

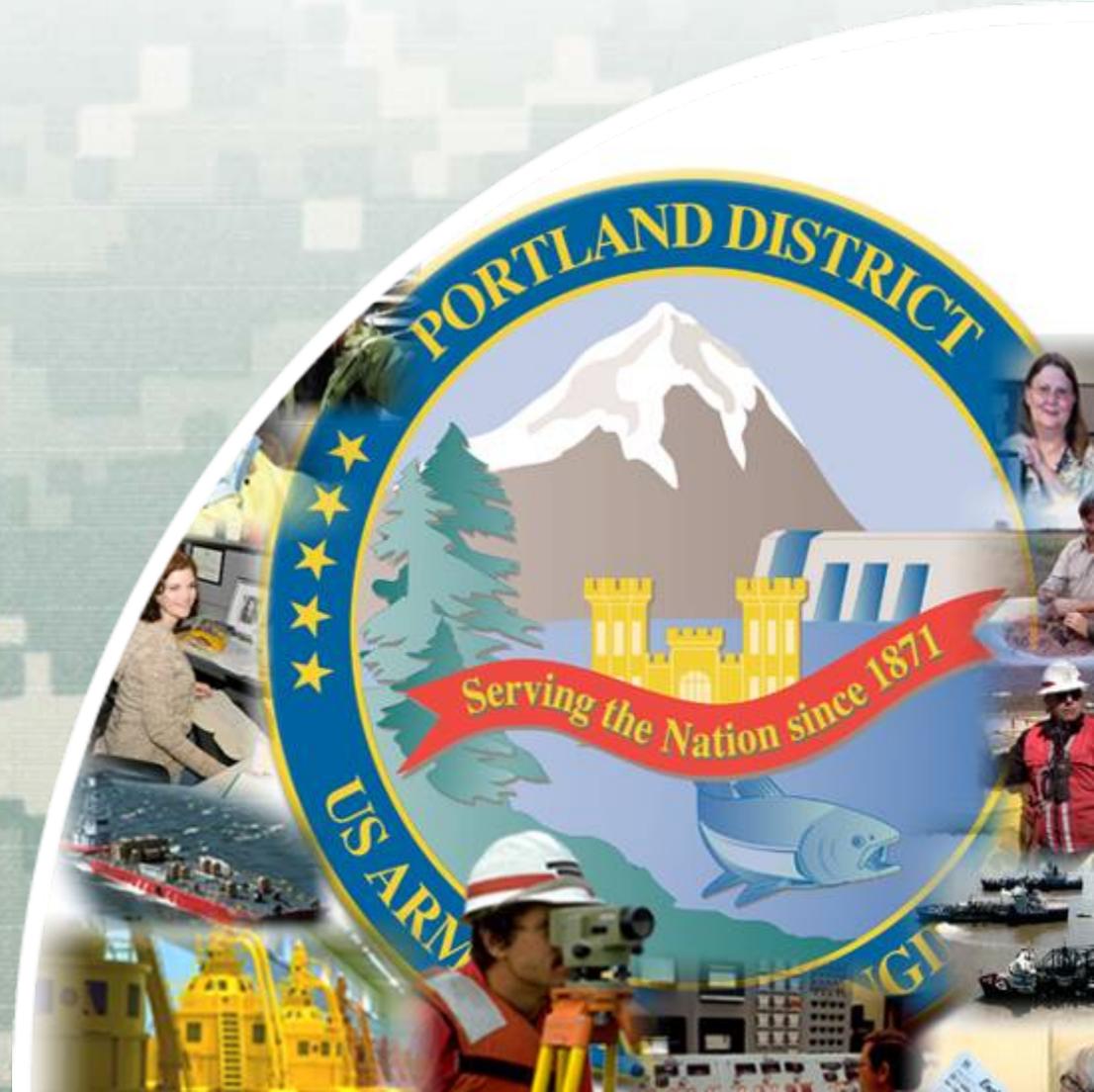
John Day Navlock Electrical Controls Upgrade

