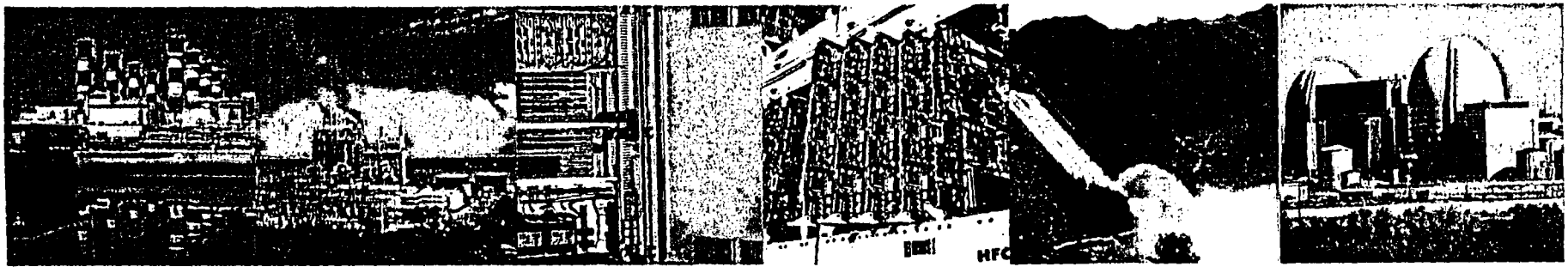
HF Controls Corporation



Nuclear I & C Systems Capability

DOOSAN

June 22, 2004

HFC

Agenda Items

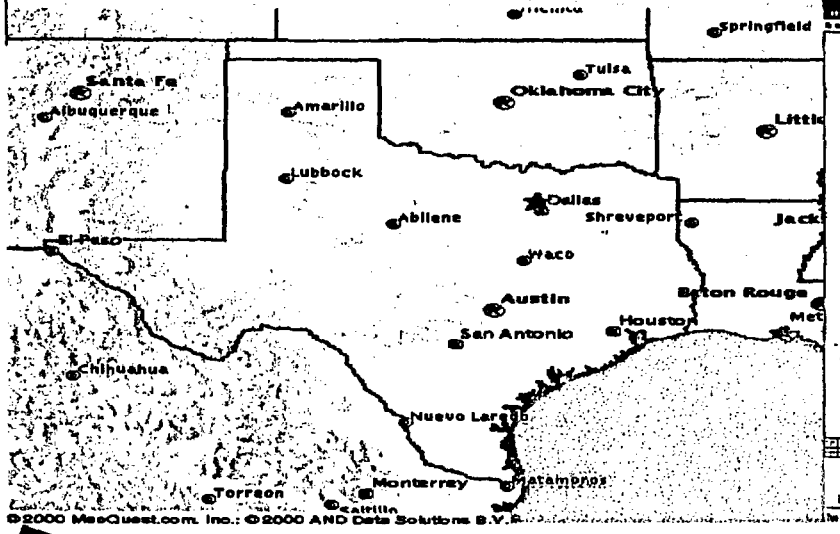
• Introduction • Organization • Background • Project Objective • System Overview • Engineering Team	• HFC 6000 Nuclear Safety System • HFC 6000 Qualification Process • Proposed Schedule • Summary • Open Discussion

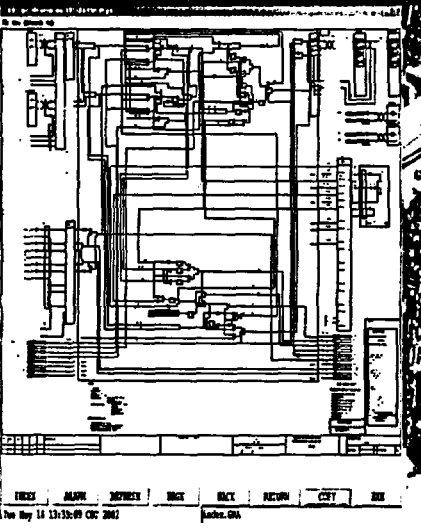
HF Controls

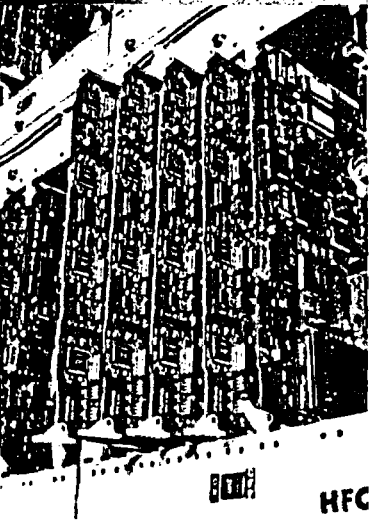
- Established as Forney Engineering Company in 1961 as a supplier of fossil plant I&C
- Commissioned by Foster Wheeler to develop utility plant control systems, strategies, and applications
- Entered the Nuclear I&C market in 1979
- Formed HF Controls August 2000
- More than 450 I & C System installations world wide

HF Controls Home Office

HFControls Corporation
16650 Westgrove Drive Suite.
500
Addison, TX 75001
Toll Free: 1-866-501-9954
Fax: 972-367-4699
www.HFControls.com







HFC

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HFC Managerial Organization

Timothy J. McCreary	**President**
Jang Ho Choi	*Vice President Finance/CFO*
Allen Hsu	*Vice President Engineering/CTO*
John Stevens	*Manager of Nuclear Engineering*
Charles E. Fisher	*Manager Quality Assurance*
Gregg Reding	*Director Operations*
Ronald Puryear	*Vice President Sales & Marketing*
Robert Cain	*V & V Team Leader & Auditor*

HFC Product Lines

System	Main Features	Application
HFC – 6000	• Qualification Processing • Standard Modular Packaging • Redundant Multi-loop Controller • Single loop application • Dedicated CSM & M/A station	US NPP/Korea NPP Plant I&C Control System
ECS 1200 Model 05	• Scalable Redundant DCS System • State-of-Art System Architecture • Mega Controller with up to 16 Microprocessors • Complete I/O library cards	Standard DCS Application
ECS 1200 Model 06/07	• I/O rack mounted redundant controllers, up to 64 I/O cards/node	Standard DCS Application
AFS SBC05	• Redundant Boiler Safety system	BMS

HFC Control System

- Built on a 50 year legacy of power generation and boiler safety control
  - System and its predecessors share common features developed specifically for power and steam generation continuous and discrete safety control
  - Built with concepts to enhance safety, reliability, data integrity, particularly because of the demands of boiler safety
    - Many features exceed the requirements of NFPA
    - Has been certified for use in safety and non-safety areas for nuclear power generation in Korea
  - Influenced by customer input; customizable for user requirements

