

LESSONS LEARNED

WANAPUM DAM UNIT CONTROLS PROJECT

Ian Jones
Grant PUD Hydro
Electrical Engineering
Supervisor

LESSONS LEARNED

WANAPUM DAM UNIT CONTROLS PROJECT

- **Original Equipment**
- **Project Drivers**
- **New Equipment**
- **Lessons Learned**
 - **New Equipment**
 - **System Integration**
 - **Project Management**
 - **Commissioning**

EXISTING EQUIPMENT

WANAPUM DAM UNIT CONTROLS PROJECT

- **Exciters**

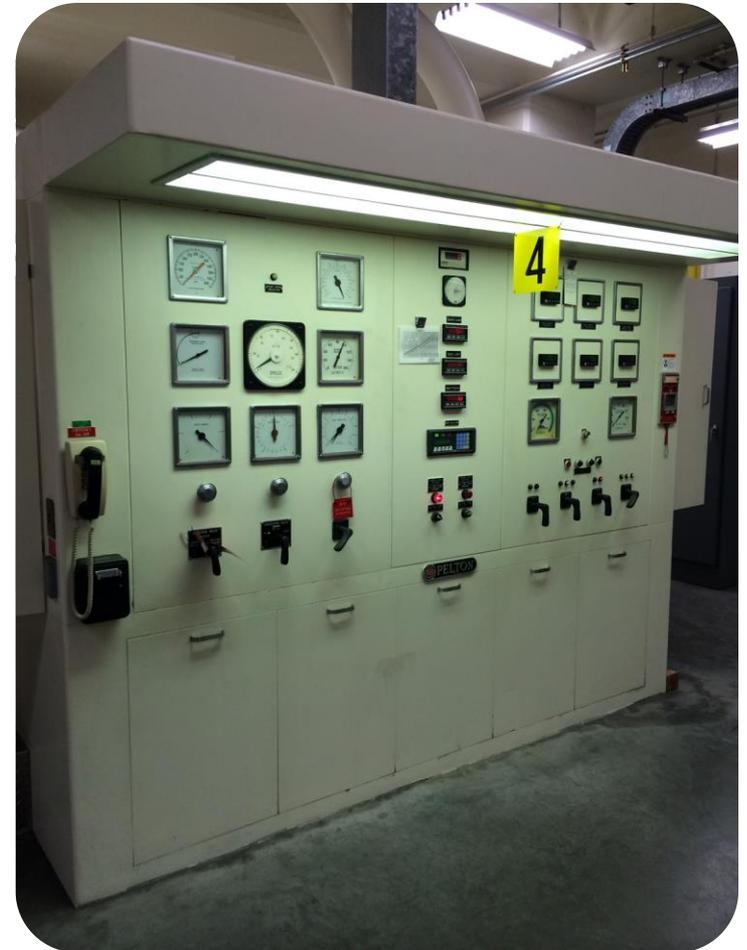
- GE Amplidyne
- Original Equipment
- “Rotary Exciter”



EXISTING EQUIPMENT

WANAPUM DAM UNIT CONTROLS PROJECT

- **Governors**
 - Pelton Type II
 - Original Equipment
 - “Mechanical Governor”
 - Kaplan Turbine blade control



EXISTING EQUIPMENT

WANAPUM DAM UNIT CONTROLS PROJECT

- **Unit Auxiliaries & Protection**

- GE Electromechanical Relays
- Molded Case Circuit Breakers
- Relay based logic and controls