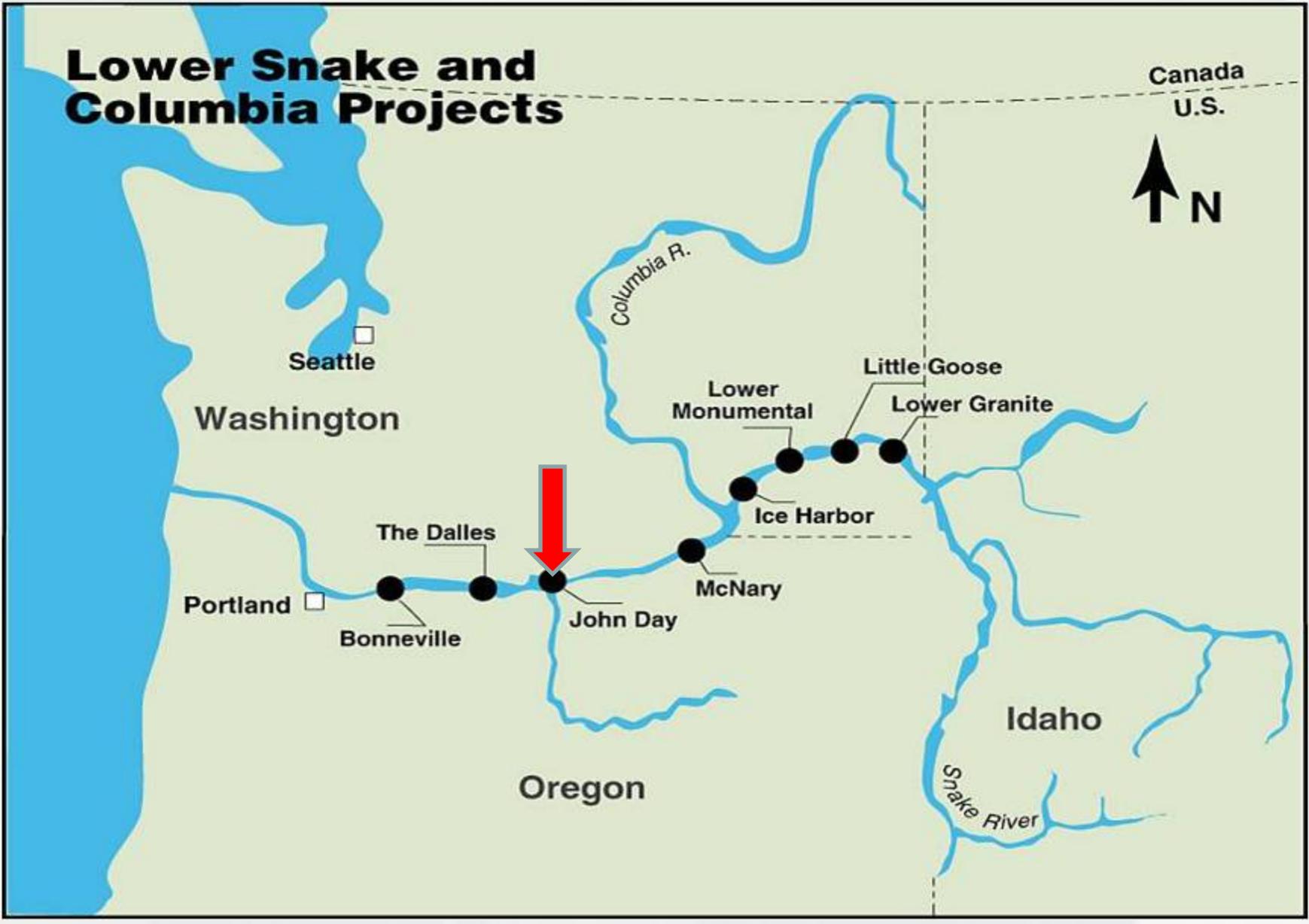
2012 Navlock Maintenance Workshop
01 March 2012

Joe Brackin
Shane Ruark, P.E.
Duncan Kwong, P.E.
CENWP-EC-DE



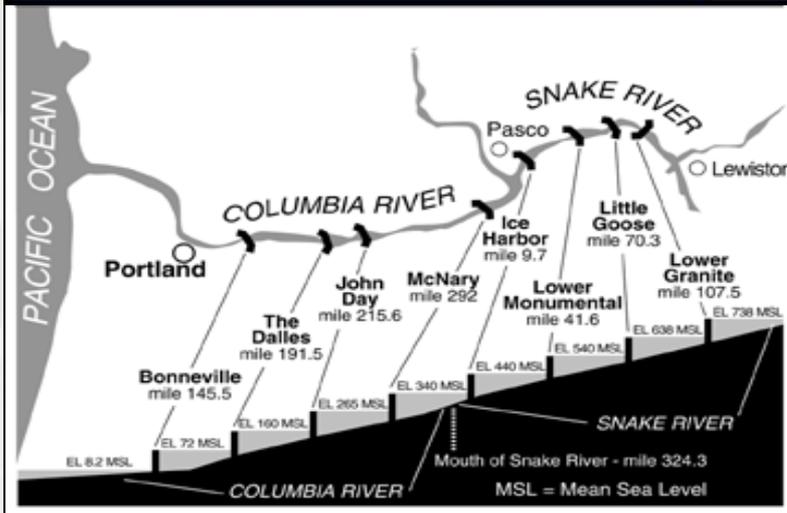
US Army Corps of Engineers
BUILDING STRONG®







	Bonneville	The Dalles	John Day	McNary	Ice Harbor	Lower Monumental	Little Goose	Lower Granite
Inside Celar Dimensions, Feet	86 x 675	86 x 675	86 x 669	86 x 675	86 x 665	86 x 666	86 x 668	86 x 675
Maximum Lift, Feet	70	90	113	83	103	103	101	105
Upstream Gate, Type	Miter	Tainter	Sub Lift	Miter	Tainter	Sub Lift	Tainter	Tainter
Downstream Gate, Type	Miter	Miter	Vert Lift	Miter	Vert Lift	Vert Lift	Miter	Miter
Minimum Tailwater Elevation, Feet	5.0	70.0	155.0	257.0	335.0	437.0	533.0	633.0
Lower Lock Sill Elevation, Feet	16.0	54.5	140.0	236.0	321.0	422.0	518.0	618.0
Minimum Depth Over Lower Sill, Feet	21.0	15.5	15.0	21.0	14.0	15.0	15.0	15.0
Normal Maximum Pool Elevation, Feet	74.0	160.0	265.0	340.0	440.0	540.0	638.0	738.0
Minimum Pool Elevation, Feet	70.0	155.0	257.0	335.0	437.0	537.0	633.0	733.0
Upper Lock Sill Elevation, Feet	40.0	140.0	242.0	320.0	422.5	522.0	618.0	718.0
Normal Depth Over Upper Sill, Feet	34.0	20.0	23.0	20.0	18.0	19.0	20.0	20.0
Minimum Depth Over Upper Sill, Feet	30.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Bottom Elevation of Downstream Gate Open Position, Feet	NA	NA	251.0	NA	410.0	505.0	NA	NA



Operation of Columbia River Navigation System

350 miles of navigable waterways from Portland, Or to Lewiston, ID.