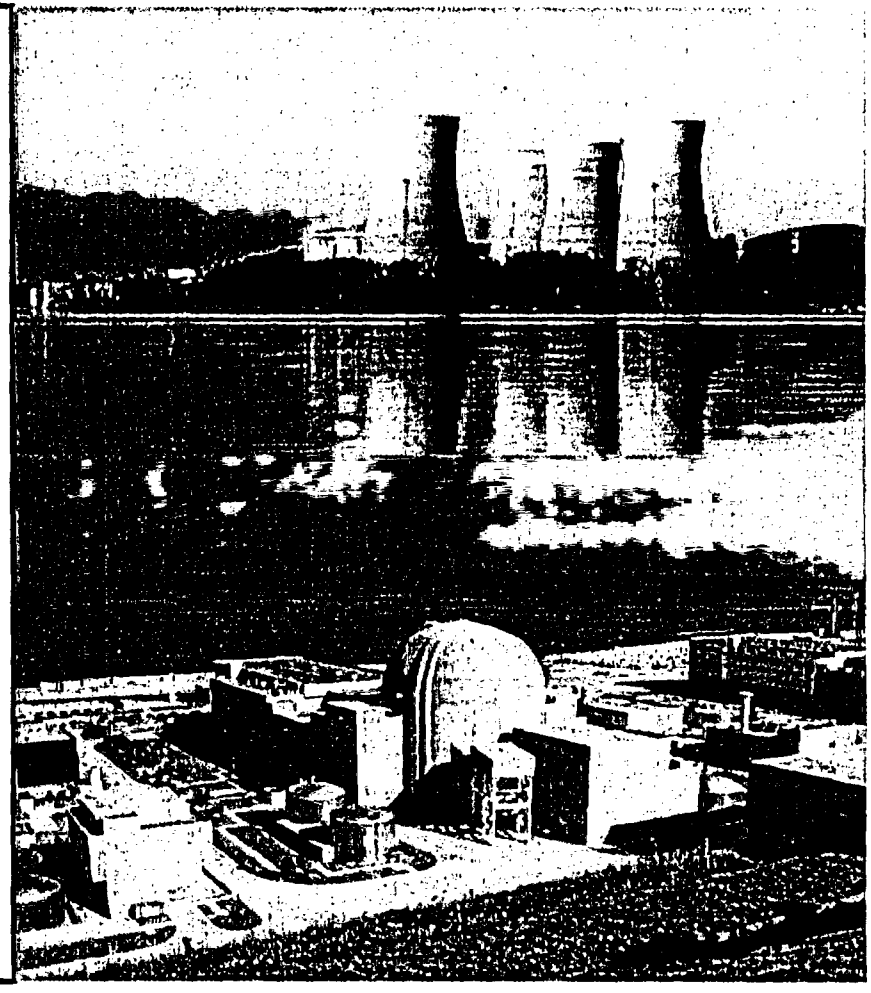
Projects Since 2000 (Non Nuclear)

Logan Station PP	HF1054
Colton Kiln	HF1050
Namyangju WTP	HF1049
APC Plant Control	HF1048
New Hanover PP	SE1139
Chevron Petro-Chem	HF1044
Mt. Carmel PP	HF1040
Seattle Metro WTP	HF1034
Seoul #4 & #5 PP	HF1013
Mojave Cement	HF1008
Colton PP	HF1003
ARCO Oil	S10083
PSO PP	S10058
New Hampshire PP	S10047
Vero Beach PP	S10044
Garland Power PP	S10039
DECO PP	S10038
TXU Collins PP	S10035
TRIGEN PP	S10031
US Steel Casting	S10028
CIPSCO PP	S10020
Santee Cooper PP	S10019
Stone Container PP	S10018
WEPCO PP	S10012
DUKE Power PP	S10004

>>>

Foundation in Nuclear Power

- Awarded ILS (Interposing Logic System) for Duke Power's Cherokee Units 1 & 2 and Perkins 1 & 2
  - *Projects cancelled; 90% complete*
  - *USA nuclear projects stopped*
- ILS applied to boiler safety and other logic control systems
  - *242 systems sold*
- Yonggwang 3 & 4 ILS awarded in 1990

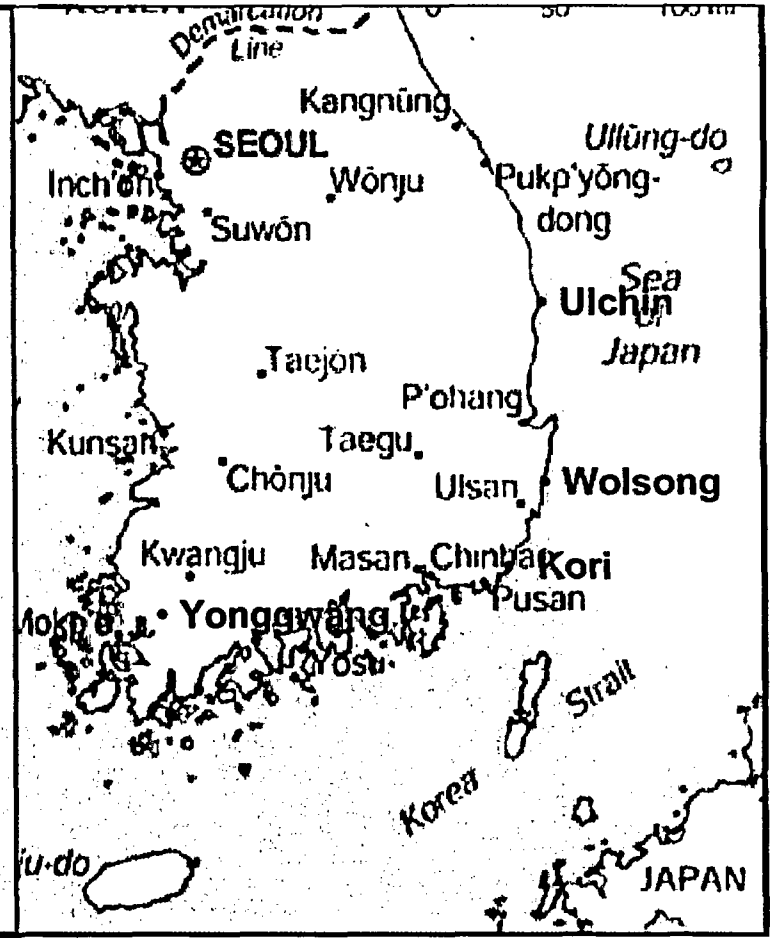


Nuclear Power I & C Experience in Korea

Year	Owner	Plant	SR/NSR	Application/Events
1994	KEPCO	Yonggwang NPP Unit 3 & 4	SR & NSR	Plant I & C Systems
1994	KEPCO	Yonggwang NPP Unit 3 & 4	Safety	AAC/DG I & C System
2001	KHNP	Ulchin NPP Unit 5 & 6	SR & NSR	KINS approval on Plant I & C System Design
2001	KHNP	Kori NPP Unit 1, 2, 3 & 4	SR	EDG I & C Systems
2002	KHNP	Ulchin NPP Unit 5	SR & NSR	Plant I & C System (Commercial as of June 2004)
2003	KHNP	Ulchin NPP Unit 6	SR & NSR	Plant I & C System (Commercial by April 2005)
2003	KHNP /Doosan	Kori NPP	Non-safety	Control Rod System (CRCS)
In Progress	KEPCO	KEDO NPP Unit 1 & 2	SR & NSR	Plant I & C Systems
	KHNP	Kori NPP Unit 1, 2, 3 & 4	SR	AAC/DG I & C System
	KHNP	Doosan R & D project	Non-safety	CRCS Power Cabinet Control System
	KHNP	Doosan R & D project	Safety	Core Protection Control System (CE Reactor)