UPGRADE DRIVERS

WANAPUM DAM UNIT CONTROLS PROJECT

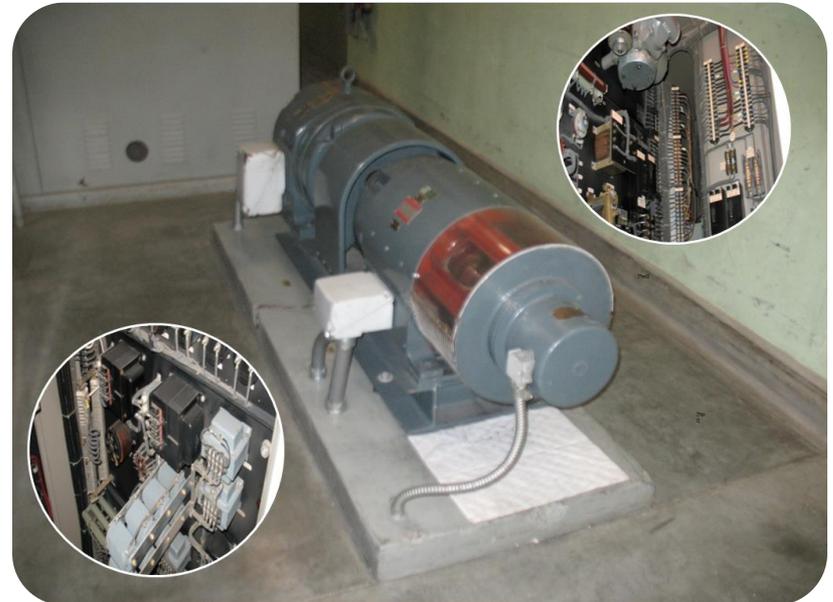
• Exciters

Threats

- **Obsolescence**
- **High Maintenance**
- **Minimal Support**
- **Larger unit design**

Opportunities

- **Reduced Maintenance**
- **Improved Performance**
- **PSS integration**
- **Data Communications**
- **Factory support**
- **Test & Documentation**



UPGRADE DRIVERS

WANAPUM DAM UNIT CONTROLS PROJECT

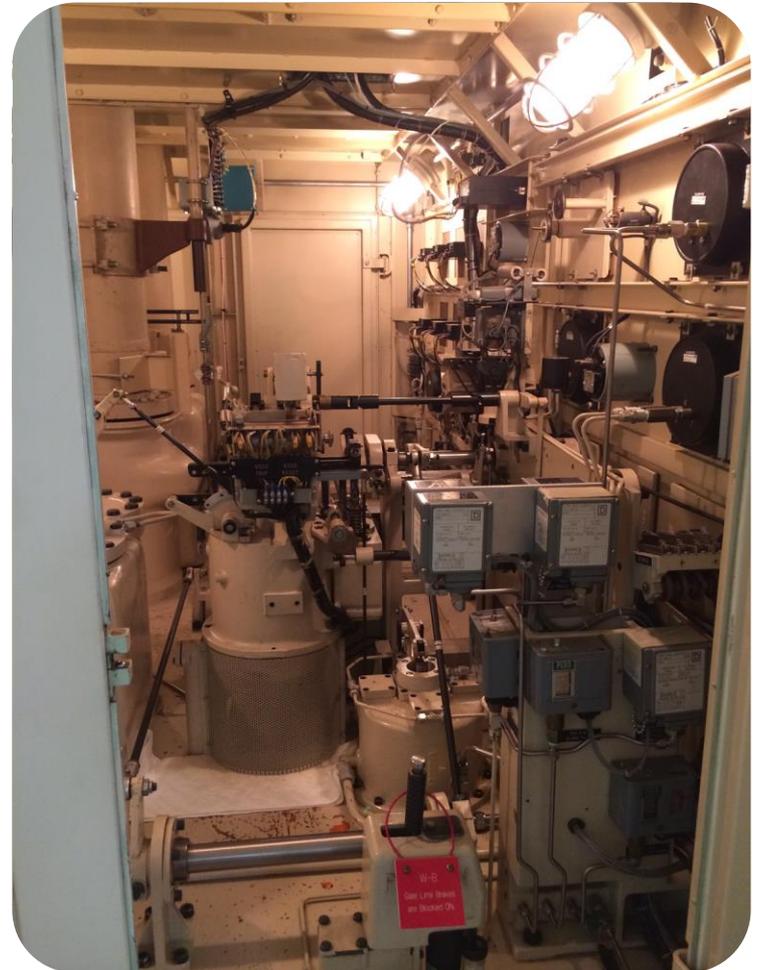
- **Governors**

Threats

- **Obsolescence**
- **Minimal Support**
- **High Maintenance**

Opportunities

- **Efficiency & Performance**
- **Reduced Maintenance**
- **Data Communications**
- **Test & Documentation**



