The background of the slide is a close-up, slightly blurred image of the American flag, showing the stars and stripes. In the center-right, there is a faint, golden silhouette of a dam structure, likely the Kaskaskia Dam, which is the subject of the presentation.

*Presentation
for the*

***2005 Tri-service infrastructure systems
conference***

***Remote Operation System, Kaskaskia Dam
Design, Certification, & Accreditation***

by

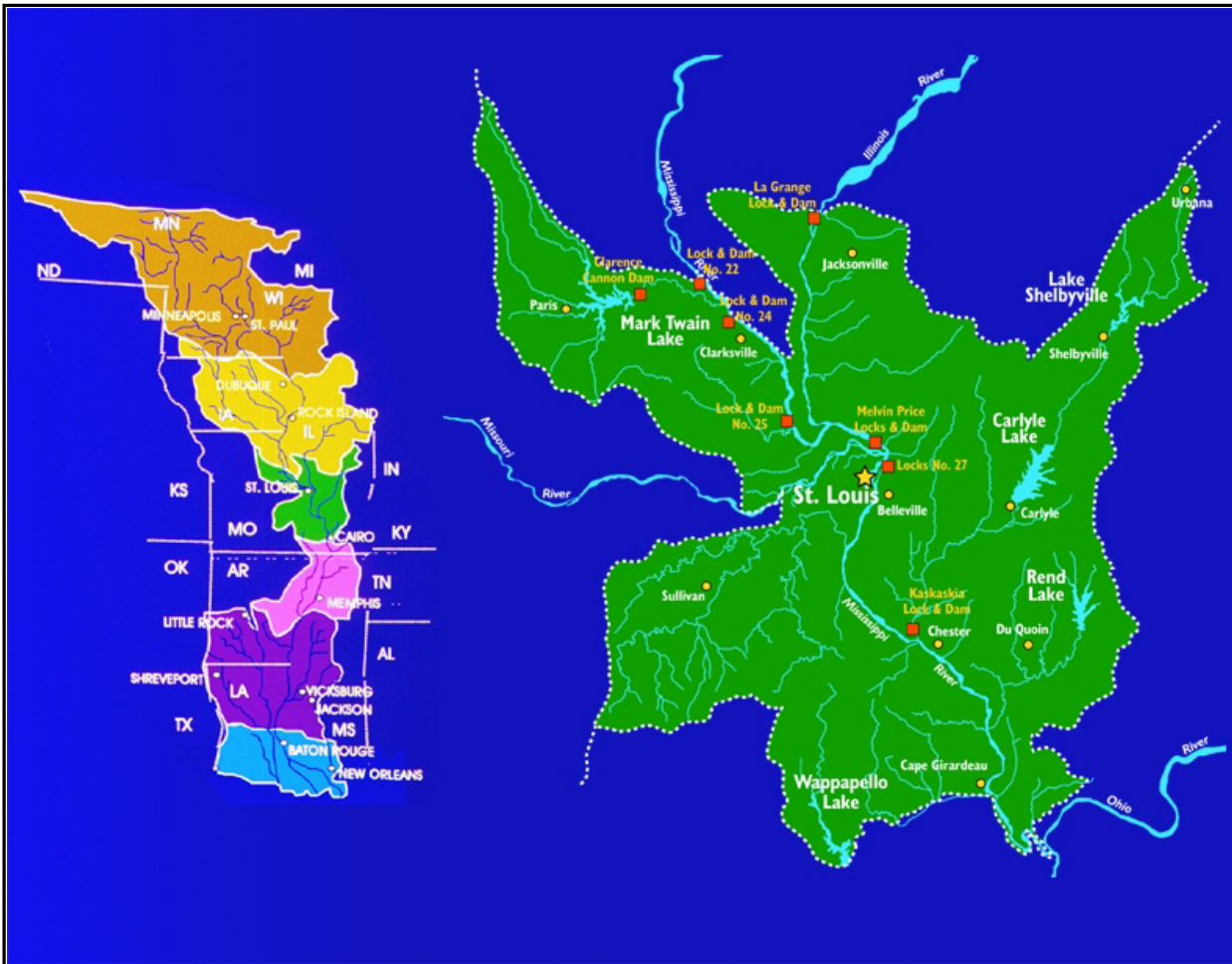
Shane M. Nieu Kirk, P.E.

Electrical Engineer, St. Louis District

August , 2004



St. Louis District



- 10 rivers
- 5 lock & dam sites
- 5 Corps lakes
- 720 miles of levees
- 92 flood control systems
- 416 miles of navigable channel
- 70 pumping plants
- 162 recreation areas
- 1 hydropower project



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Primary Missions

- **Navigation**
- **Flood Damage Reduction**
- **Environmental**
- **Hydropower**
- **Water Supply**
- **Readiness**
- **Recreation**
- **Regulatory**
- **FUSRAP**
- **Interagency/International Support**



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Agenda



- Overview/Background
- System Design & Architecture
- System Accreditation & Certification

Kaskaskia Lock and Dam

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Kaskaskia Navigation Project



- **Constructed in 1974**
- **Located approximately 60 miles south of St. Louis**
- **Pool provides 36 miles of navigation channel on the Kaskaskia River**
- **Supports commercial navigation for grain and industry**
- **Provides water supply to several communities**
- **Project includes:**
 - **600' x 84' Lock Chamber**
 - **Two 60' Tainter Gates**

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Remote Operation System

- The FY04 budget for the project was \$2.4M. The initial FY05 budget was \$392k.
- Operations Division requested the design of a system to control the pool in the event 24/7 operation of the project could not be maintained.
- System was designed by Engineering Division at a cost of **\$30,000**. Startup and EDC totaled another **\$29,500**.
- Electrical enclosures were fabricated locally at a cost of **\$51,150**.
- Installation of enclosures, conduit, cable, & CCTV was under a separate contract at a cost of **\$123,525**.