Seven to Ten Lockage's per day.

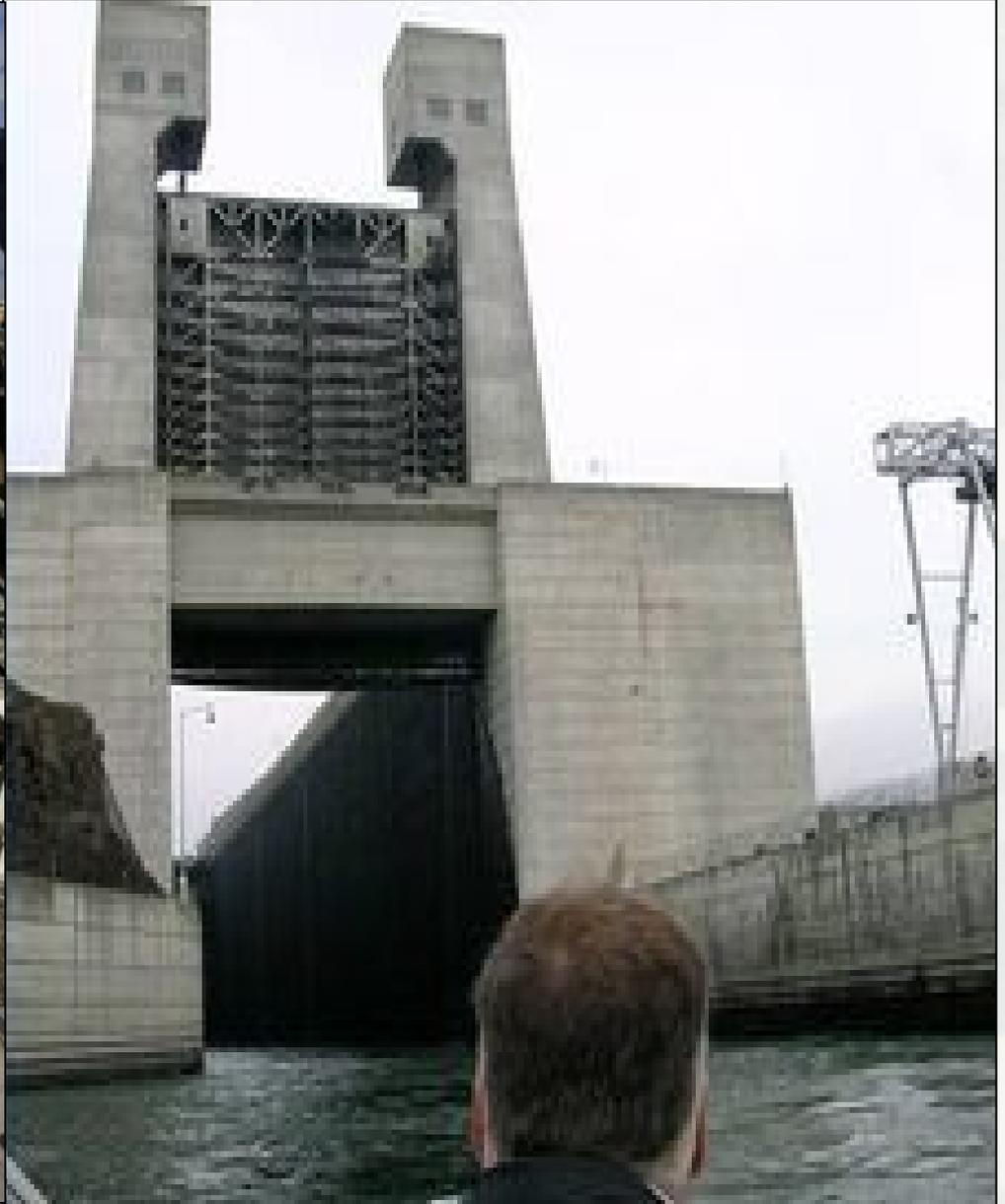
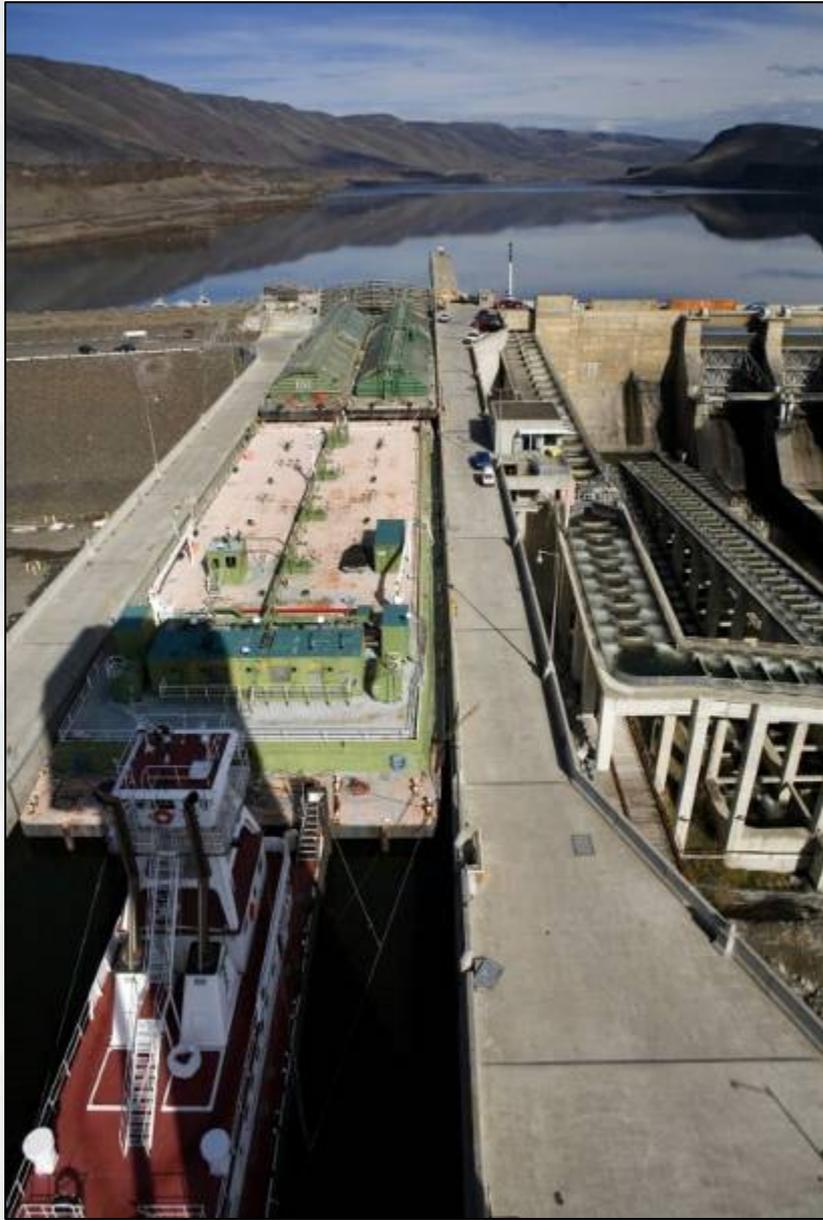
Scheduled Maintenance Outage occurs two weeks in March each year.