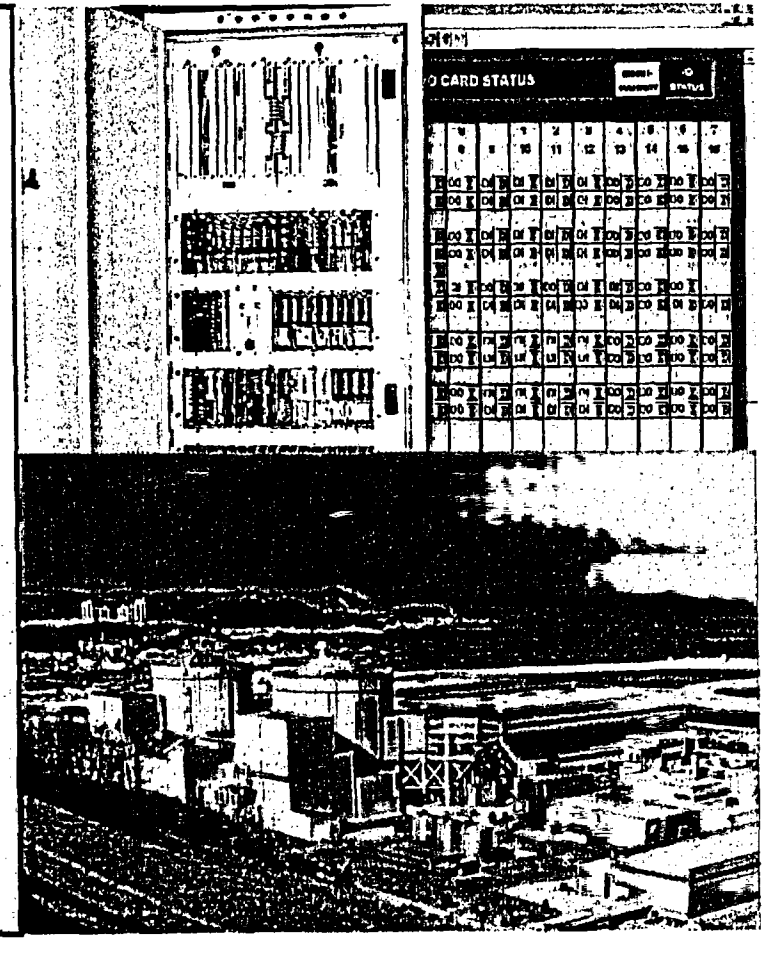
Korean Nuclear Power Plants

- The world's most active nuclear power market
  - *USA technology*
  - *USA control*
- 18 existing units
  - *CE PWR design*
  - *1100 MW*
- 8 units under construction
- 4 units in negotiation
- Korea Institution of Nuclear Safety (KINS) as license authority
  - *YGN 3 & 4 and UCN 5 & 6*



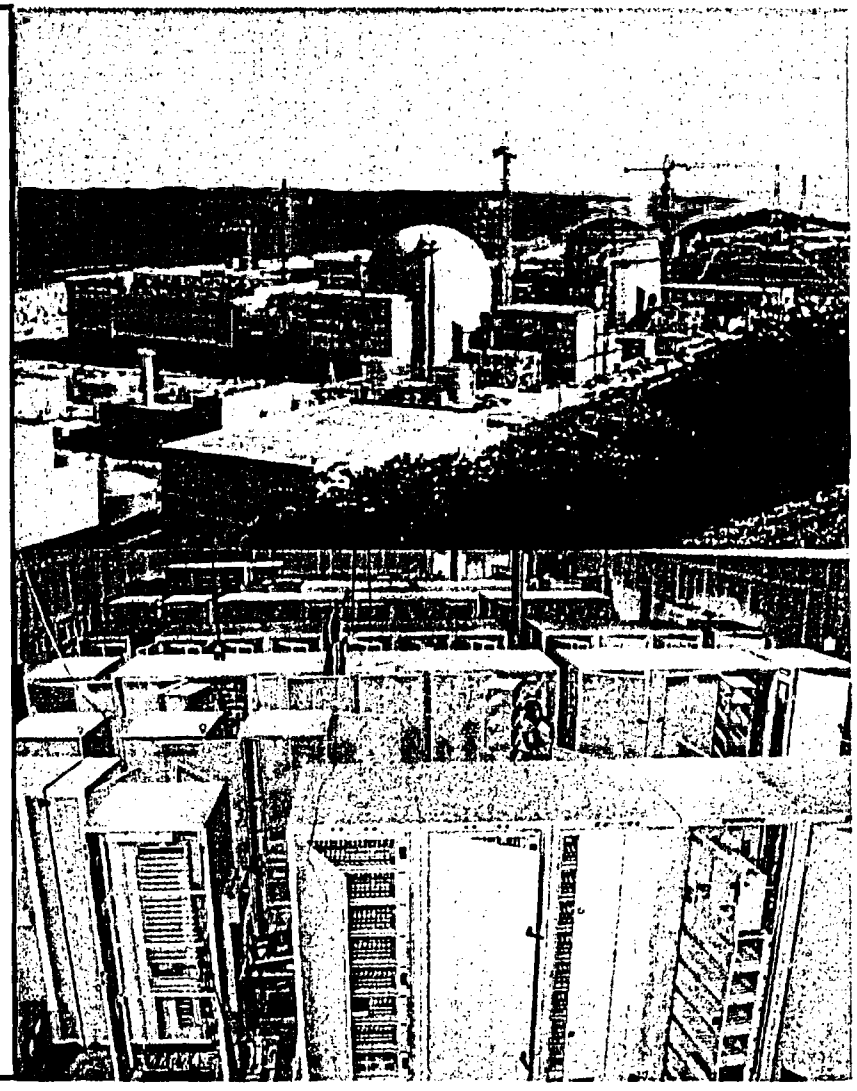
Capability in Nuclear Plants

- Korea Hydro and Nuclear Power, Yonggwang Nuclear Power Plant, Units 3 and 4
  - *Plant Interposing Logic System, Model AFS-1000™*
  - *Safety and non-safety class service*
  - *71 cabinets*
  - *9,000 I/O*
  - *1,900 loops*
  - *Single loop integrity*
  - *In operation since 1994 with no defects or changes*



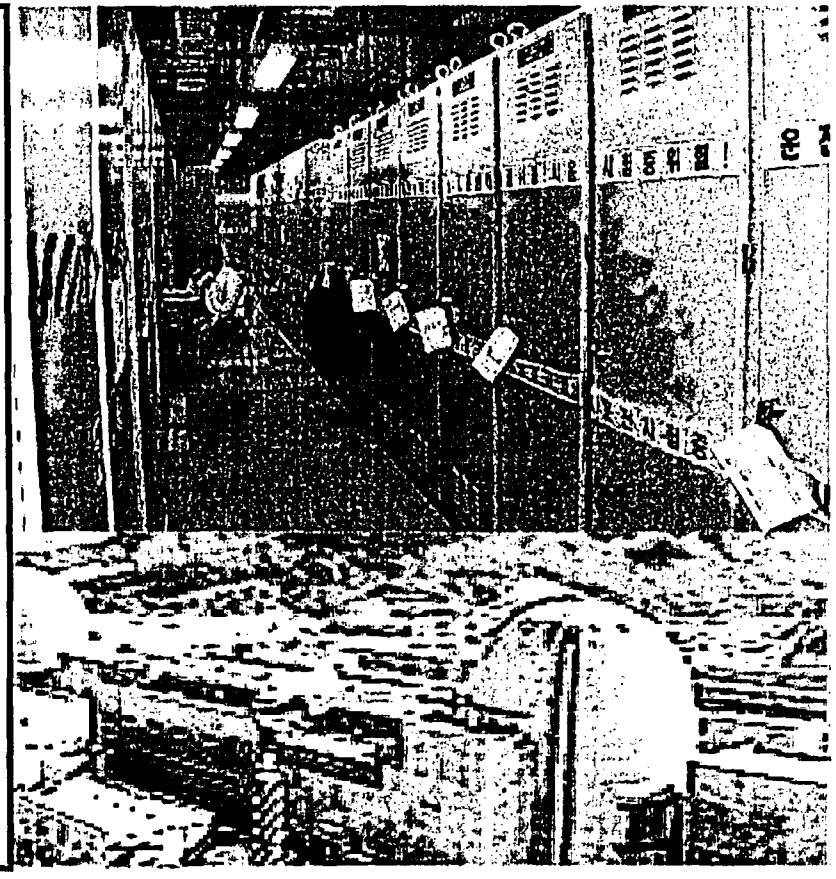
Capability in Nuclear Plants

- Characteristics of the Ulchin and KEDO Plant I & C Control Systems
  - *176 cabinets*
  - *30,000 I/O*
  - *2,567 loops*
  - *Panel-mounted instruments including hard manual stations*
  - *Engineering Workstations*
  - *Functions*
    - **Engineered Safety Features**
    - **Diesel Load Sequencer**
    - **Feed-water control**
    - **BOP monitoring and process control**
- Survived through 5.2~~G~~ R Earthquake recently