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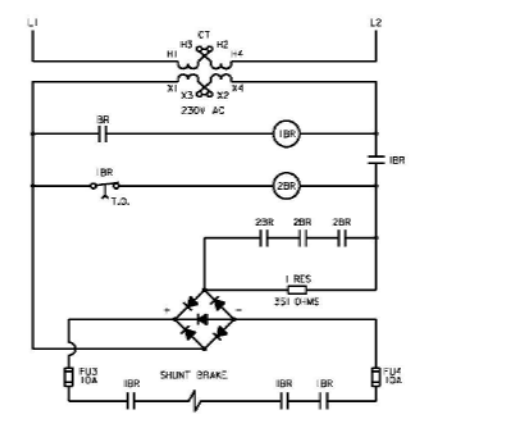
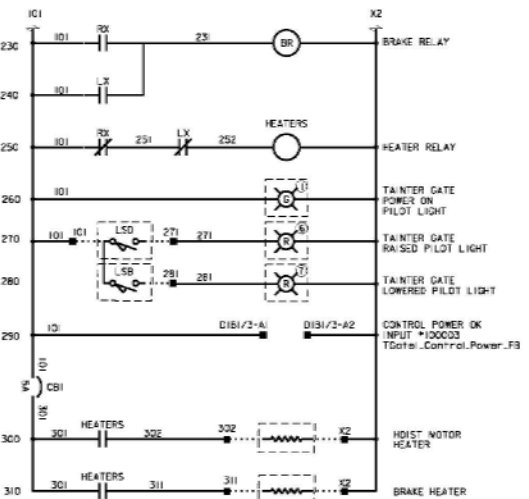
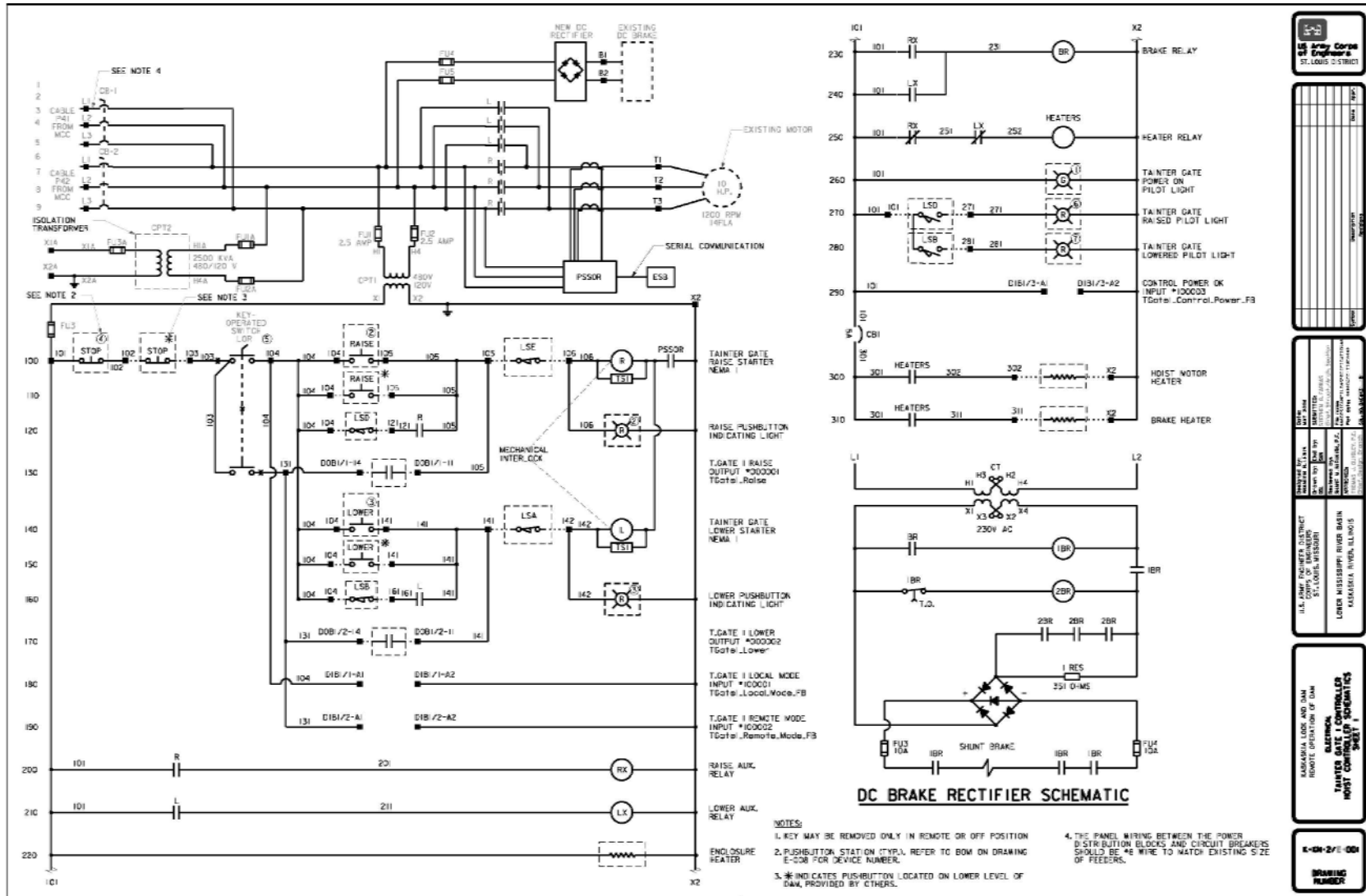
Kaskaskia Navigation Project



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Tainter Gate Hoist Controller



NOTES:
1. KEY MAY BE REMOVED ONLY IN REMOTE OR OFF POSITION
2. PUSHBUTTON STATION (TYP.) REFER TO BOX ON DRAWING E-COB FOR DEVICE NUMBER.
3. * INDICATES PUSHBUTTON LOCATED ON LOWER LEVEL OF DAM, PROVIDED BY OTHERS.
4. THE PANEL WIRING BETWEEN THE POWER DISTRIBUTION BLOCKS AND CIRCUIT BREAKERS SHOULD BE #8 WIRE TO MATCH EXISTING SIZE OF FEEDERS.

