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Massachusetts Institute of Technology

Control System Planning for Utilities Plants: Evolution vs Creation

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POWER ENGINEERS

MIT’s Campus Utilities

- Central Utilities Plant that serves campus electrical, heating, and cooling needs
- Five oil/gas fired boilers
- One 20MW combustion turbine with an HRSG
- Six steam driven chillers and ten electric driven chillers
- Two - 50kpph hot water heat exchangers

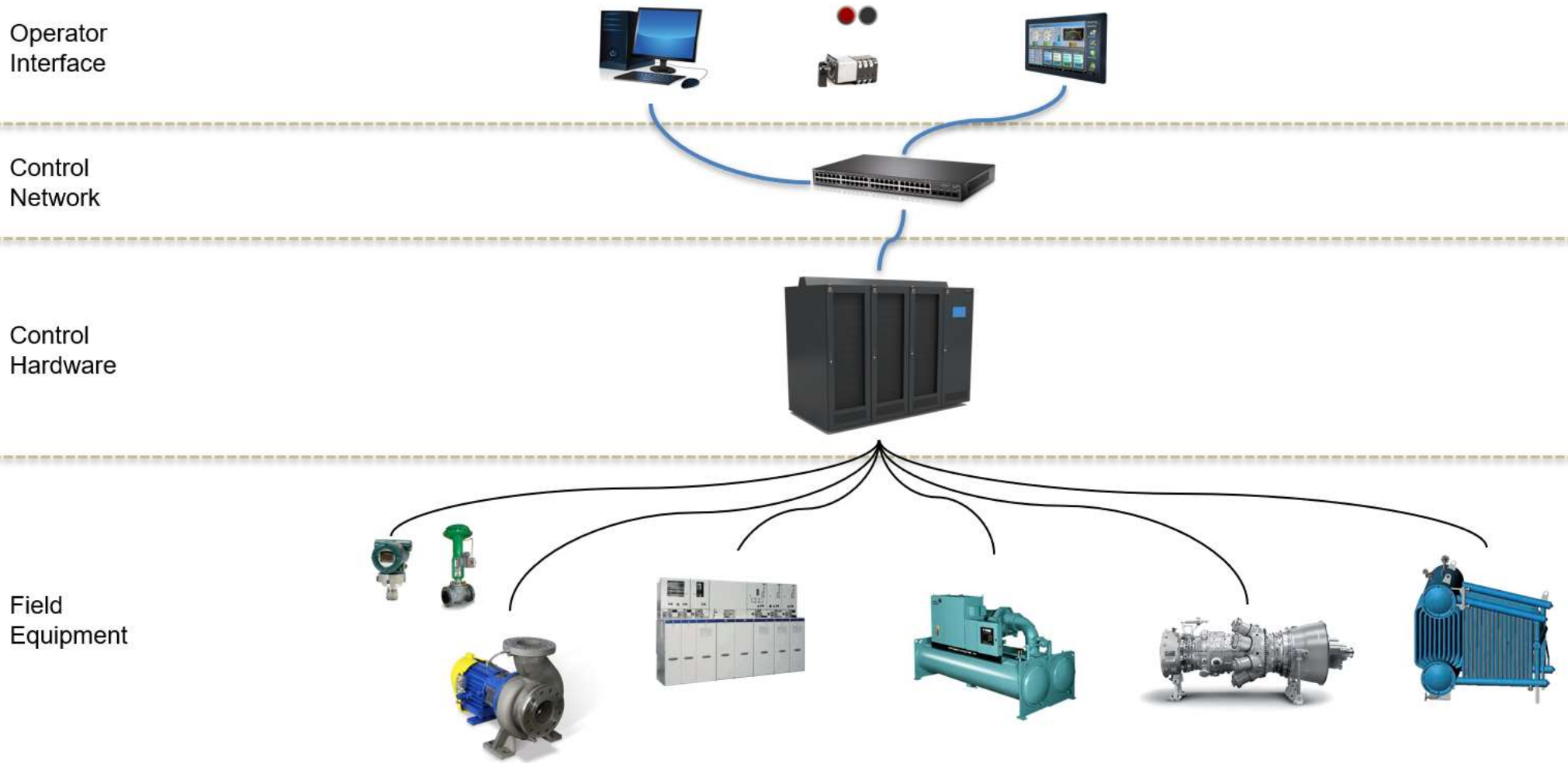
Controls Upgrade Project

MIT Central Utilities Plant

Project Drivers

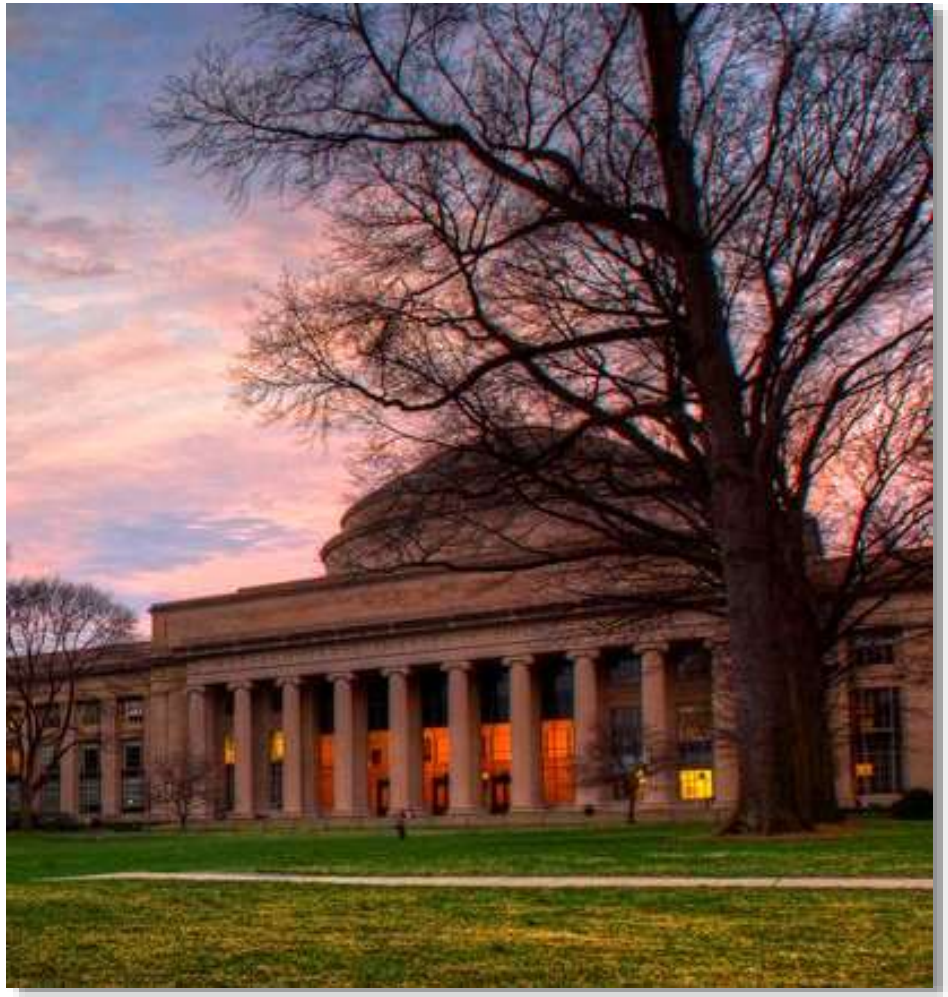
- Obsolete central control system
- Limited available spares
- Limited expansion options
- Potential plant production expansion