UPGRADE DRIVERS

WANAPUM DAM UNIT CONTROLS PROJECT

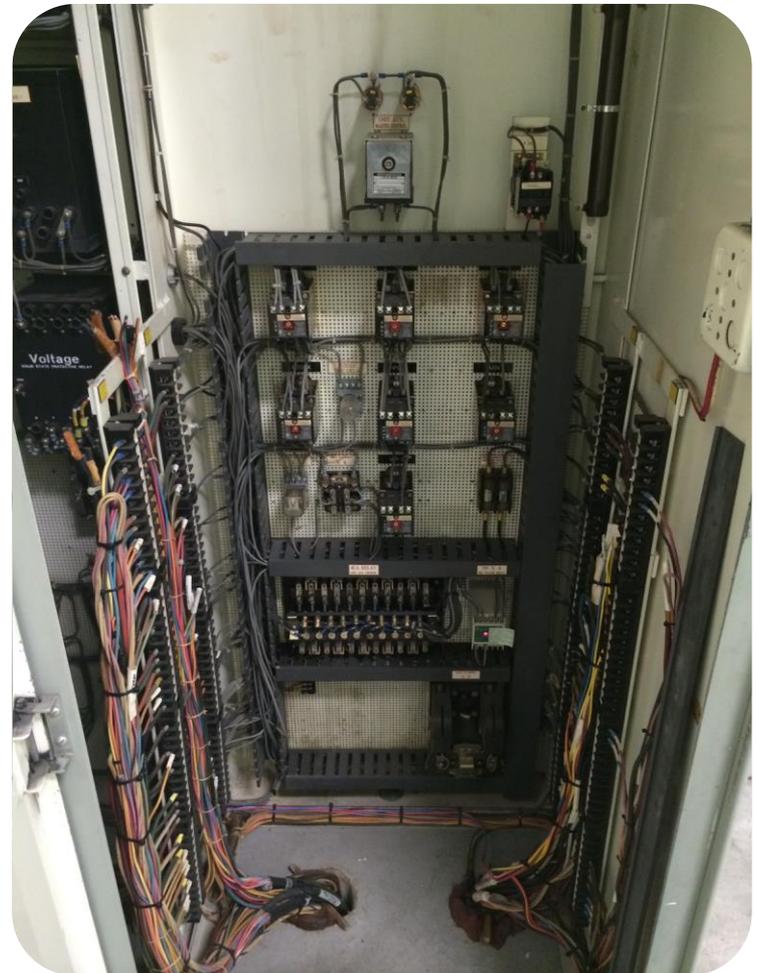
• Unit Auxiliaries & Protection

Threats

- Obsolescence
- Calibration issues

Opportunities

- Network Communications
- Test & Documentation
- Improved protection
- Digital controls
- Safer Power Distribution



NEW EQUIPMENT

WANAPUM DAM UNIT CONTROLS PROJECT

- **Exciters**

- ABB
- “Static Exciters”
- Unitrol PLC
- Windows HMI
- Modbus Comm Link



NEW EQUIPMENT

WANAPUM DAM UNIT CONTROLS PROJECT

- **Governors**
 - L&S Electric
 - “Digital Hydraulic”
 - 3-D Cam
 - ‘COTS’
 - Allen-Bradley



NEW EQUIPMENT

WANAPUM DAM UNIT CONTROLS PROJECT

- **Unit Auxiliaries**

- MCC's
- AB Control Logix PLC
- Design build by GPUD

- **Protection**

- Redundant SEL 300G's
- SEL 2032 Comm Processor
- DNP Comm Link
- Design build by GPUD /
Power Engineering Inc.



LESSONS LEARNED

WANAPUM DAM UNIT CONTROLS PROJECT

- **New Equipment**
- **Systems Integration**
- **Project Management**
- **Commissioning**

LESSONS LEARNED

WANAPUM DAM UNIT CONTROLS PROJECT

- **New Equipment**
 - **Specifications**
 - **Exciters**
 - **Governors**
 - **Auxiliaries**



LESSONS LEARNED

WANAPUM DAM UNIT CONTROLS PROJECT

- **Systems Integration**
 - **“Control Room Issues”**
 - **Network Communications**
 - **Load Control**
 - **VAR Control**
 - **KPI’s**
 - **Ergonomics**

LESSONS LEARNED

WANAPUM DAM UNIT CONTROLS PROJECT

- **Project Management**
 - **Stakeholder Feedback**
 - **Stakeholder “buy-in”**
 - **Schedule**

LESSONS LEARNED

WANAPUM DAM UNIT CONTROLS PROJECT

- **Commissioning**
 - **Scheduling**
 - **Comms Testing**
 - **Test Plans Documentation**
 - **Acceptance Testing/
Model Validation Testing**

LESSONS LEARNED

WANAPUM DAM UNIT CONTROLS PROJECT

- **Conclusion**
 - **Technical challenges w/ comms and control**

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LESSONS LEARNED

WANAPUM DAM UNIT CONTROLS PROJECT

Questions?

Further Information?
ijones@gcpud.org

Thank you.