Two extended outages planned for 2011 and 2014





DOWNSTREAM GATE
Height 112 feet
Width 86 feet
2,000,000 lbs





Customer Concerns & Design Goals

- Gates going skew during operation
 - ▶ Need to maintain level +/- 1-inch
- Maintenance intensive
 - ▶ System is always being worked on
 - ▶ Wiring “is a mess”
- Difficult to troubleshoot
 - ▶ No drawings
- Limited/unreliable indication in control stands

- Reliability
 - ▶ Reliable Hardware
 - ▶ Reliable Operation
 - ▶ Reliable Backup System
- Easy to troubleshoot
 - ▶ Provide tools to reduce troubleshooting time
- Easy to operate
 - ▶ Provide sufficient information for all operating equipment
- Follow-Up Training and Support

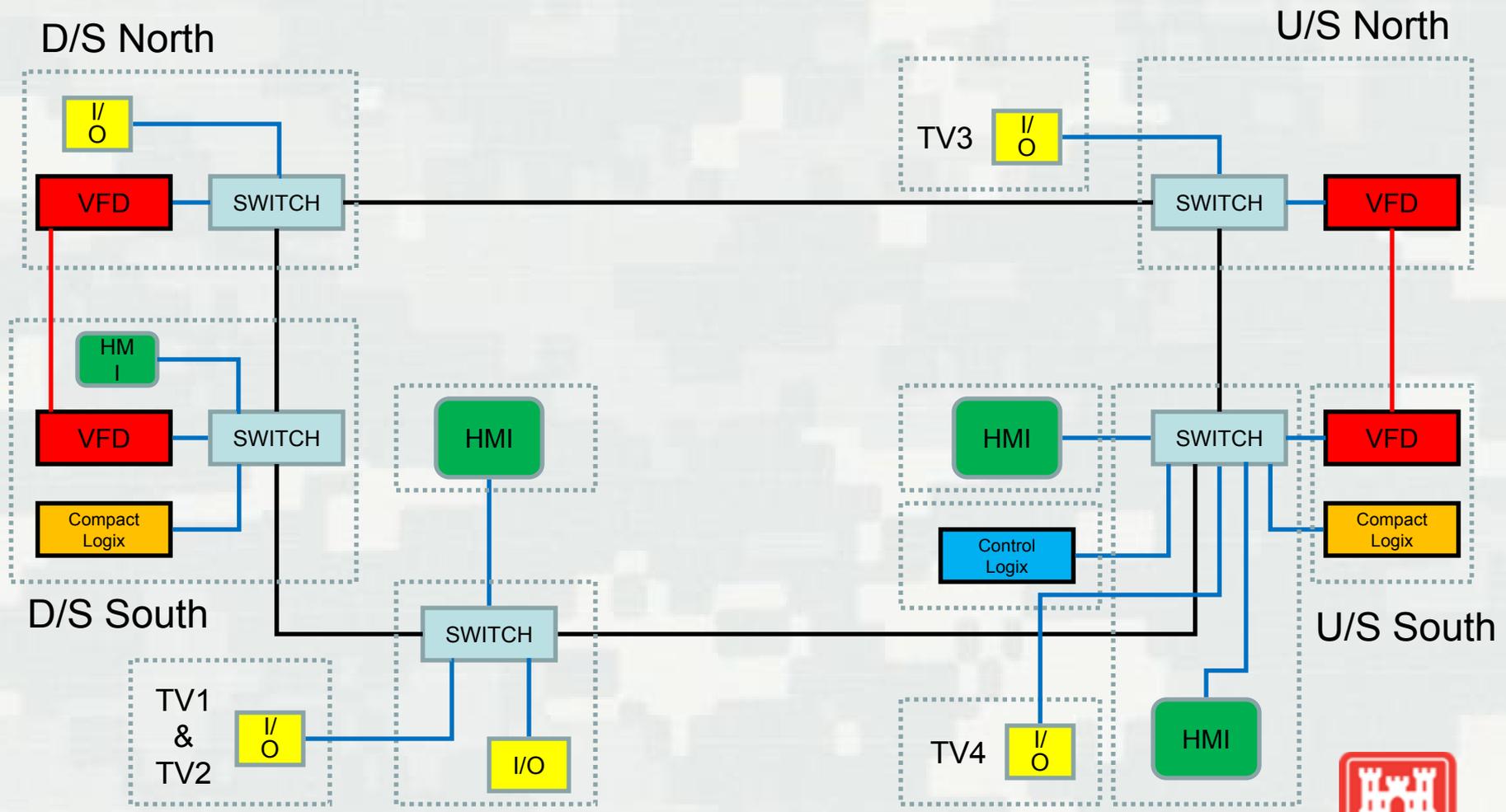


Electrical Scope

- Control System
 - ▶ New Control Consoles and Cabinets
 - ▶ PLC based system using Allen Bradley ControlLogix, CompactLogix, and Point I/O
 - ▶ Ethernet Ring
- Navlock Gates
 - ▶ Change from hydraulic motors to electric motors using variable frequency drives (VFDs)
 - ▶ Absolute encoders for gate position
- Tainter Gates
 - ▶ HPU's replaced in 2004 so kept equipment
 - ▶ Provided new wiring