Control System

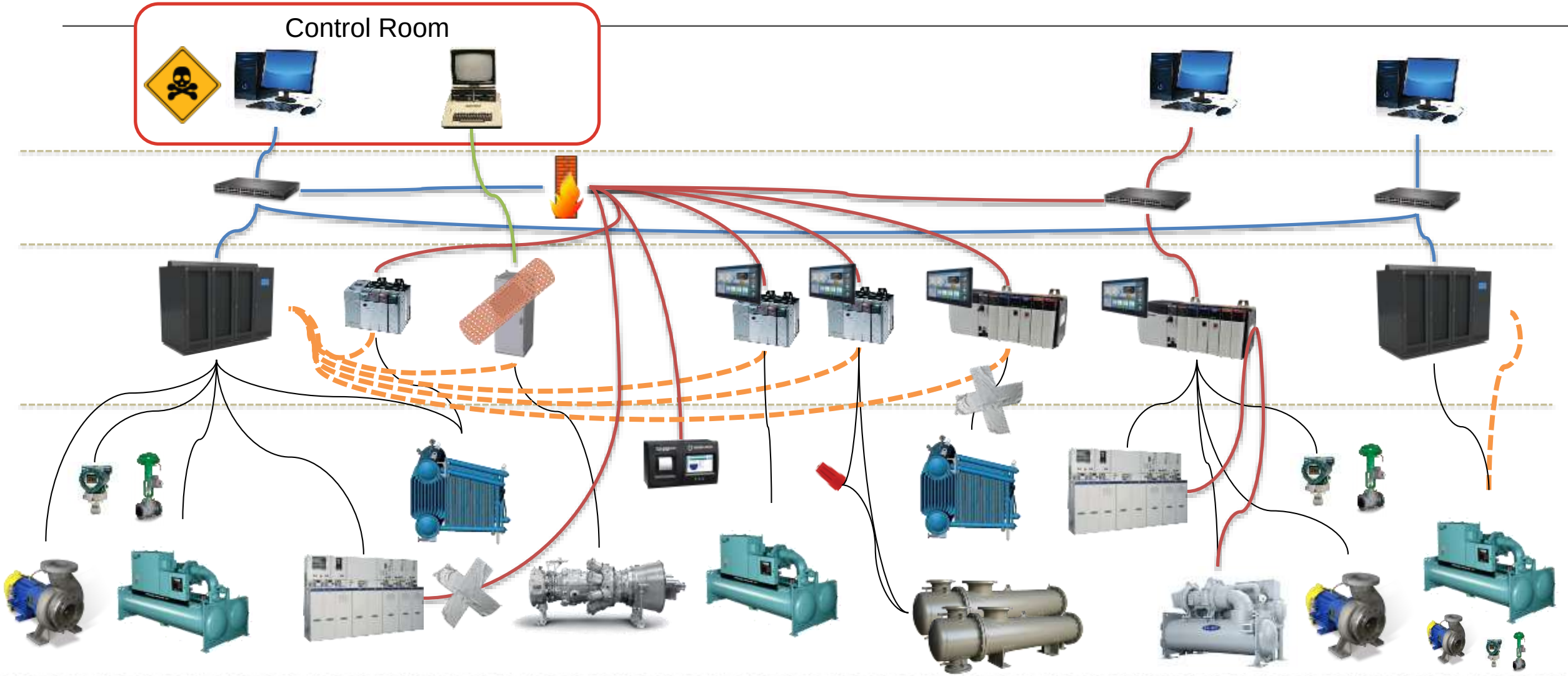


Facilities Plants

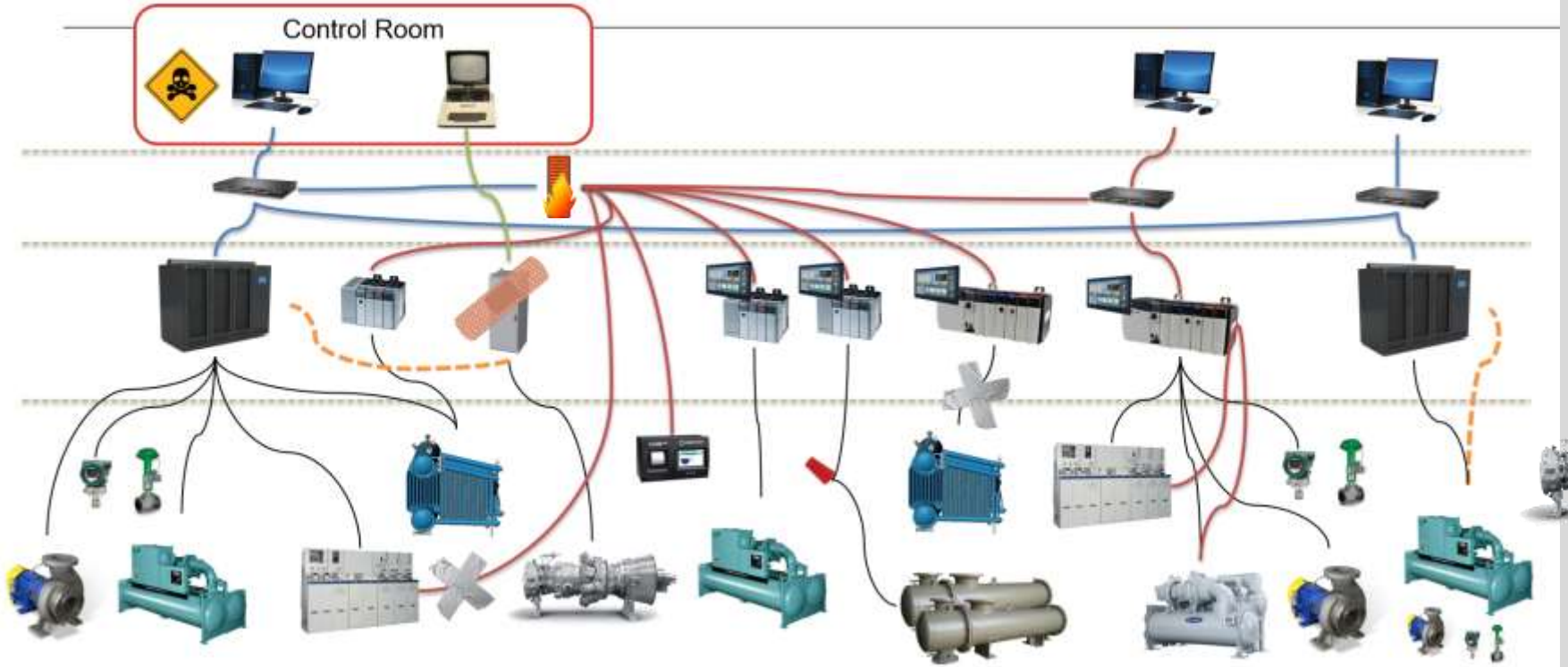
- Improvements
  - Upgrades
  - Replacements
- Expansion
  - New equipment
  - New plant?
- Change
- EVOLVING!