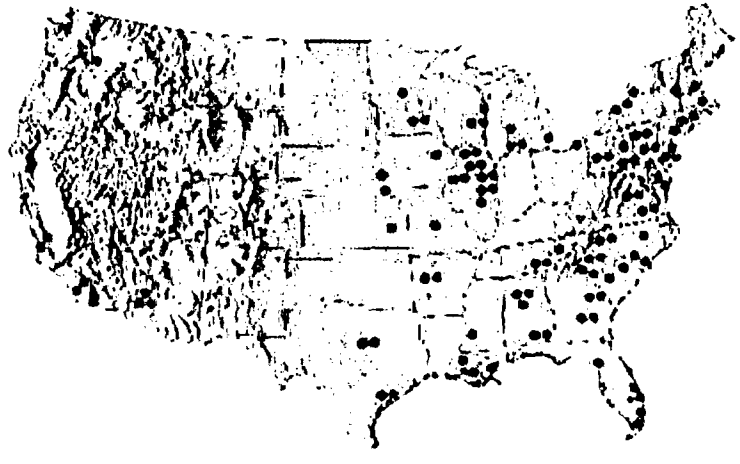
Capability in Nuclear Plants

- Kori Nuclear Generating Station, Units 1 - 4
  - *Emergency diesel engine startup and annunciation system*
  - *400 devices*
  - *Panel board annunciation*
  - *Manual control stations*
  - *In operation since 2001*



Nuclear Power Strategic Initiatives

- Korean nuclear systems create a base for HFC to develop the USA nuclear market
- BOP applications capability established; safety applications in ESFAS and other areas
- Digital protection systems in nuclear installed for 10 years; in fossil and process for nearly 25 years
- 25 years of applicable experience for plant controls upgrades; well established nuclear V&V program



Strategic Alliances with key partners establishes HFC with capabilities for USA nuclear plants

DOOSAN

HFC

Our Background

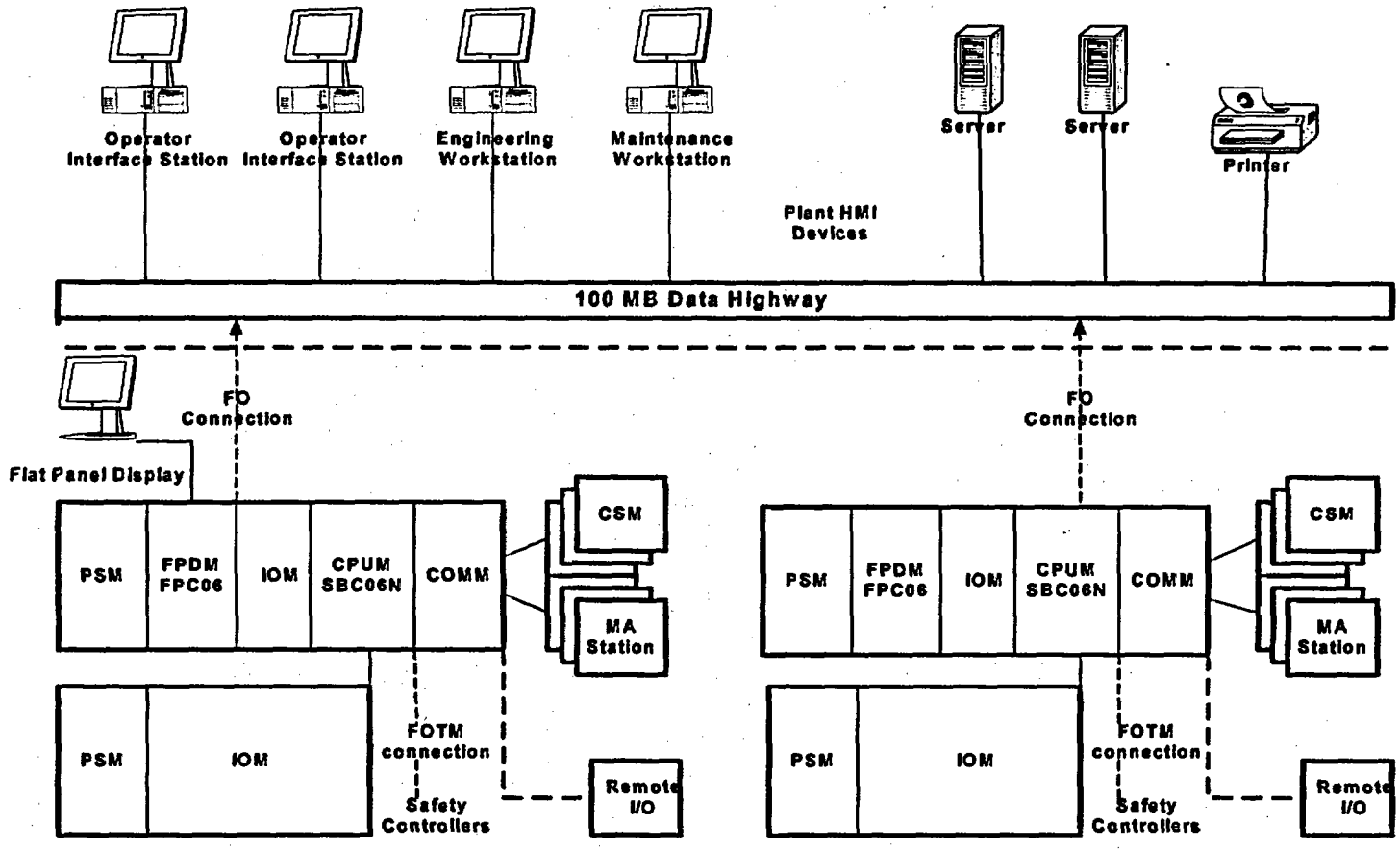
- In 25 years, built 450 Plant I & C Systems
- For 10 years, built 11 digital Nuclear I & C Control Systems
- Core team 350 years of power plant control systems experience
- Technology and applications engineering core since 1976

Capability Summary

• HF Controls has a large installed base of digital controllers and I/O modules in nuclear power plants • HF Controls has significant experience with digital controls at nuclear power plants	• The HF Controls system at Ulchin are two relatively large size digital control systems; those being built for KEDO will be similar in size • HF Control system was selected as Korea NPP protection system development project (CRCS, CPCS,...)

