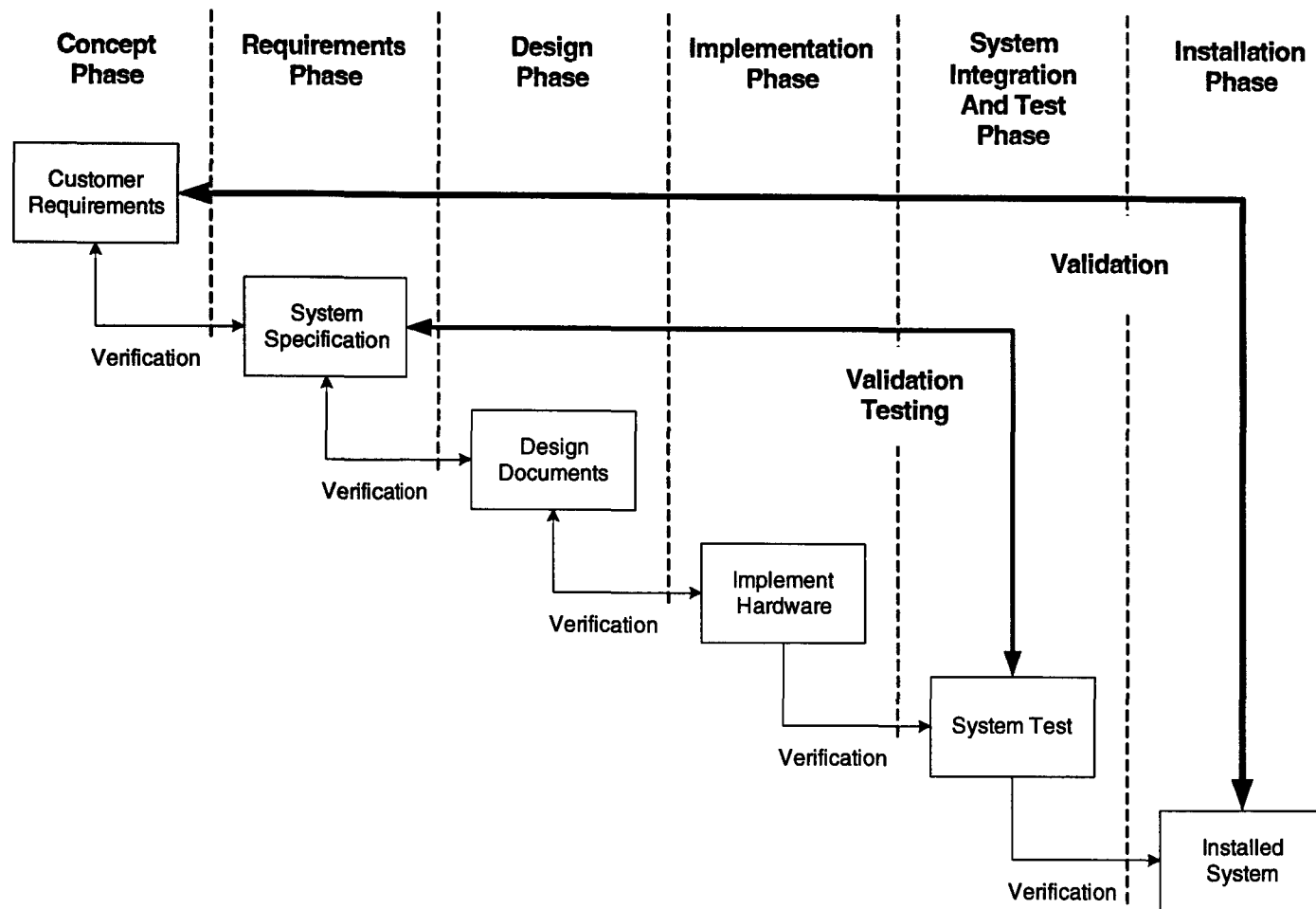
# MSFIS Controls Project Team







# Development Life Cycle





# Project Milestones

<b>Customer Requirements</b>	<b>Jun-06</b>
<b>MSFIS System Specification</b>	<b>Jul-06</b>
<b>ALS Design Specifications</b>	<b>Sep-06</b>
<b>Qualification Testing</b>	<b>Oct-06</b>
<b>Qualification Test Report</b>	<b>Jan-07</b>
<b>V&amp;V Report</b>	<b>Jan-07</b>
<b>LAR Submittal</b>	<b>Mar-07</b>
<b>Factory Acceptance Test</b>	<b>Jul-07</b>
<b>Site Acceptance Test</b>	<b>Sep-07</b>
<b>Installation</b>	<b>Apr-08</b>



# Regulatory Process



# Regulatory Process

- License Amendment Request
  - TS 3.3.2, Function 4, Steam Line Isolation, and Function 5, Turbine Trip and Feedwater Isolation
    - Add new sub-Functions for MSFIS Automatic Actuation Logic and Actuation Relays
  - TS 3.7.2/TS 3.7.3 - MSIV/FWIV Closure Times (SR 3.7.2.1/SR 3.7.3.1)
    - Limits will be moved to the TS Bases based on TSTF-491, Rev. 2
  - TS 3.7.3 - Addition of Main Feedwater Regulating Valves and Bypass Valves (consistent with NUREG-1431, W Standard TS)
  - TS 3.7.3 - Extend Completion Time for one or more MFIVs inoperable from 8 hours to 72 hours (consistent with NUREG-1431, W Standard TS)



# Questions?