System Configuration

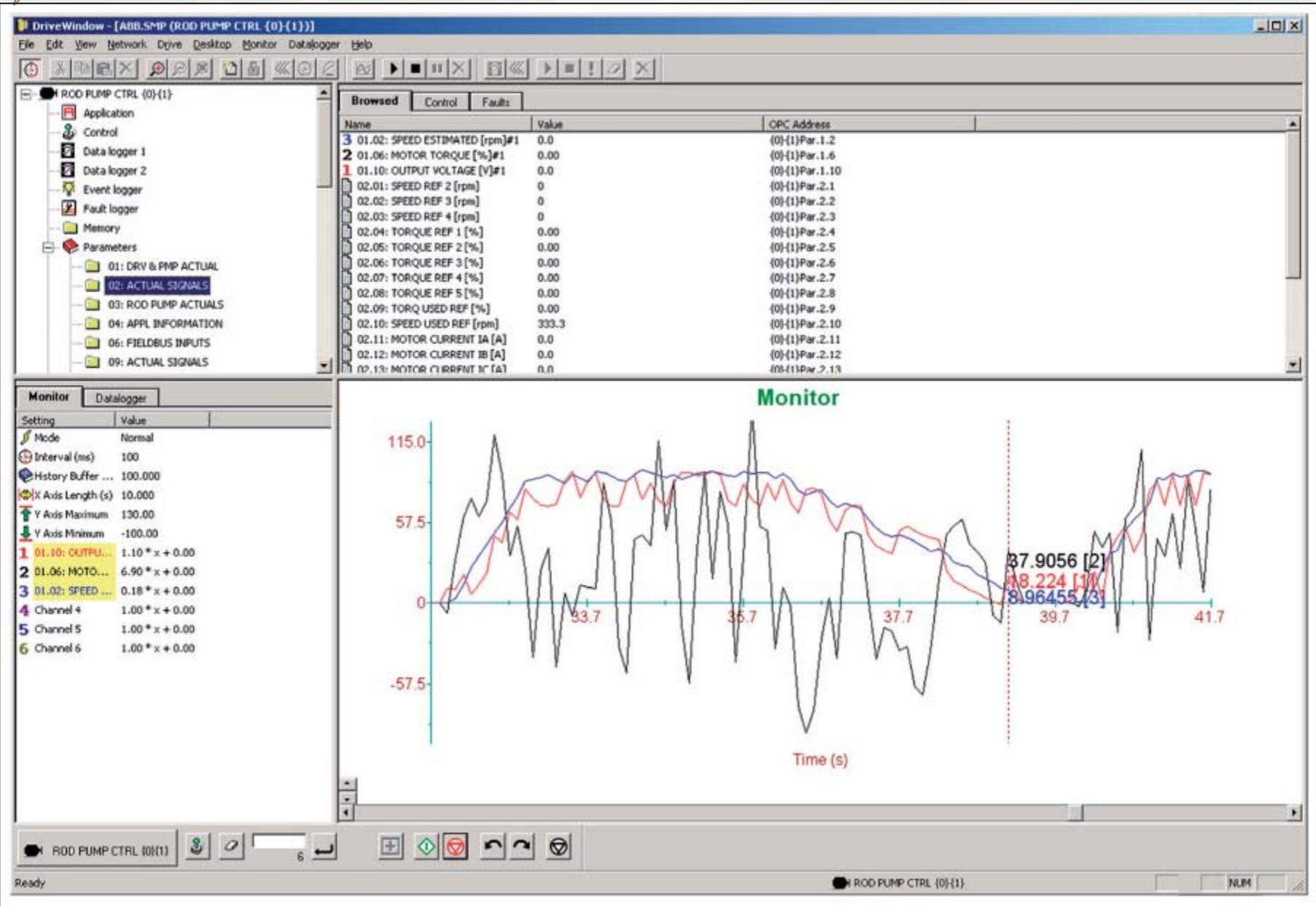




Gate Control

- VFDs
 - ▶ VFDs to reduce “shock-loading” during starting and stopping of gate
 - ▶ Two different operating speeds [Regular (23.12 ft/min – 1000 rpm) and creep (3 ft/min – 130 rpm)]
- SSI Encoders
 - ▶ 4096 revs
 - ▶ 8192 steps/rev
 - ▶ ~24,500 counts for each foot of travel
- Master/Slave Configuration
 - ▶ Master Drive maintains speed based on speed reference
 - ▶ Slave adjusts speed to keep gate level