HFC 6000 Nuclear Safety System

System overview



HFC 6000 Nuclear Safety System

Engineering Team

- Meet 10CFR50 Appendix B requirements
- V&V programs in place and operating; in-house commercial grade dedication
- KINS (Korea Institution of Nuclear Safety) approved software qualification process
- Stable base staff with large availability of supplemental resources in the area
- Expanded nuclear experience and capability
  - *Hurst Technology, Inc.*
  - *The Windsor Group*

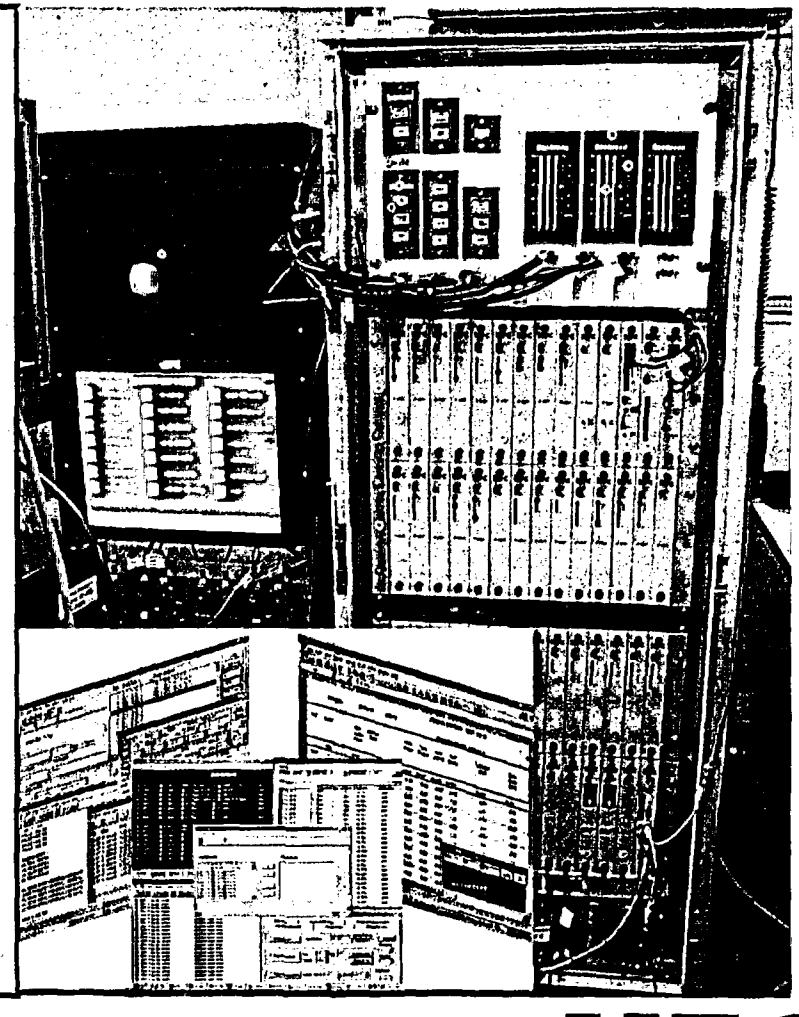
HFC Organization Development

- Development of our Appendix B quality program
  - *August 2000 - HFC spin off*
  - *February 2001- QA Program designed and manufacturing began*
  - *December 2001- ISO audit and registration*
  - *August 2002 – ISO audit*
  - *August 2003 – ISO audit to new 9001-2000*

- Audits
  - *January 2002, KHNP*
    - "satisfactorily implemented"
  - *February 2002, KINS*
    - No findings for hardware nor system performance
    - Minor findings related to software testing
    - "...HFC is qualified to provide safety [and non-safety] systems for any nuclear plant control application"
  - *August 2002, ISO renewal*
  - *August 2003, ISO (9001-2000)*
  - *Periodic inspection, KHNP*
    - Passed

HFC-6000 Safety Control System

- HFC-6000 represents the suitable approach to safety critical I&C
  - *I/O modules*
  - *SBC-06N single- and multi-loop controllers*
  - *Proprietary communications network*
  - *Flat panel display*
  - *Dedicated Control Switch Module and M/A station for manual control of output*
- One product for all safety critical applications
- Modular design for easier mounting through standard 19″ racks



High Integrity Safety Control

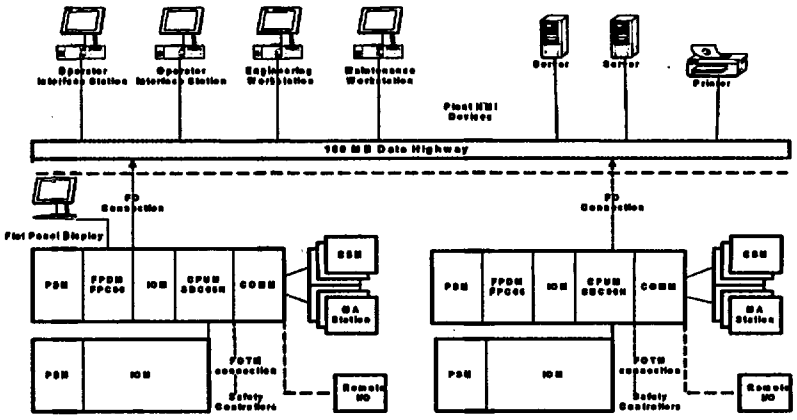
A full spectrum of Class 1E systems can be implemented with HFC's HFC-6000 platform:

- *HVAC controls*
- *Engineered Safety Features Actuation System*
- *Feed-water controls*
- *Post Accident Monitoring System*
- *Chiller controls*
- *Diesel load sequencer*
- *Diesel generator controls*
- *Turbine controls*
- *Exciter controls*
- *Radwaste monitoring*
- *Reactor coolant systems*
- *Reactor Protection system*

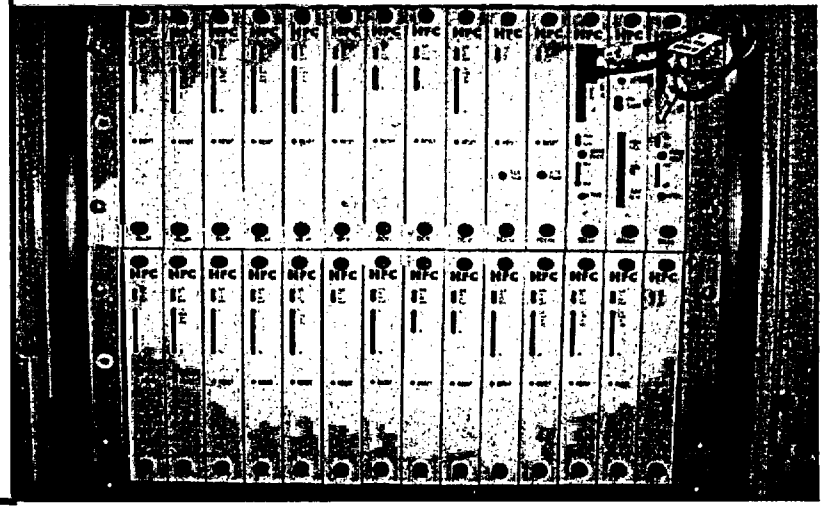
Proven technology with 10 years of successful operation in nuclear plants

Simple, Straightforward Approach

- Highly modular and scaleable
- Small systems accommodated
- Single/multiple loop, multifunction controller provides robust features and performance
- Segregation of functions provide maintenance and operation benefits