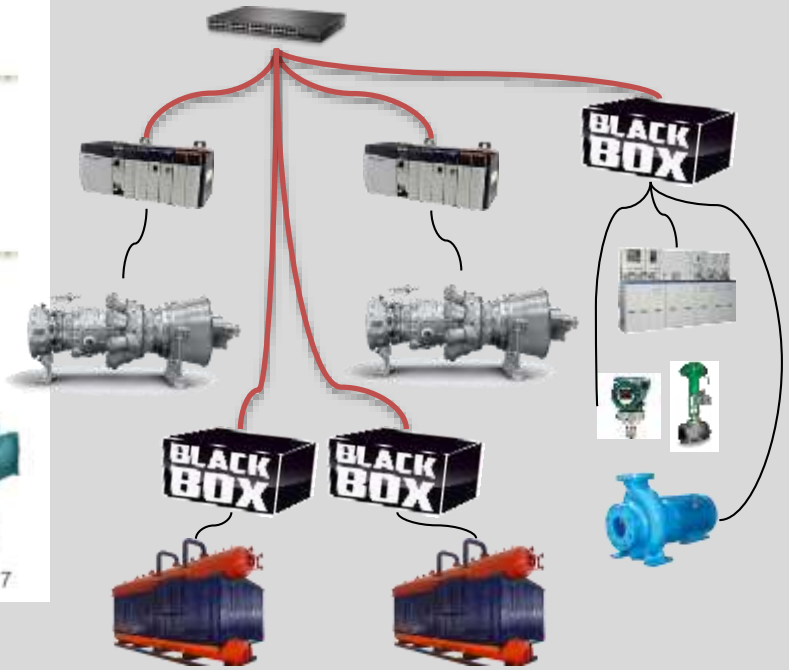


Control System (reality)



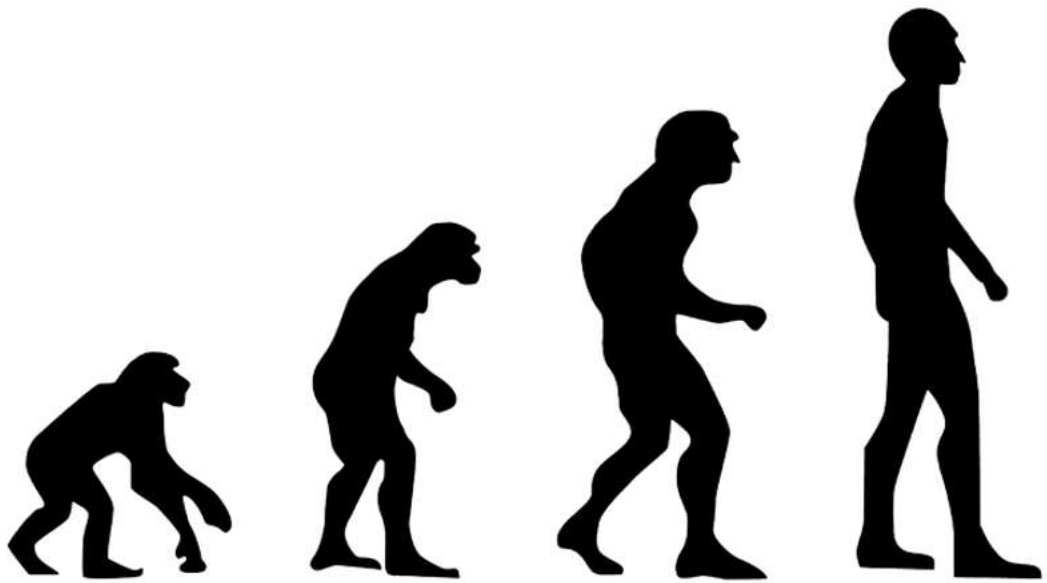
Control System (reality)