US Army Corps of Engineers
ST. LOUIS DISTRICT

DATE: 10/11/11
DRAWN BY: J. J. JONES
CHECKED BY: J. J. JONES
APPROVED BY: J. J. JONES

U.S. ARMY CORPS OF ENGINEERS
ST. LOUIS DISTRICT
LOWER MISSISSIPPI RIVER BASIN
HOIST CONTROL ELECTRICAL SCHEMATIC

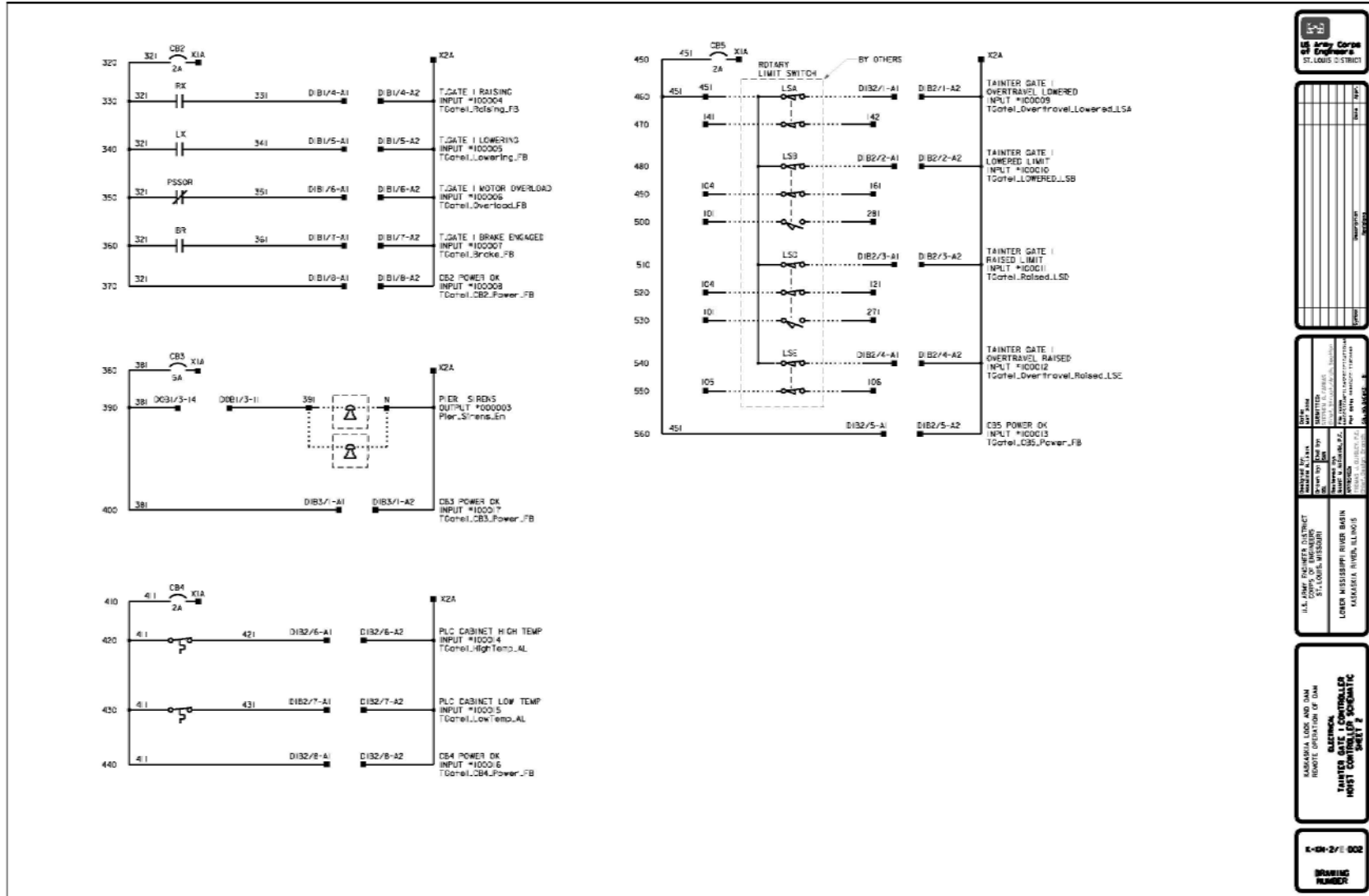
K-09-27/E 004
DRAWING NUMBER



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Tainter Gate Hoist Controller



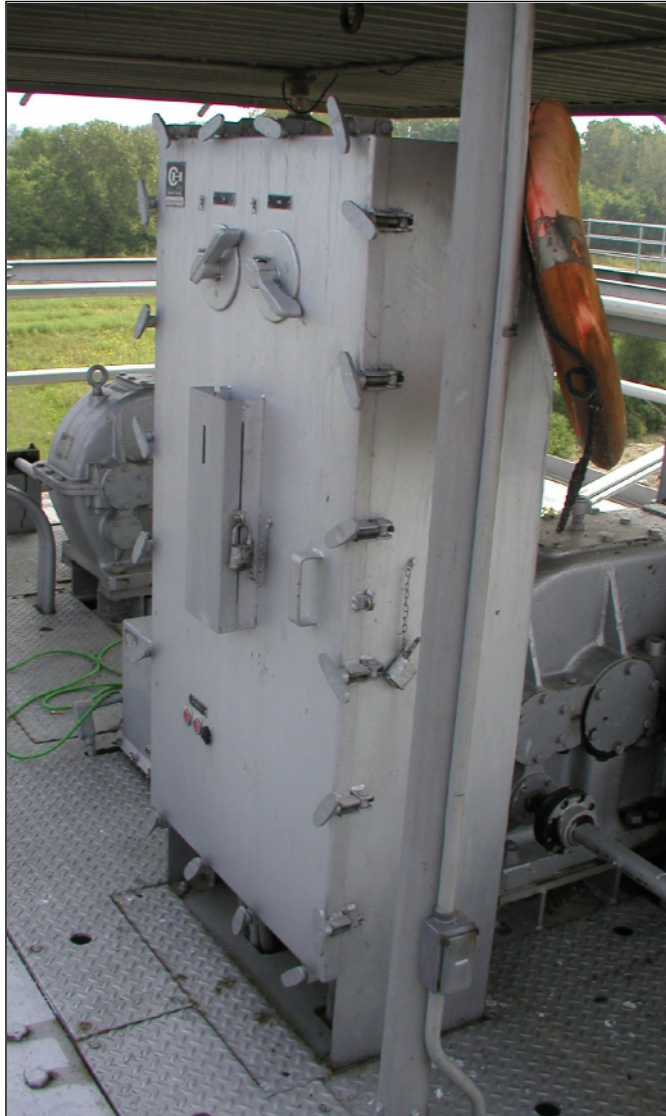
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Tainter Gate Hoist Controller



- **Two Tainter Gate Hoist Controllers and an Ethernet Switch Enclosure were fabricated in a panel shop**
 - **Greater control over equipment delivered**
 - **Greater oversight of fabrication**
 - **Tested by the Government**
- **Enclosures were installed under a separate contract**

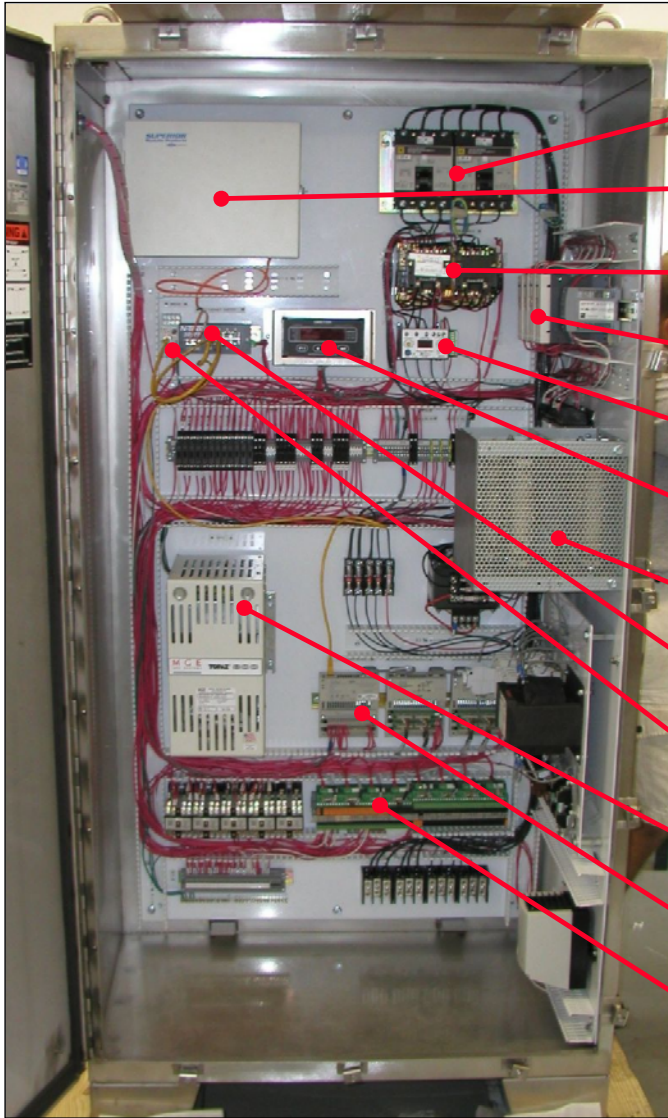
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Tainter Gate Hoist Controller



- **Mech. Interlock Circuit Breaker**
- **Fiber Optic Interconnect**
- **Reversing Starter**
- **Power Supplies**
- **Solid-State Motor Overload**
- **Resolver Interface Module**
- **DC Brake Rectifier**
- **Industrial Ethernet Switch**
- **Ethernet-Serial Bridge**
- **Isolation Transformer**
- **Schneider Momentum PLC**
- **Isolation Relays**

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Tainter Gate Hoist Controller