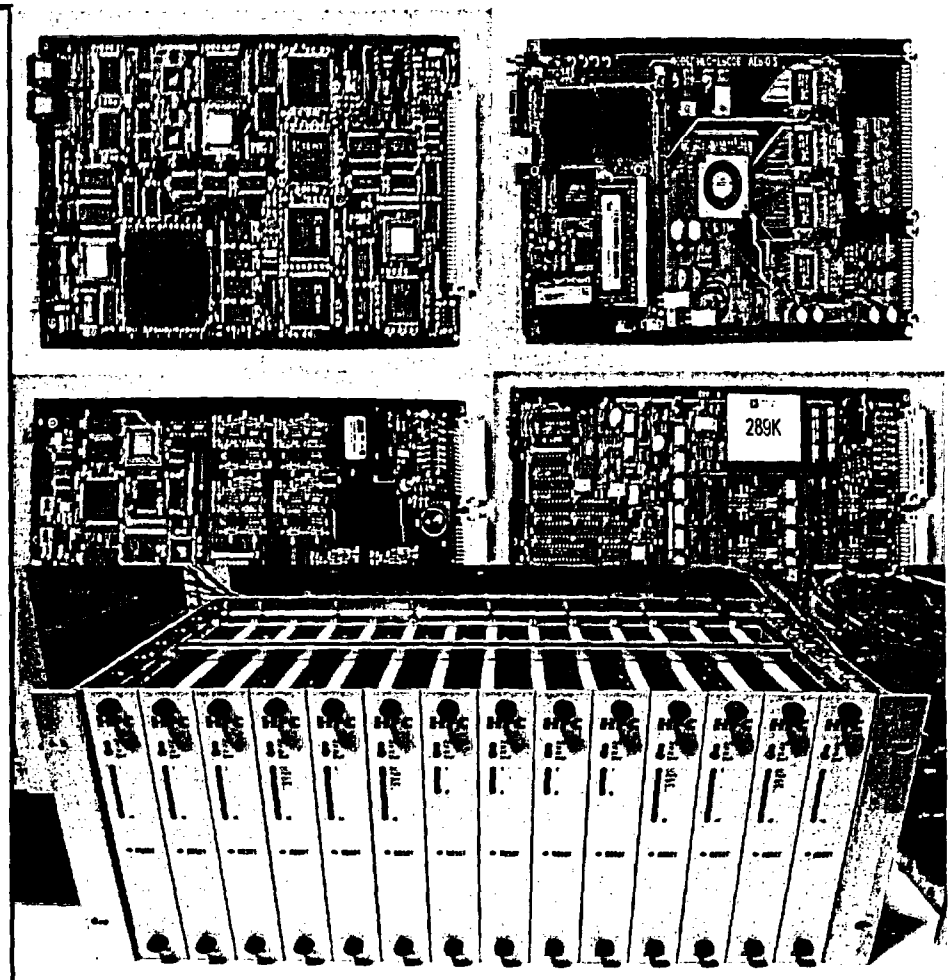


HFC 6000 Nuclear Safety System



High Integrity – Product Basis

- HFC 6000 basis:
  SBC-04N/SBC-06N Controller
  - *Key product for HFC fossil projects*
  - *Used in Boiler Control and Safety Systems*
    - USA installations
    - Wide-spread applications around the world
  - *Technology Approved by KINS for Class 1E applications in 2001*
  - *Embedded Pentium Class*



SBC Controller Recent Projects

Year	Owner	Plant	Plant /Unit size	Application
2004	KHNP	KORI 1, 2, 3 & 4	1000 MW	AAC/DG for all 4 units
2004	KEDO	Light Water Reactor	1000 MW	Plant Control System
2003	KHNP/Doosan	KORI NPP	1000 MW	CRCS Control System
2003	(Seattle) Metro Waste Commission	Renton Treatment Plant	440 MGD	Plant Control System
2002	KHNP	Ulchin Nuclear Power Plant	1000 MW	Plant Control System
2002	Bowater	Calhoun Plant	63 MW	Power Boiler Combustion Safety
2002	Reliant Energy	Parrish Plant	3970 MW	Boiler Safety Shutdown System
2002	Incheon City	Potable Water Plant	96 MGD	Plant Control System
2001	California Portland Cement	Colton Co-Gen Facility	30 MW	Power Plant Control System
2000	Santee Cooper	Cross Generating Station	545 MW	Plant Control System
2000	International Paper	Savannah Mill	188 MW	Power Boiler Combustion Safety
2000	KEPCO	Young Dong Plant	400 MW	Boiler Safety Shutdown System
2000	Commission Federal Electricidad	Rosarito Station	300 MW	Turbine Control System, Boiler Safety, Combustion Control

Turbine Control Experience
Selected Projects

Owner	Plant	Plant size	Application
CFE	Rosarito 5 & 6	150 MW	Siemens Westinghouse
TXU Energy	Collin	160 MW	GE Mark V
City of Detroit	Mistersky 1	40 MW	Siemens Westinghouse
City of Detroit	Mistersky 2	50 MW	Siemens Westinghouse
Duke Power	Bad Creek 1 – 4	320 MW	GE Mark
Reedy Creek	Walt Disney World CoGen	45 MW	GE Mark
Santee Cooper	Cross 3	540 MW	GE Mark VI
KEPCO	Cheju Island 1 & 2	200 MW	GE Mark VI
KEPCO	Seochun 1 & 2	200 MW	GE Mark VI
KHNP	Younggwang 3 & 4	1100 MW	GE
KHNP	Ulchin 5 & 6	1100 MW	GE
KEDO	LWR 1 & 2	1100 MW	Toshiba

Important Issues For Digital Control Upgrades

Obsolescence management	Advanced, open system
✓ Control of hardware manufacturing and development ✓ Compatibility with past systems ✓ Upgrades supported ✓ Focus on client service	✓ Standard switched Ethernet TCP/IP network ✓ "Plug and go" ✓ Third party accommodation **Advanced system design** ✓ ONE STEP configuration ✓ Self documenting ✓ System configuration can be managed by SQL database ✓ Data elements easily up/downloaded via TCP/IP

Important Issues For Digital Control Upgrades

Information management	Control strategies
✓ **Quality tagging** ✓ *Quality tags propagate throughout calculated points and graphics* ✓ *Tracking and display of point quality* ✓ *Support special treatment of quality data* ✓ **Alarming** ✓ *Multiple levels, types, priorities of alarms, direction* ✓ *Intelligent alarming* ✓ **Historian** ✓ *Native and third party*	✓ 1 millisecond SOE (without special modules) ✓ 100 millisecond system response time ✓ I/O point not tethered to specific controller **Maintenance** ✓ Direct connect to I/O modules ✓ Hot swap of components