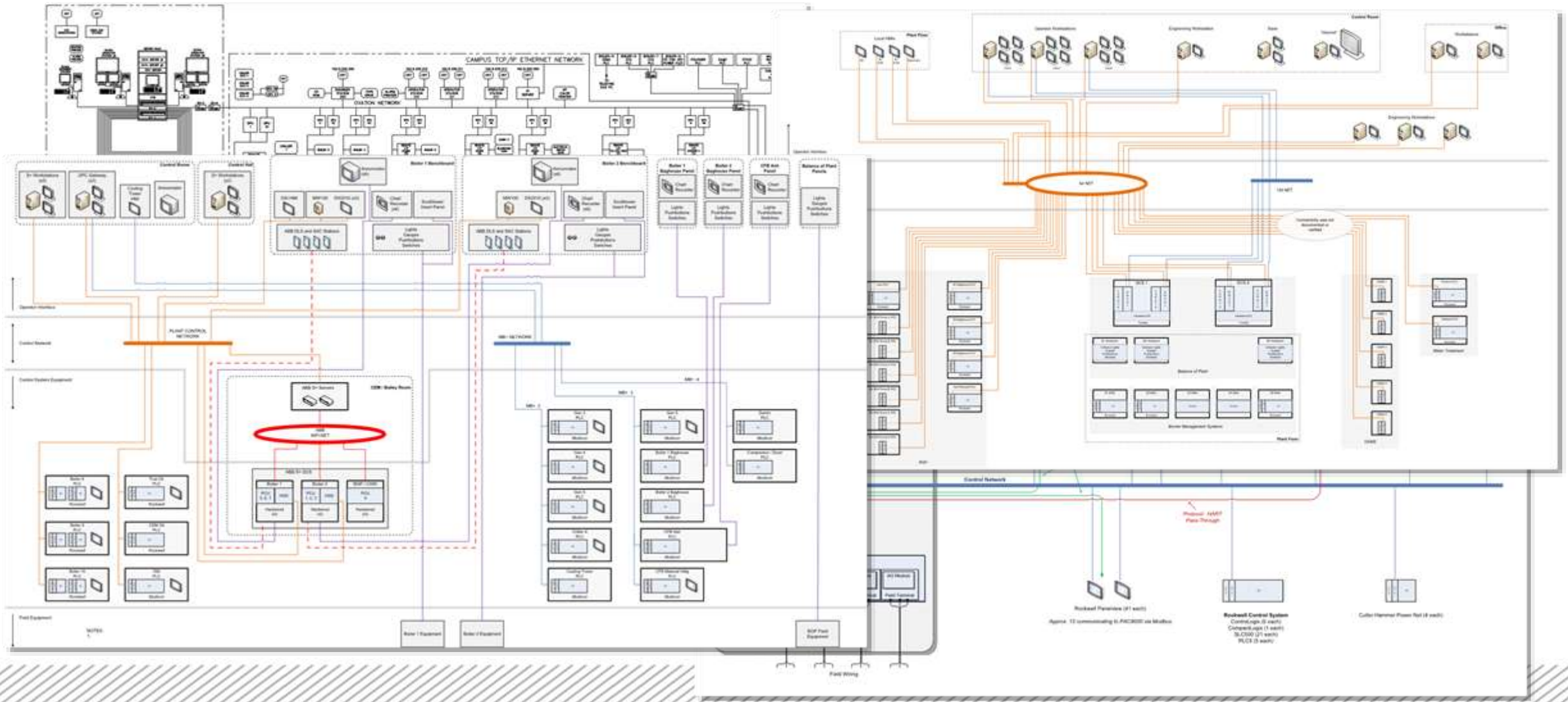


Control System (reality)

Control systems EVOLVE to meet the needs of an ever changing plant.