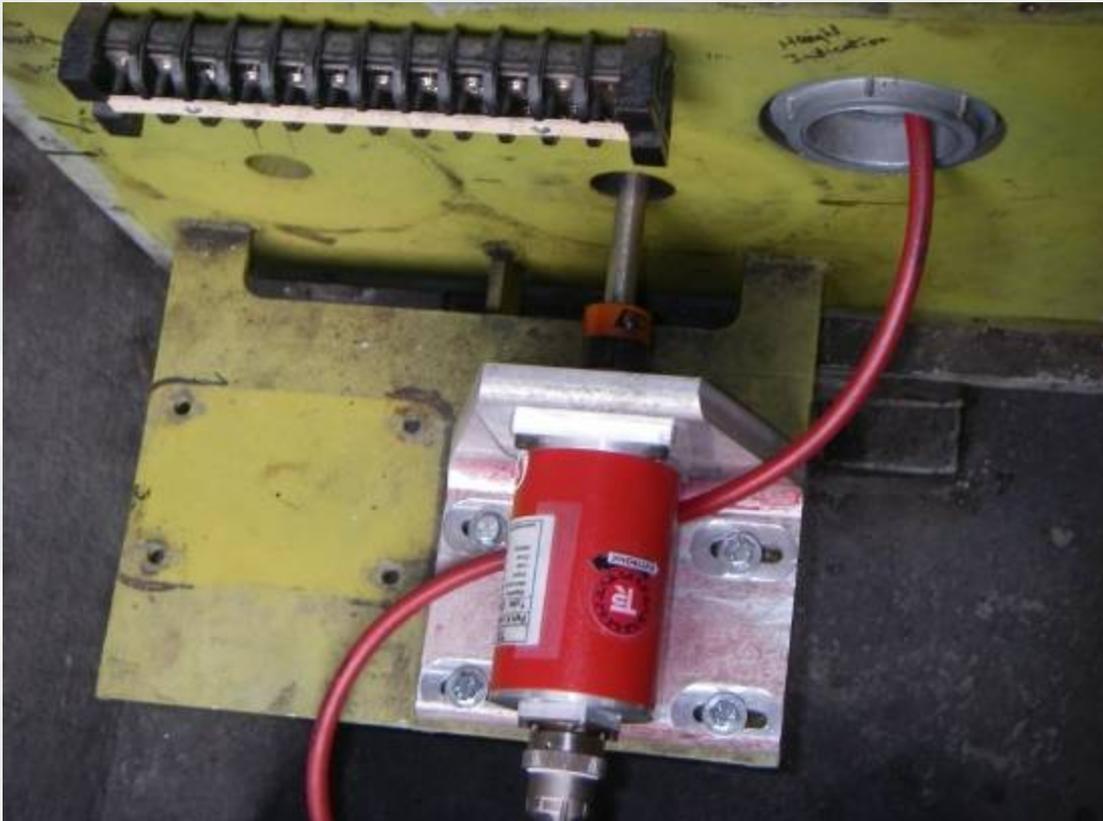






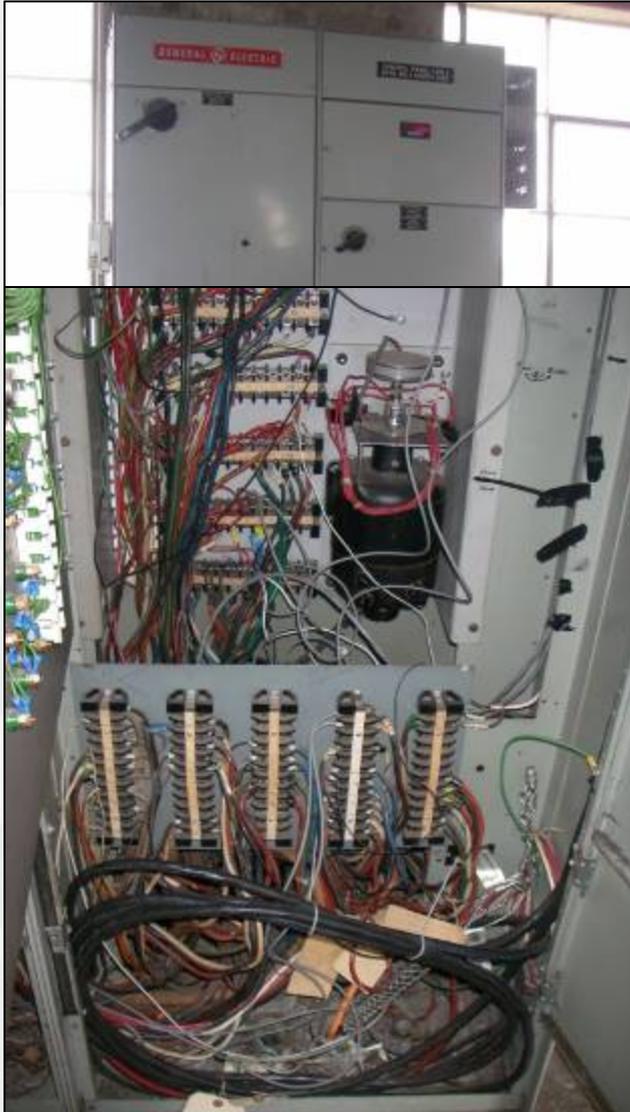


SSI Encoders





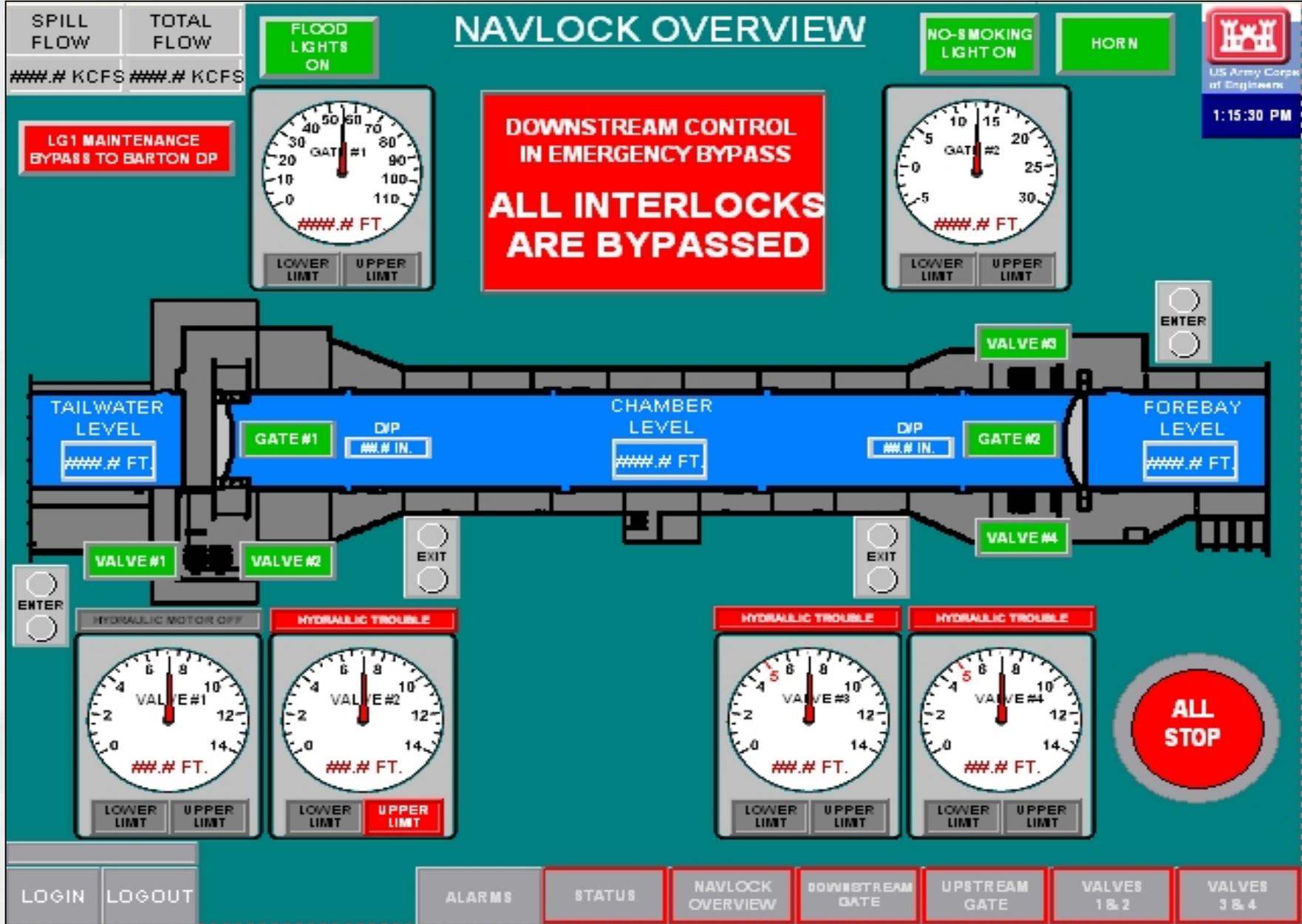
OLD EQUIPMENT



NEW EQUIPMENT







SPILL FLOW

TOTAL FLOW

FLOOD LIGHTS ON

VALVES 1 AND 2

NO-SMOKING LIGHT ON

HORN



1:42:51 PM

####.# KCFS ####.# KCFS

VALVE #1

####.# FT.