HFC 6000 Qualification Process

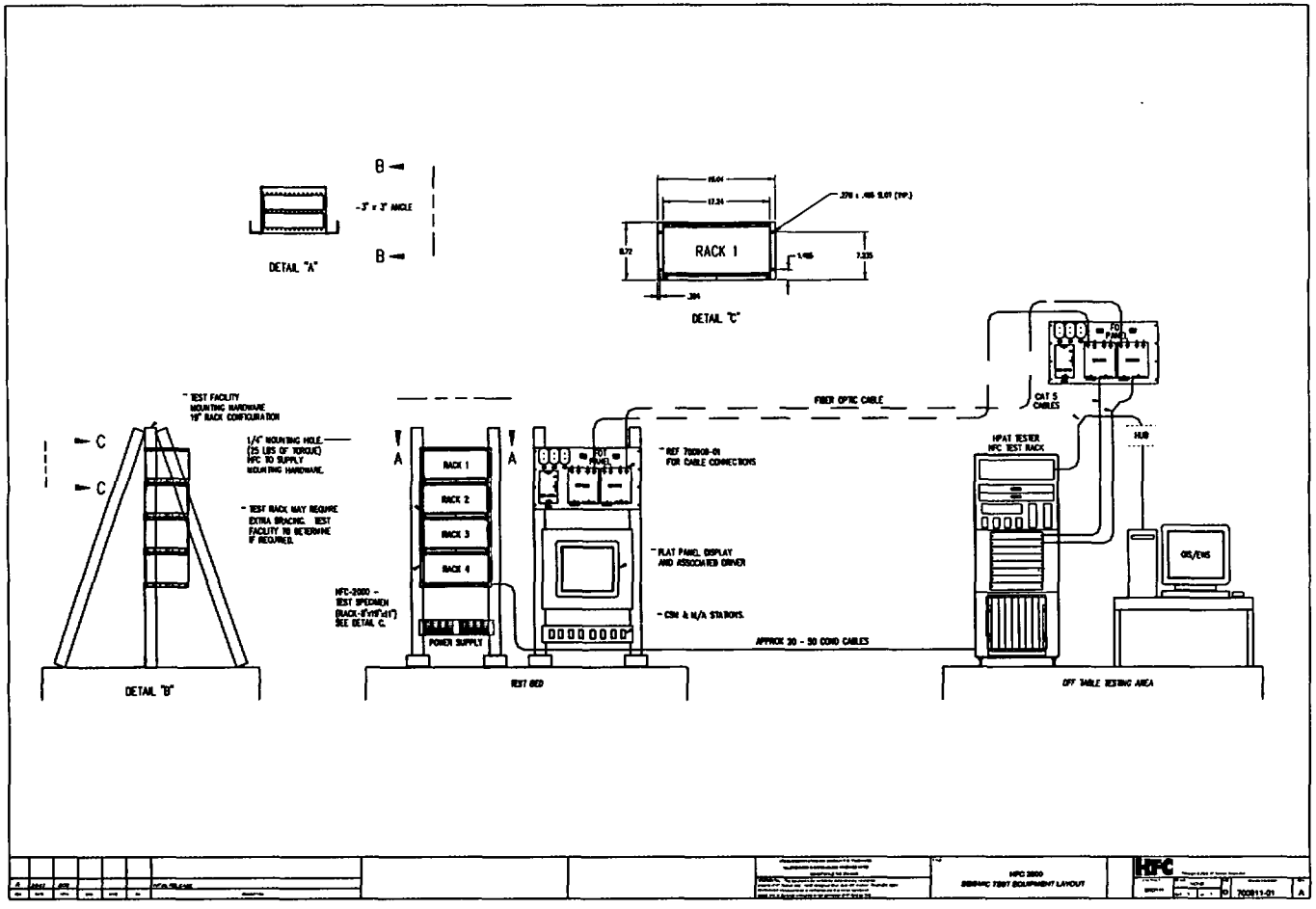
Qualification of HFC 6000 Safety System

- HFC 6000 form factor
- Controllers and I/O library
- Rack Mounted FPD and driver
- Communication and Network
- Control Switch Module & M/A Station
- Hot swappable Power Supply Module
- Multi Loop and Single Loop Control Application
- Software V & V

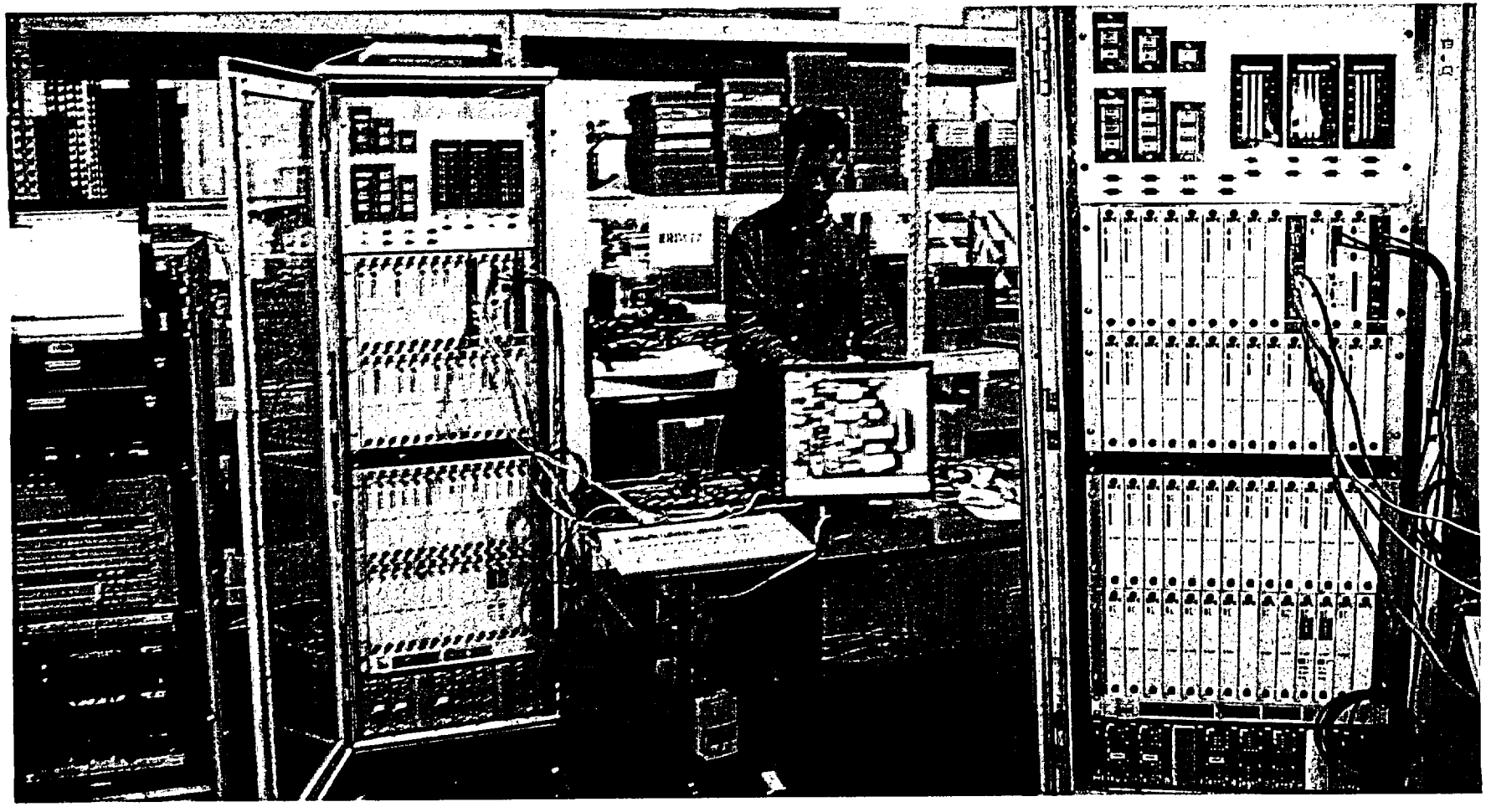
The Status of Qualification Test

- HFC finalized qualification test procedures in March, 2004
- Qualification laboratory tests completed at Wyle Lab. in April, 2004
- Very satisfactory overall test results, few minor deviations processed through HFC internal "Condition Report (NCR)" process
- The qualification tests data and summary test reports are being prepared