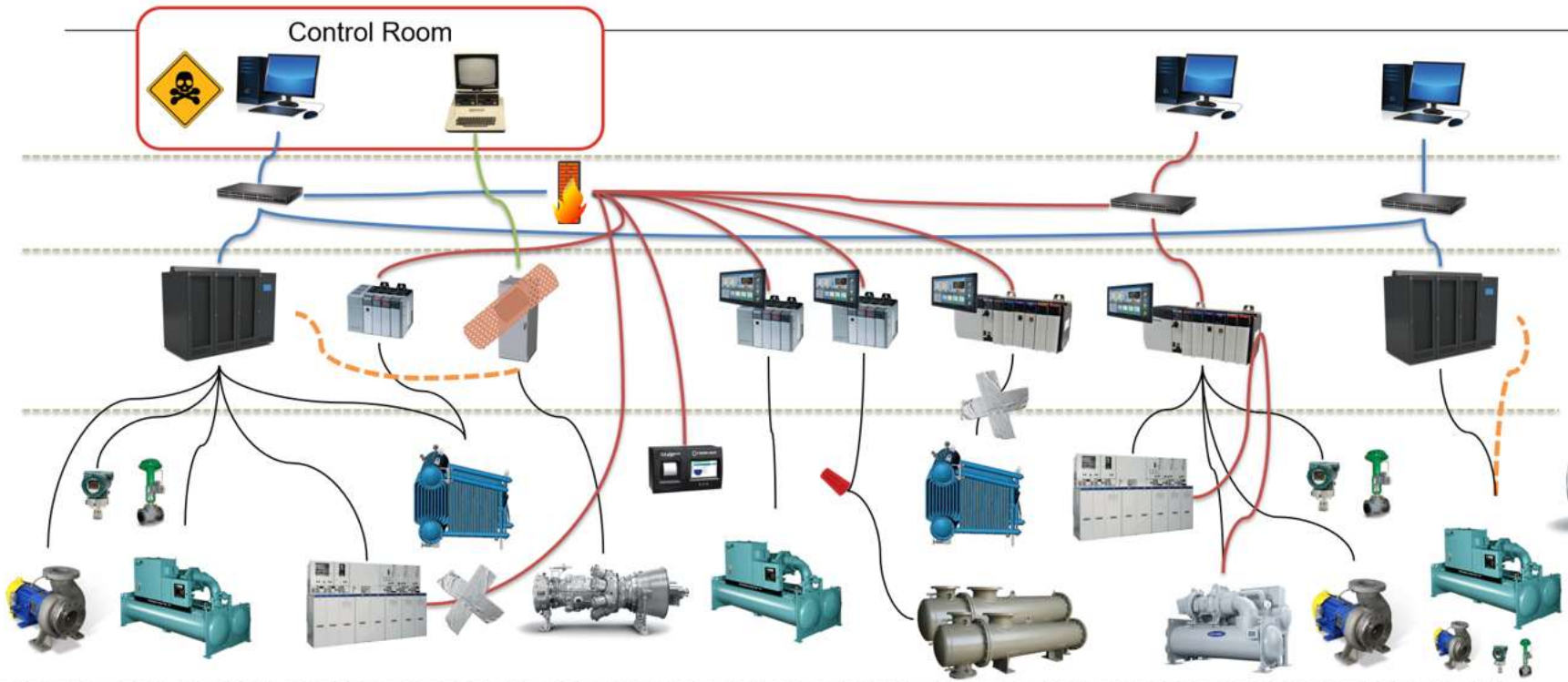


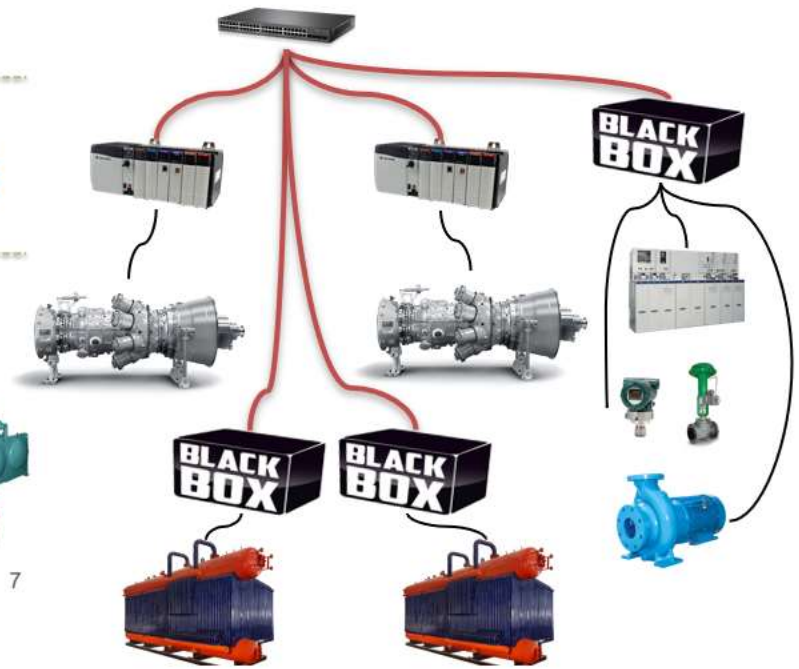
Control System (reality)