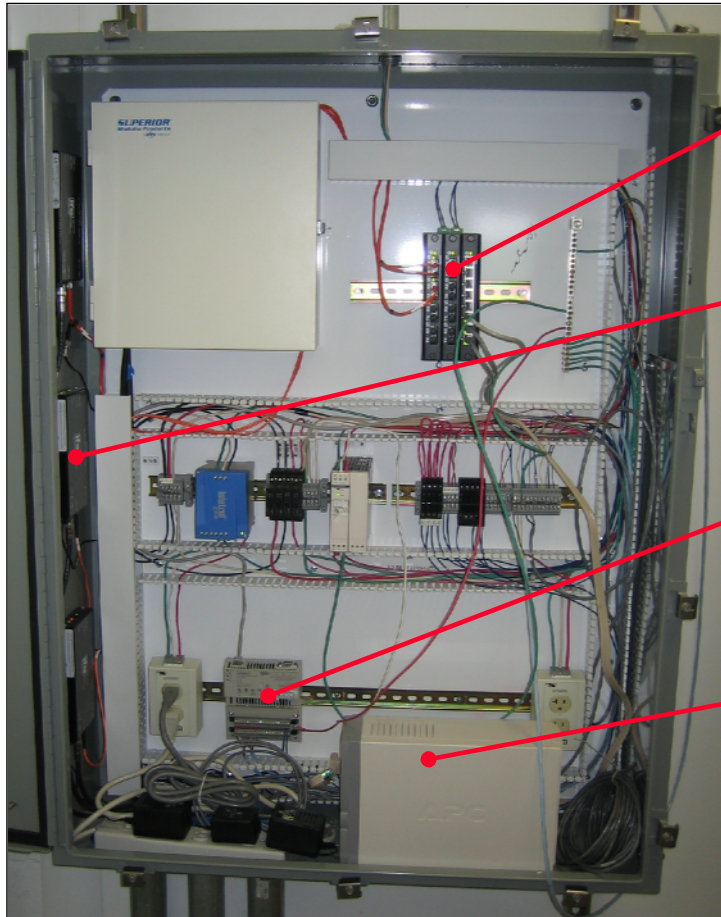
- Local controls provided in a separate enclosure on the side of the controller
- Includes a keyed Local-Off-Remote selector switch
- Key cannot be removed while in Local mode (also cannot close enclosure with key in place)



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Ethernet Switch Enclosure



- Provides Ethernet connectivity to the PLCs on the dam
- Enclosure houses the F/O transceivers for the CCTV cameras
- A Momentum PLC processor was added for water levels
- Uninterruptible power supply



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Tainter Gate Position



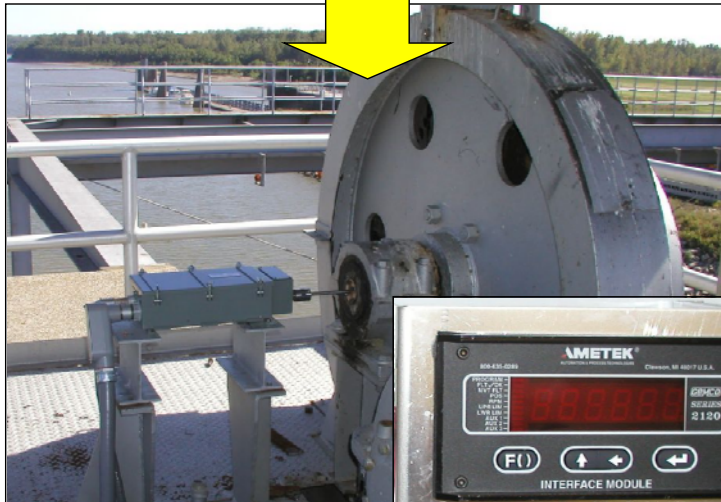
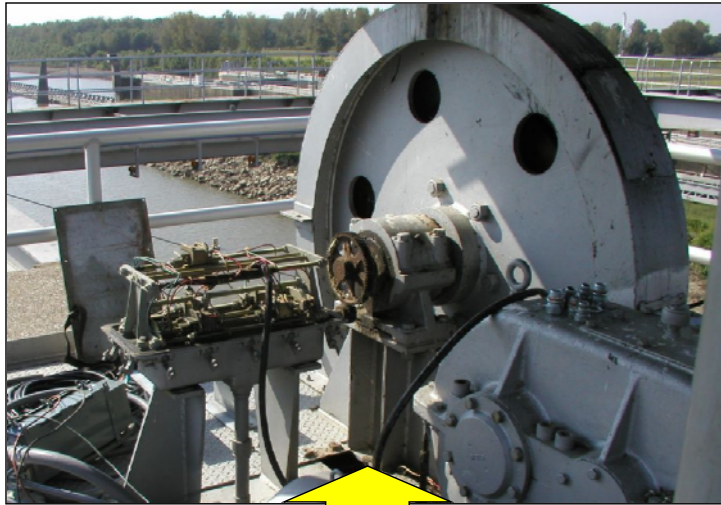
- **Inclinometer measures angle of upper strut**
- **Linear feet of opening is calculated using trigonometry**



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Tainter Gate Limit Switch



- Original traveling nut limit switch was replaced by a rotary cam limit switch (Gemco 1980R)
- Includes integral gear reduction and resolver for hoist position. Requires interface module for a 4-20mA input to PLC
- The 1980 was used in lieu of the 1997 to avoid the cost of the incremental control. This feature was implemented in the PLC



Water Level Sensing



- In an effort to save money dedicated sensors were not installed
- Original approach was to access all levels across the network
- Because the network data was received by satellite and was not real-time, a PLC was added to interface with Water Control's float gages
- Pool and tailwater levels are analog inputs from shaft encoder
- Other river stage data is accessed from a database across the network



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Closed Circuit Television

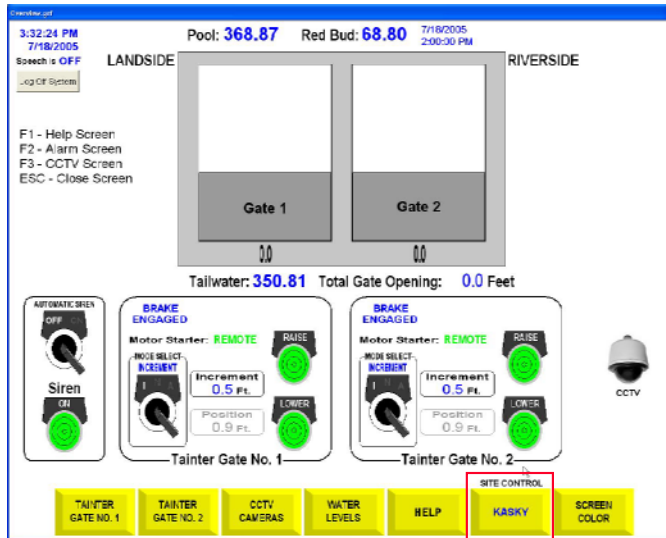


- **Two cameras provide coverage of the pool, gate, and staff gage**
- **One downstream camera provides coverage behind the tainter gates and downstream of the dam**
- **Cameras are accessible across the network via a digital video recorder**
- **DVR is accessed using Internet Explorer or client software**

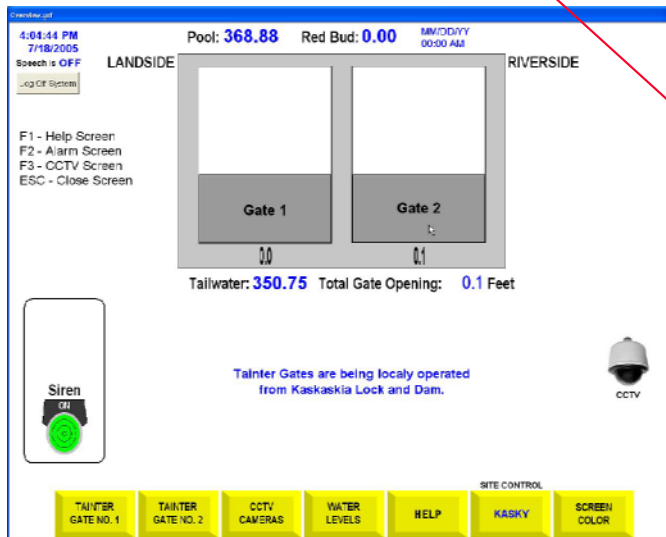


Human Machine Interface

Local



Remote



- iFIX by GE Fanuc
- A single application is used between both the local and remote locations
- Each location is stand alone (SCADA node) communicating to each PLC
- Both locations cannot control the dam at the same time. This is controlled by the local site