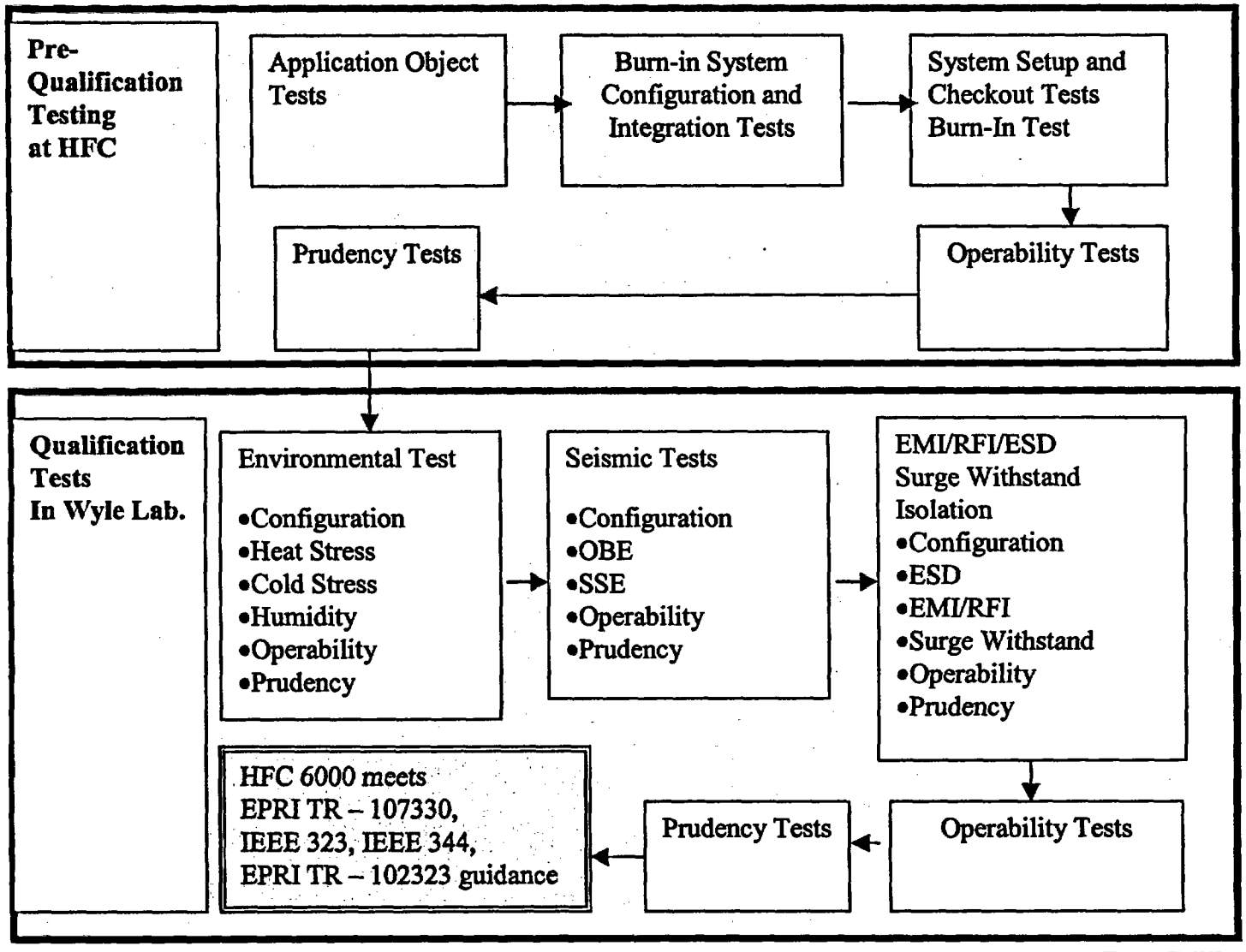
HFC 6000 Qualification System



HFC6000 Test set



Equipment Qualification



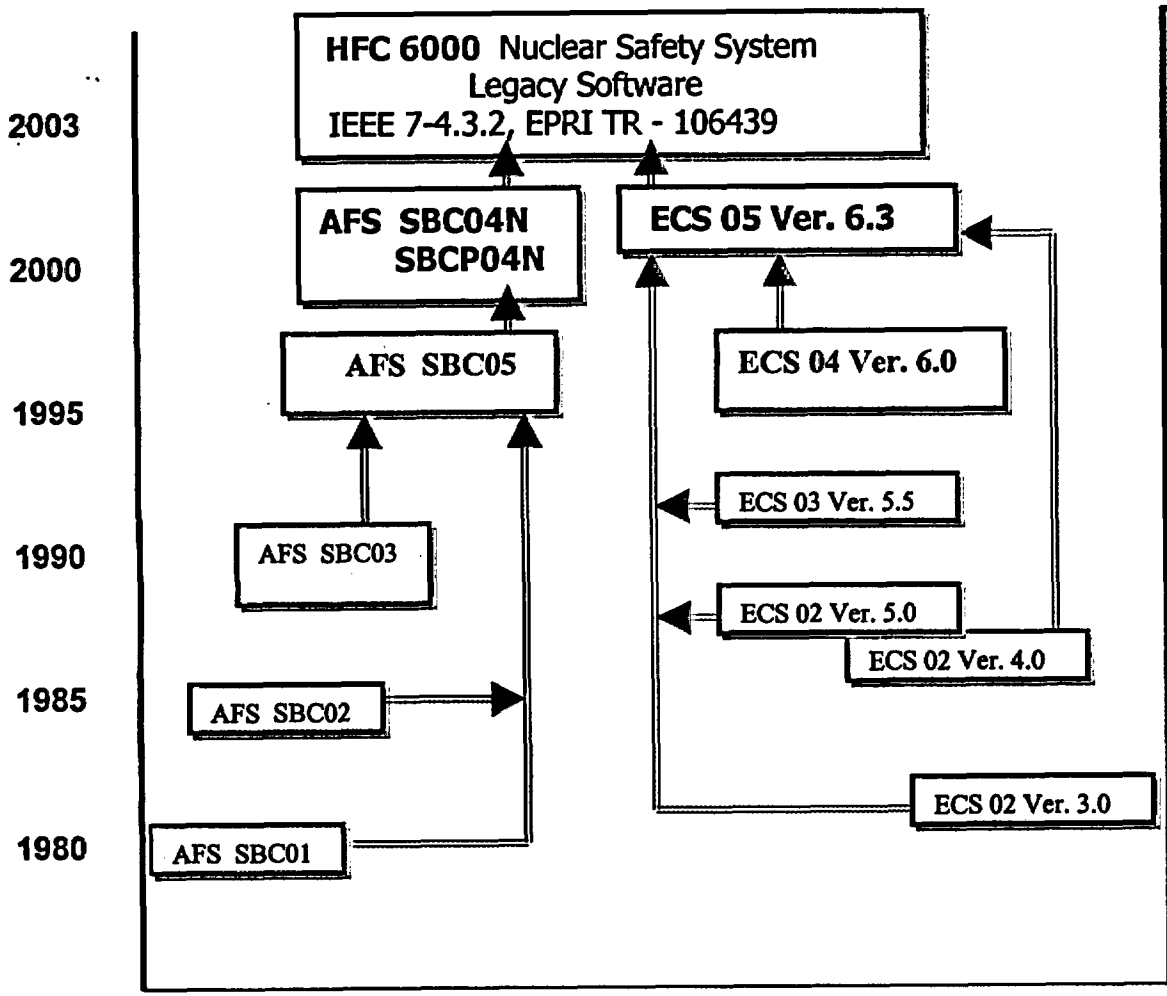
Hardware Qualification

- HFC 6000 qualification hardware was designed, manufactured and tested according to the following regulations guidance
  - *10 CFR 50 Appendix B*
  - *ASME NQA1*
  - *IEEE 603*
  - *EPRI TR-107330*

Software Qualification

- Safety related software by design
  - *Software life cycle model*
  - *Software V & V Process and Procedures*
  - *Follows the Standard Review Plan and HICB BTP – 14*
- Legacy Software (Pre Development Software)
  - *Follows IEEE 7-4.3.2 and EPRI TR – 106439*
  - *Same as designed back in 1980*

Software Qualification - PDS



Communication

One-Step Documentation Tool
Open Architecture Networking
Universal Communication Packets
Windows based EWS/HAS
Firewall Protection

Controller

Real Time Operating System
Interactive Digital & Analog Control algorithms
Boolean Logic control algorithms w/ functional blocks
Analog control algorithms w/ anti-windup process
System wide 1 milliseconds SOE
HART & Modbus Interface Protocol
Redundancy and Failover software
Diagnostic Software

Proposed Qualification Schedule

Category	Task	Schedule	Comp
Qualification Test	Test System Configuration Perform Factory Test Perform Special Tests	- - -	100% 100% 100%
Contact USNRC	Introduction meeting	6/2004	0%
Topical Report	Activate Topical Report Team Generate Topical Report Submit Topical Report	- 09/2004 10/2004	100% 20% 0%
NRC Activities	Review and Audit		

Summary

- HFC continues its excellent performance on current projects and expands its capability to provide integrated process control and safety I & C systems for Korean and USA nuclear plants
  - *Equipment meets appropriate NRC regulations and guidance and necessary technical requirements for safety I & C application*
  - *Experienced in all facets of modern digital control systems*
  - *HFC has capability with large control systems*
  - *Reputable and capable organization*

Open Discussion