Control System Planning ???

Control System (reality)





Know your architecture

HMI

- ❑ HMI System
- ❑ Open / Proprietary
- ❑ Protocols
- ❑ Single Interface
- ❑ Location

Network

- ❑ Open / Closed
- ❑ Expandable
- ❑ VLAN capable

Hardware

- ❑ DCS and/or PLC
- ❑ Life Cycle
- ❑ Expandable
- ❑ Migratable
- ❑ Application Software
- ❑ Support
- ❑ Training

Field

- ❑ Additional capability
- ❑ Datalink

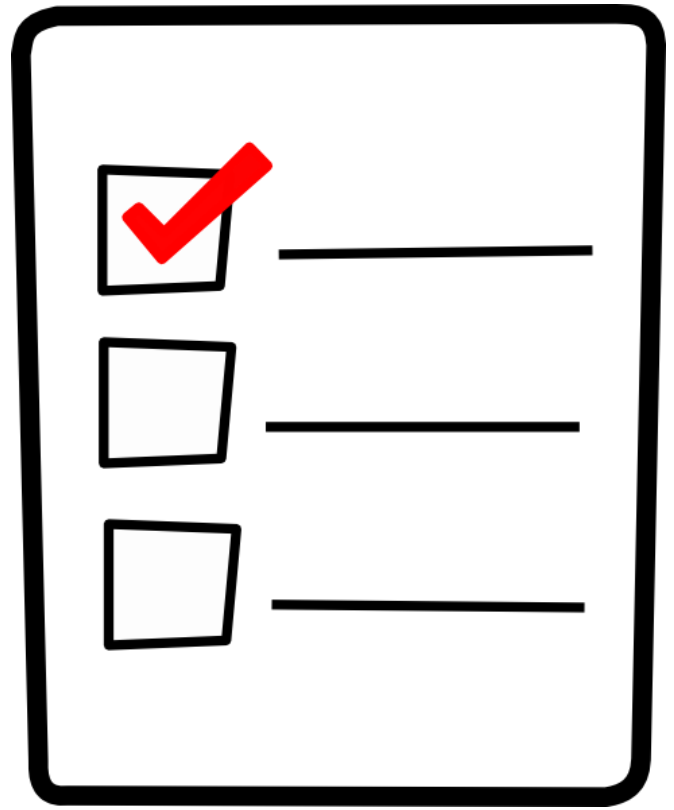
What's your wish list?

HMI
- ✓ Common interface
- ✓ Multi-location

Network
- ✓ Independent Networks

Hardware
- ✓ Multi-platform
- ✓ System independence
- ✓ I/O migration or replacement

Field
- ✓ Plant expansion



Know your constraints

Outage?

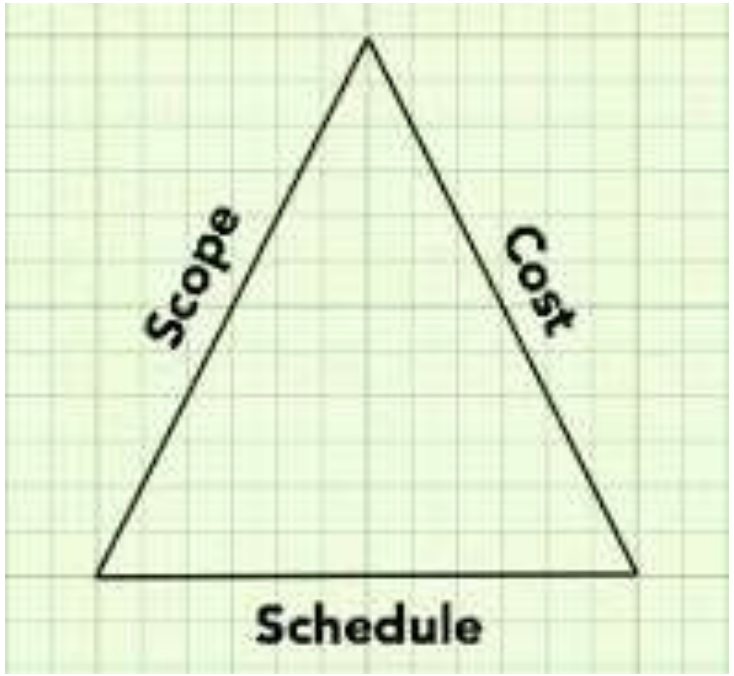
Interconnections?