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Human Machine Interface

Overview.grf

3:32:24 PM
7/18/2005

Speech is OFF

Log Off System

F1 - Help Screen
F2 - Alarm Screen
F3 - CCTV Screen
ESC - Close Screen

Pool: **368.87** Red Bud: **68.80** 7/18/2005
2:00:00 PM

LANDSIDE RIVERSIDE

Gate 1 Gate 2

0.0 0.0

Tailwater: **350.81** Total Gate Opening: **0.0** Feet

AUTOMATIC SIREN
OFF ON
Siren
ON

BRAKE ENGAGED
Motor Starter: **REMOTE**
MODE SELECT INCREMENT
Increment **0.5 Ft.**
Position **0.9 Ft.**
RAISE LOWER

BRAKE ENGAGED
Motor Starter: **REMOTE**
MODE SELECT INCREMENT
Increment **0.5 Ft.**
Position **0.9 Ft.**
RAISE LOWER

CCTV

Tainter Gate No. 1 Tainter Gate No. 2

SITE CONTROL

TANTIER GATE NO. 1 TANTIER GATE NO. 2 CCTV CAMERAS WATER LEVELS HELP **KASKY** SCREEN COLOR

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Human Machine Interface

Overview.grf

3:38:21 PM
7/18/2005

Speech is OFF

Log Off System

F1 - Help Screen
F2 - Alarm Screen
F3 - CCTV Screen
ESC - Close Screen

Pool: 368.87 Red Bud: 68.80 7/18/2005 2:00:00 PM

LANDSIDE RIVERSIDE

Gate 1 0.0 Gate 2 0.1

Tailwater: 351.04 Total Gate Opening: 0.1 Feet

AUTOMATIC SIREN
OFF ON
Siren
ON

BRAKE ENGAGED
Motor Starter: REMOTE
MODE SELECT INCREMENT
Increment 0.5 Ft.
Position 0.9 Ft.
RAISE LOWER

Tainter Gate No. 1

BRAKE ENGAGED
Motor Starter: REMOTE
MODE SELECT INCREMENT
Increment 0.5 Ft.
Position 0.9 Ft.
RAISE LOWER

Tainter Gate No. 2

CCTV

SITE CONTROL

TANTIER GATE NO. 1 TANTIER GATE NO. 2 CCTV CAMERAS WATER LEVELS HELP KASKY SCREEN COLOR

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Human Machine Interface

3:32:28 PM
7/18/2005
Speech is **OFF**

Tainter Gate No. 1

Ctrl Pwr ●

CB2 ●

CB3 ●

CB4 ●

CB5 ●

CB6 ●

CB7 ●

CB8 ●

CB9 ●

CB10 ●

CB11 ●

BRAKE ENGAGED

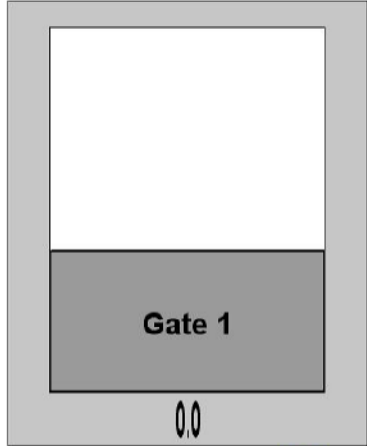
Motor Starter: **REMOTE**

MODE SELECT
INCREMENT

Increment **0.5 Ft.**

Position **0.9 Ft.**

Tainter Gate No. 1



Gate 1

Total Gate Opening: **0.0 Feet**

Pool: **368.9**

Tailwater: **350.8**

Red Bud: **68.80**
7/18/2005 2:00:00 PM

Measurements

Average Volts: 482 Volts	Average Current: 0.0 Amperes
V _{ac} : 481 Volts	I _a : 0.0 Amperes
V _{bc} : 482 Volts	I _b : 0.0 Amperes
V _{ab} : 484 Volts	I _c : 0.0 Amperes
Voltage Unbalance: 0 %	Current Unbalance: 0 %
Power Factor: 0 Degrees	Motor Run Timer: 8 Hours
Trip/Error Code: 0	Fault History: 6B88

TRENDING

SETPOINTS

CLOSE



Human Machine Interface

3:32:36 PM
7/18/2005
Speech is OFF

Tainter Gate No. 1

Ctrl Pwr ●

CB2 ●

CB3 ●

CB4 ●

CB5 ●

CB6 ●

CB7 ●

CB8 ●

CB9 ●

CB10 ●

BRAKE ENGAGED

Motor Starter: REMOTE

MODE SELECT INCREMENT

Increment: 0.5 Ft.

Position: 0.9 Ft.

RAISE ●

LOWER ●

Gate 1

Pool: 368.9

Tailwater: 350.7

Red Bud: 68.80
7/18/2005 2:00:00 PM

Tainter Gate No. 1

Set Points

Low Voltage Threshold:	450 Volts	Rapid Cycle Timer:	0 Seconds
High Voltage Threshold:	537 Volts	Restart Delay:	8 Minutes
Voltage Unbalance Threshold:	6 %	Restart Delay (UC):	20 Minutes
CT/Turns Ratio:	1	Number Restarts (UC):	0
Overcurrent Threshold:	170 Amperes	Number Restarts:	0
Undercurrent Threshold:	0.0 Amperes	Undercurrent Trip Delay:	5 Seconds
Current Unbalance Threshold:	999 %	Ground Fault Current Threshold:	9
Overcurrent Trip Class:	20	RS-485 Slave Address:	1