AUTO-CLOSE NOT ACTIVE

VALVE #2

####.# FT.

HYDRAULIC TROUBLE

HYDRAULIC TROUBLE

VALVE #1 IN BYPASS

LOCAL CONTROL

VALVE #1

OPEN VALVE #1

STOP

CLOSE VALVE #1

VALVE #2 BYPASS

LOCAL CONTROL

VALVE #2

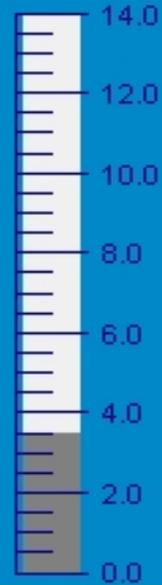
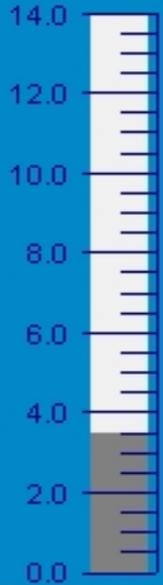
OPEN VALVE #2

STOP

CLOSE VALVE #2

UPPER LIMIT

UPPER LIMIT



OPEN VALVES 1 & 2

STOP

CLOSE VALVES 1 & 2

PERMISSIVES

GATE #*

VALVE #*

VALVE #*

INDEPENDENT

HYDRAULIC OVER PRESSURE PRESS TO RESET

HYDRAULIC OVER PRESSURE PRESS TO RESET

ALL STOP

LOGIN LOGOUT

ALARMS

STATUS

NAVLOCK OVERVIEW

DOWNSTREAM GATE

UPSTREAM GATE

VALVES 1 & 2

VALVES 3 & 4



SPILL FLOW	TOTAL FLOW
####.# KCF8	####.# KCF8

FLOOD LIGHTS ON

NO SMOKING LIGHT ON

HORN



US Army Corps of Engineers

VALVE 1 & 2 AUTO-CLOSE DIFF. LIMIT ENTER (0-100 IN) <input type="text" value="N.N INCHES"/>	VALVES 3 & 4 AUTO-CLOSE DIFF. LIMIT ENTER (0-150 IN) <input type="text" value="N.N INCHES"/>	LG2 DP SETTING ENTER (0-50 IN) <input type="text" value="N.N INCHES"/>
VALVE #3 OPENING SPEED ENTER (0-10V) <input type="text" value="N.N VOLTS"/>	VALVE #4 OPENING SPEED ENTER (0-10V) <input type="text" value="N.N VOLTS"/>	LG1 MAINTENANCE BYPASS TO BARTON DP
VALVE #3 CLOSING SPEED ENTER (0-10V) <input type="text" value="NN.N VOLTS"/>	VALVE #4 CLOSING SPEED ENTER (0-10V) <input type="text" value="NN.N VOLTS"/>	LG2 MAINTENANCE BYPASS TO BARTON DP



LOGIN LOGOUT



RAISE OVER-TRAVEL		SKEWED		PERMISSIVES IN BYPASS	
UPPER LIMIT		NORTH DRIVE FAULT		CREEP SPEED	
LOWER LIMIT		NORTH DRIVE COM FAULT		INDEPENDENT	
LOWER CREEP (DUCKBILL)		SOUTH DRIVE FAULT		S. VFD START INTERLOCKS	
SOUTH STATUS	NORTH STATUS	LG1P DATA	LG2P DATA	TRACK N & S	

NORTH DRIVE RPM ###.#	SOUTH DRIVE RPM ###.#	EXIT TO DISPLAY CONFIG
NORTH DRIVE % TORQUE ###.##	SOUTH DRIVE % TORQUE ###.##	
NORTH MOTOR CURRENT (A) ###.##	SOUTH MOTOR CURRENT (A) ###.##	RETURN

NORTH DRIVE FAULT	NORTH CONTROL POWER AVAIL.
NORTH DRIVE COM FAULT	NORTH DRIVE READY
N. BRAKE RESISTOR OVER-TEMP	NORTH DRIVE RUNNING
NORTH BRAKES RELEASED	NORTH CONTROL PANEL IN REMOTE
NORTH CONTROL PANEL IN LOCAL	RETURN

LG1P DATA

GATE #1 NORTH HEIGHT ###.## FT.	GATE #1 SKEW ##.## IN.	GATE #1 SOUTH HEIGHT ##.## FT.
ENCODER NORTH COUNT #####	ENCODER SOUTH COUNT #####	
UPPER LIMIT	UPPER CREEP	RETURN
LOWER LIMIT	LOWER CREEP	



Key Activities

- Define operating scheme with project personnel
- As-build before starting design
- In-house programming
- Field support during construction
- Training for operations staff
- Periodic Follow-Up



Questions?

Did you
do your
safety