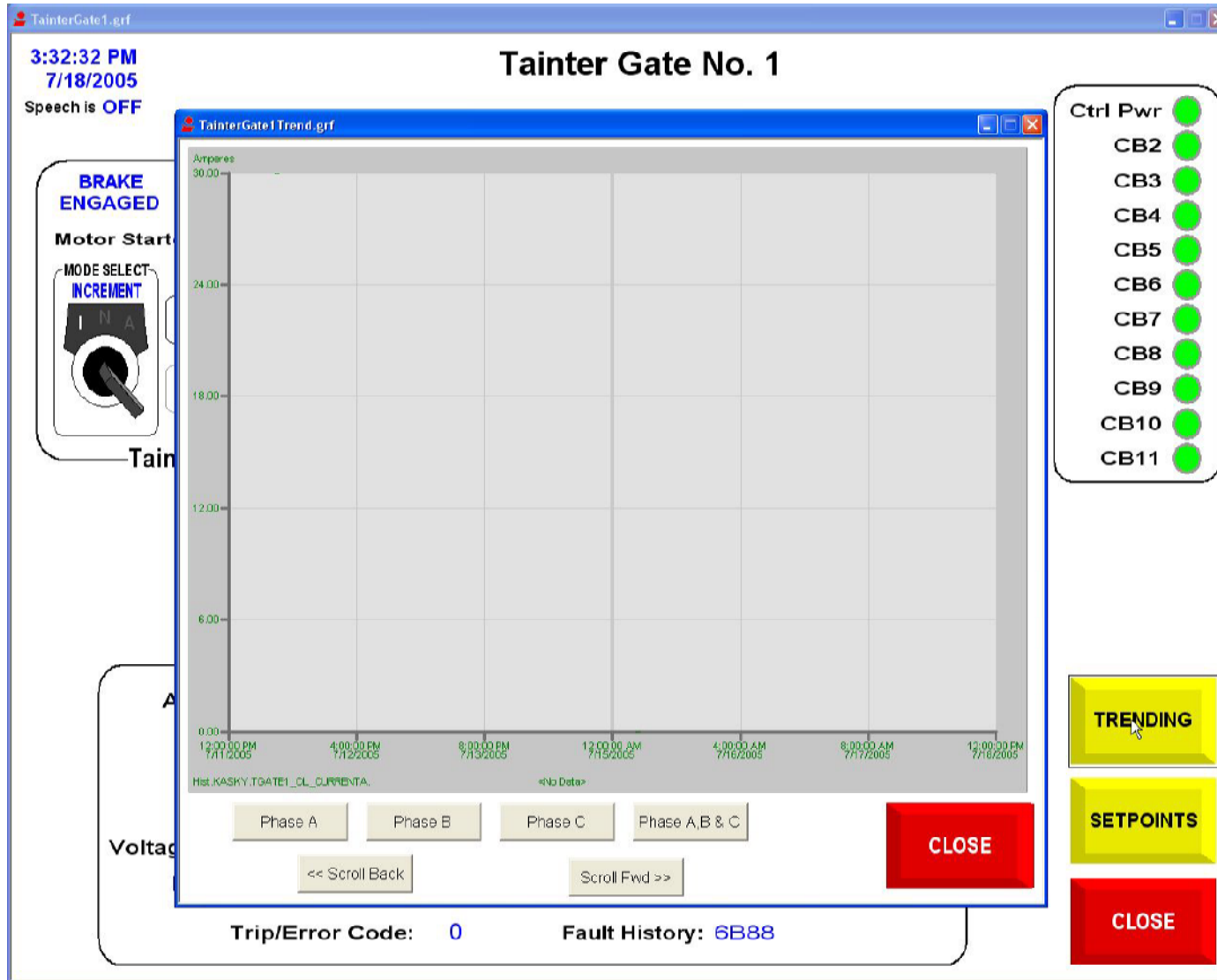
CLOSE



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Human Machine Interface



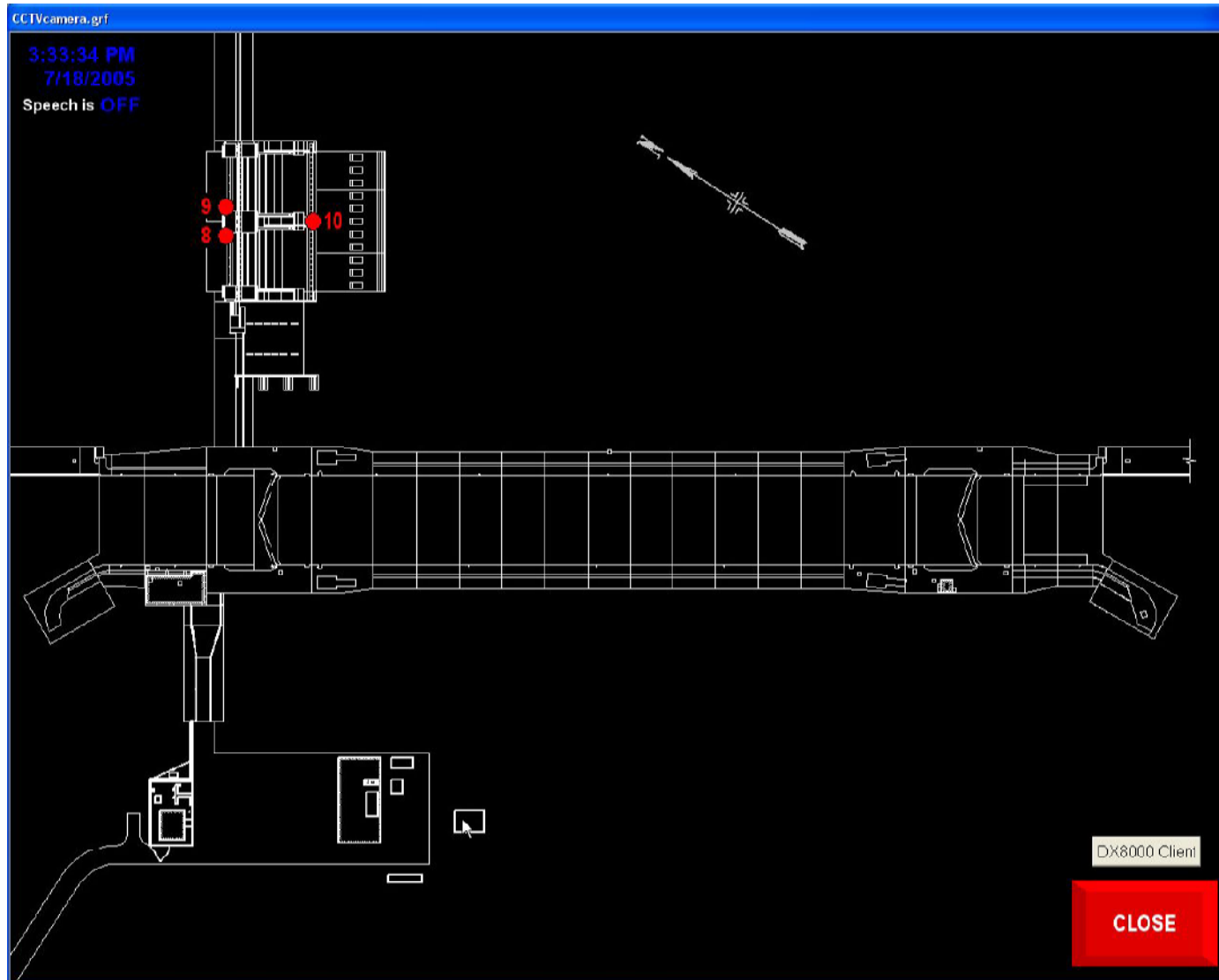
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Human Machine Interface



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Human Machine Interface

CCTVcamera.grf

3:37
7/18
Speech

PELCO

PTZ REC PTZ REC

Camera 1
Camera 2
Camera 3
Camera 4
Camera 5
Camera 6
Camera 7
Camera 8
Camera 9
Camera 10
Camera 11
Camera 12
Camera 13
Camera 14
Camera 15
Camera 16

Zoom
Focus
IRIS
1 2 3
4 5 6
7 8 9
0
PgM Clr
Preset Pattern
Set

3:37:06 PM
7/18/2005
Speech is OFF

	Camera 8	Camera 9	Camera 10
Preset 1	U/S of Gate	U/S of Gate	Tailwater
Preset 2	Pool	Pool	D/S of Gate 1
Preset 3	Staff Gage, 0'	Staff Gage, 0'	D/S of Gate 2
Preset 4	Staff Gage, 7'	Staff Gage, 7'	

DX8000 Client

CLOSE HIDE

CLOSE

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Human Machine Interface



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Human Machine Interface

Help.grf

3:41:29 PM
7/18/2005
Speech is OFF

Kaskaskia Navigation Project Dam Remote Operation System

F1 - Help Screen
F2 - Alarm Screen
F3 - CCTV Screen
ESC - Close Screen

EMERGENCY PHONE NUMBERS	PERSONNEL PHONE NUMBERS	CCTV LOCATIONS	WATER LEVEL CALIBRATION
-------------------------------	-------------------------------	-------------------	----------------------------

Manufacturer's Documentation

DVR CLIENT USER MANUAL	OVERLOAD INSTRUCTION BULLETIN	OVERLOAD PROGRAM MANUAL
------------------------------	-------------------------------------	-------------------------------

For Immediate Assistance:

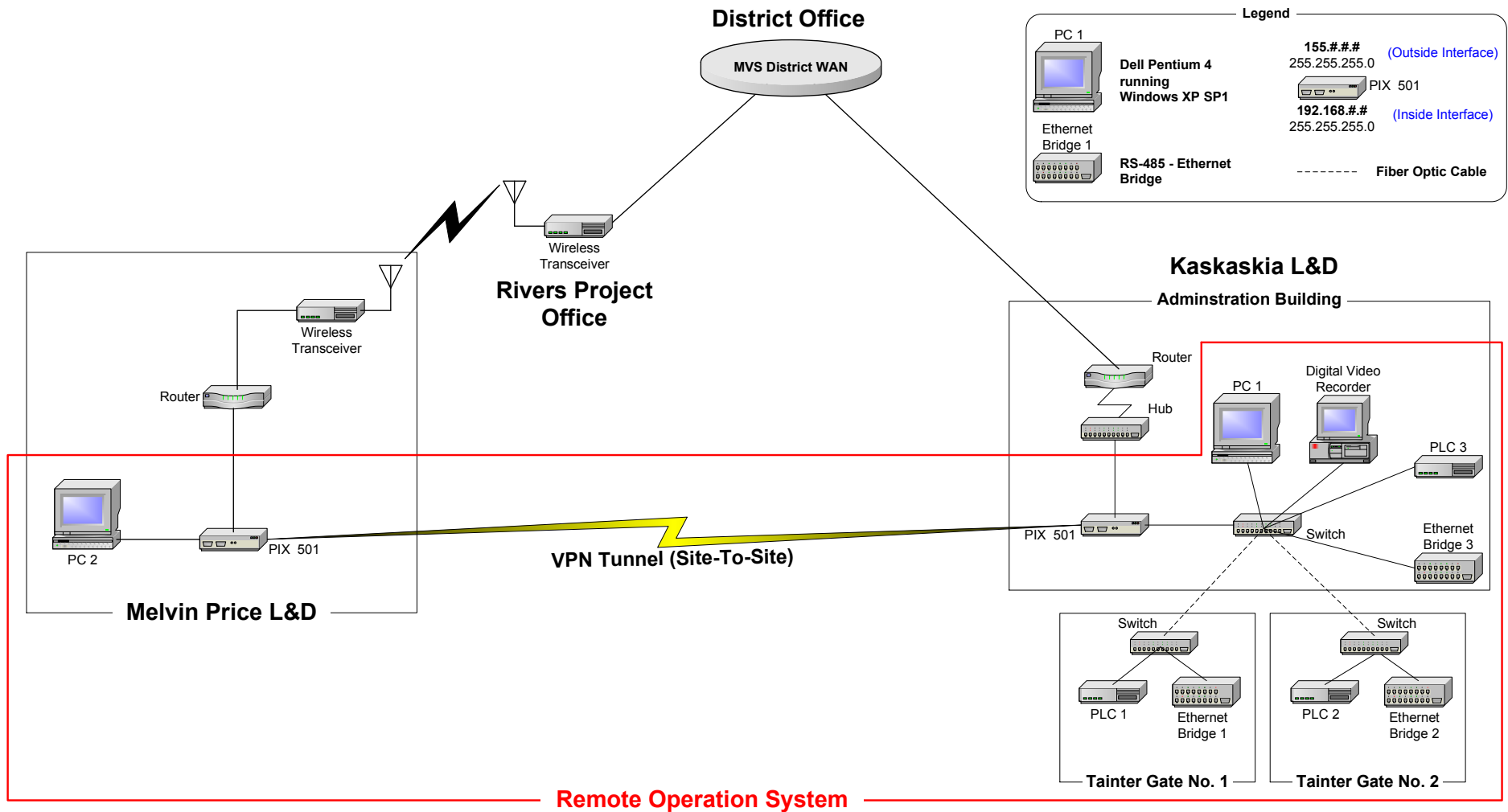
	Work	Home	Cellular
Gary Buckholtz	#	#	#
Jim Deterding	#	#	#
Shane Nieu Kirk	314-331-8254	314-961-8602	314-540-6693
Andy Schimpf	314-331-8269	314-894-1082	314-630-6280

CLOSE

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Network Diagram





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System Description & Functionality

- **Operators login using local user accounts**
- **Passwords are updated manually. Distributed using encrypted email with CAC**
- **Patches and updates to be installed manually using PCAnywhere**
- **Access to VPN firewall using local user accounts (including extended authentication)**



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HQ Guidance for SCADA Systems

- **No formal guidance concerning the connection of SCADA systems to the network exists**
- **As a result of a briefing given to HQ's Information Assurance Section, informal guidelines were developed**
- **Questions concerning the guidelines resulted in a "cease and desist" order for the Information Assurance Program Manager**
- **HQ directed the St. Louis District to certify and accreditate the Remote Operation System using DITSCAP prior to placing it online**

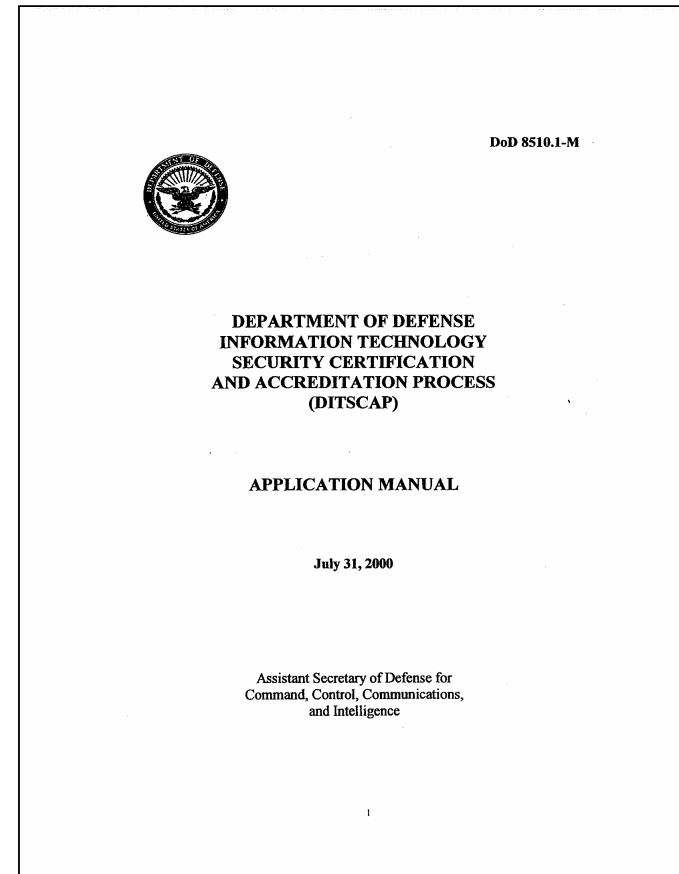


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DoD Information Technology Certification and Accreditation Process (DITSCAP)

- **DITSCAP is defined by DoD Instruction 5200.40**
- **Developed to meet the requirements of DoD Directive 5200.28. This includes:**
 - **Stand-alone PCs**
 - **Connected Systems**
 - **Networks**
- **Instructions for the process are provided in DoD Manual 8510.1-M**





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DoD Information Technology Certification and Accreditation Process (DITSCAP)

- **DITSCAP uses a single document approach collecting all of the information into the Systems Security Authorization Agreement (SSAA).**
- **The SSAA is a formal agreement among the Designated Approval Authority (DAA), Certifying Authority (CA), Program Manager, and User Representatives.**
- **To aid in the development of the SSAA, HQ has directed that all new DITSCAPs use the Xacta tool.**
- **Xacta is a web-based application that assures SSAA consistency across USACE.**



Xacta Information Assurance Manager

- Accessed using Internet Explorer
- The tool is administrated by Mr. William Barnett of HQ (contractor)
- Access is granted after completing a user request form
- To access the tool, all pop-up blockers and outside toolbars (Google) must be turned off

Project Definition - Microsoft Internet Explorer

Resources Preferences About Logout

XACTA ASSESSMENT ENGINE

Page History Save Reset

My Home

My Projects

- Remote Operation System, Kaskaskia Lock and Dam
- Tasks
- Requirements and Definition
- Project Definition
- Project Personnel
- System Security
- System Users
- System Environment
- System Component Groups
- System Components
- System Interfaces
- System Data Flow
- System Boundary
- Requirement Questionnaire
- Current SRIM
- Appendix F
- Appendix C
- Project Reports

Project Name: Remote Operation System, Kaskaskia Lock and Dam

Generic or Type Accreditation

Operational or Eits Accreditation

Acronym: RDS

Version: 1.0

Definition: This system allows the remote operation of the two tainter gates located at Kaskaskia Lock and Dam (Modoc, IL) from the control room at Melvin Price Locks & Dam (East Alton, IL). Personal computers interface with the programmable logic controllers (PLCs) located at Kaskaskia L&D across the CEES network using human machine interface (HMI) software.

Current Accreditation Status: Not Specified

Accreditation Objective: Interim Authorization to Operate (IATO)

Estimated Completion Date: 08/30/2005

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Logged in as: nieukirks (User)



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Systems Security Authorization Agreement

- **Characteristics of the SSAA:**
 - Describes operating environments and threats
 - Describes the system security architecture
 - Identifies required hardware, firmware, software, etc.
 - Establishes the C&A boundary
 - Documents all requirements necessary for accreditation
 - Documents the DITSCAP plan including test plans and procedures, certification results, and residual risk
 - Forms the baseline security configuration document
- **DITSCAP includes four phases**
- **Each phase is comprised of “activities” which are broken down further into “tasks”**



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DoD Information Technology Certification and Accreditation Process (DITSCAP)

➤ DITSCAP Phases:

➤ Phase 1, Definition

- Verify system mission, environment, and architecture. Identify threats. Define level of effort and team members.

➤ Phase 2, Verification

- Document compliance of system with security requirements.

➤ Phase 3, Validation

- Assure system environment and configuration provides acceptable level of risk.

➤ Phase 4, Post Accreditation

- Monitor systems management, configuration, and changes to the operational and threat environment to assure acceptable level of risk is preserved.

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DITSCAP – Phase 1, Definition

➤ **Activities**

- **Preparation, Registration, and Negotiation**

➤ **Tasks (12)**

- 1. Review Documentation**
- 2. Prepare the System and Functional Description, System Identification**
- 3. Register the System (Define the C&A Team)**
 - **Designated Approval Authority (DAA) has final approval of the SSAA. The DAA is often the District Engineer**
 - **Certifying Authority (CA) identifies security requirements**
 - **Information Security Systems Officer (ISSO) insures system is accurately documented**
 - **Program Manager defines the system and security architecture and supports DITSCAP tailoring**



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DITSCAP – Phase 1, Definition

➤ Tasks (12)

- 4. Prepare Environment and Threat Description**
- 5. Determine System Security Requirements**
- 6. Prepare System Architecture Description (hardware, software...)**
- 7. Identify the C&A Organizations and Resources Req'd**
- 8. Tailor DITSCAP and Prepare Plan (Certification Level)**
- 9. Draft the SSAA**
- 10. Conduct Certification Requirements Review**
- 11. Establish Agreement on Level of Effort and Schedule**
- 12. Approve Phase 1 SSAA**



DITSCAP – Phase 1, Definition

➤ Roles

- **DAA – Continuously review the system for compliance with the SSAA.**
- **CA & Certification Team**
 - Support the DAA
 - Review threat description
 - Identify security requirements
- **PM**
 - Initiate dialogue with the DAA, Certifier, and User Rep.
 - Define system schedule & budget
 - Define system & security architecture
- **User Representative – defines requirements of the system and end users**
- **All support DITSCAP tailoring and Certification Level**



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DITSCAP – Phase 2, Verification

- **Activities**
 - **SSAA Refinement, System Development and Integration, Initial Certification Analysis, Assess Analysis Results**
- **Tasks (7)**
 - 1. System Architecture Analysis**
 - 2. Software, Hardware, and Firmware Analysis**
 - 3. Network Connection Rule Compliance Analysis**
 - 4. Integrity Analysis of Integrated Products**
 - 5. Life-Cycle Management Analysis**
 - 6. Security Requirements Validation Procedures**
 - 7. Vulnerability Assessment**



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DITSCAP – Phase 2, Verification

➤ Roles

- **DAA – Continuously review the system for compliance with the SSAA.**
- **CA & Certification Team**
 - **Conduct Phase 2 certification analysis tasks**
 - **Identify and assess system vulnerabilities**
 - **Report certification results to the DAA & PM**
 - **Integrate changes into the SSAA**
- **PM**
 - **Develop system or system modifications**
 - **Support certification efforts**
 - **Modify system to reduce or eliminate vulnerabilities.**



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DITSCAP – Phase 3, Validation

- **Activities**
 - **SSAA Refinement, Certification Evaluation of the Integrated System, Recommendation to DAA, DAA Accreditation Decision**
- **Tasks (8)**
 1. **Security Test and Evaluation**
 2. **Penetration Testing**
 3. **TEMPEST and RED-BLACK Evaluation**
 4. **COMSEC Compliance Evaluation**
 5. **System Management Analysis**
 6. **Site Accreditation Survey**
 7. **Contingency Plan Evaluation**
 8. **Risk Management Review**



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DITSCAP – Phase 3, Validation

➤ Roles

➤ DAA

- Continuously review the system for compliance with the SSAA
- Determine if security safeguards and residual risks are acceptable
- Sign the accreditation document

➤ CA & Certification Team

- Complete Phase 3 certification analysis tasks
- Identify and assess system vulnerabilities
- Recommend risk mitigation measures
- Report certification results to the DAA & PM
- Prepare final SSAA & recommendation

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DITSCAP – Phase 4, Post Accreditation

- **Activities**
 - **System and Security Operation, Compliance Validation**
- **Tasks (8)**
 1. **SSAA Maintenance**
 2. **Physical, Personnel, and Management Control Review**
 3. **TEMPEST Evaluation**
 4. **COMSEC Compliance Evaluation**
 5. **Contingency Plan Maintenance**
 6. **Configuration Management**
 7. **Risk Management Review**
 8. **Compliance Validation**



DITSCAP – Phase 4, Post Accreditation

➤ Roles

➤ DAA

- Decide to re-accreditate, IATO, or terminate

➤ CA & Certification Team

- Normally not involved, support DAA, ISSO, and system operators

➤ PM

- Cost/Schedule
- System Documentation

➤ User Representative

- Oversee system operation
- Report vulnerability/security incidents
- Initiate SSAA review for change in threat or system configuration



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DITSCAP – Phase 4, Post Accreditation

➤ Roles

➤ ISSO

- Periodically review mission statement, operating environment, and security architecture to insure compliance with SSAA
- Maintain integrity of the site environment and accredited security posture
- Ensure that configuration management adheres to security policy and requirements
- Initiate C&A process when reaccreditation is required



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Summary

- **The system design is the easy part**
- **All systems are required to be accredited using DITSCAP**
- **DITSCAP is a long process and should not be taken lightly**
- **Plan adequate funding for DITSCAP**

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