Data loss?

Operations?

Maintenance?

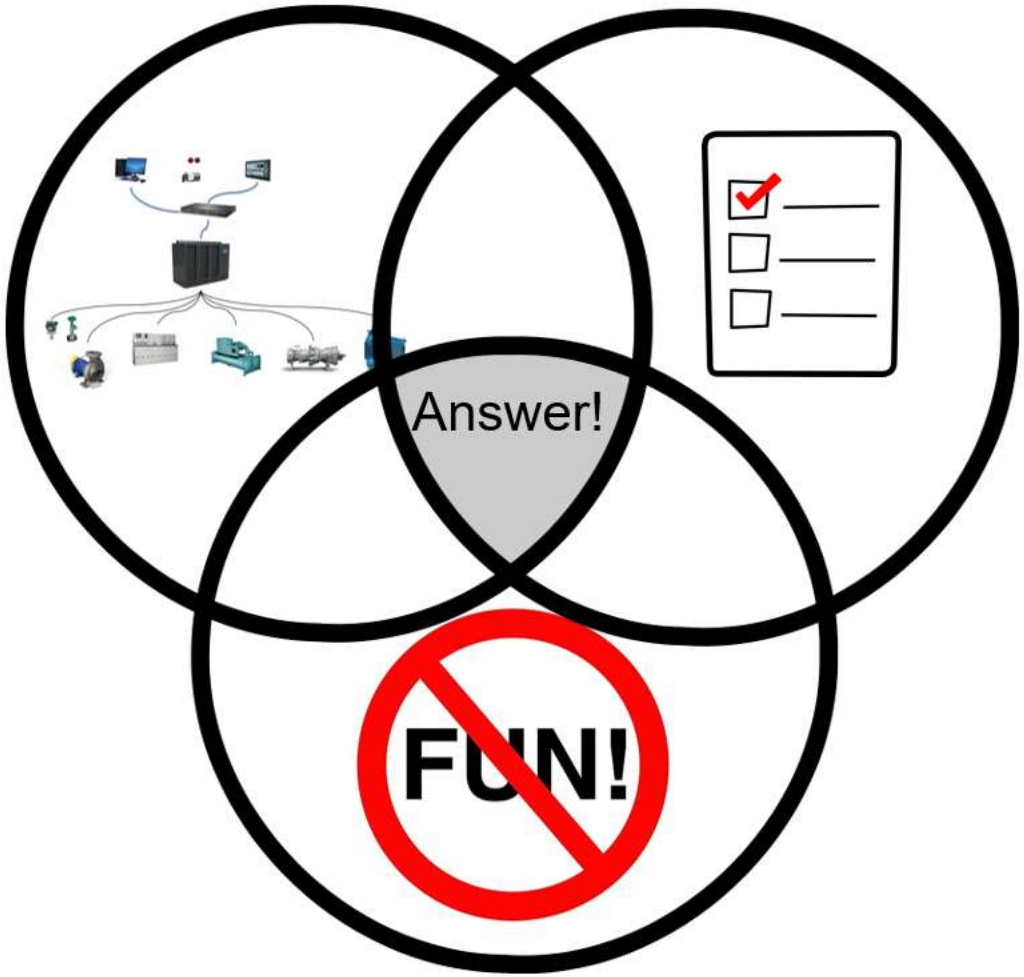
Installation?



What's your options

Evolution vs. Creation

- ✓ Common HMI
  - DCS as primary interface w/ redesigned graphics package
  - "Island" HMIs
- ✓ Migration AND Addition
  - Reduces outage time
  - Reduced development cost
  - Reduced installation cost
  - System independence
- ✓ Phased installation with cutover



Lessons learned (halftime)

- ✓ Knowledge is power
  - Ask questions!
- ✓ More than one solution
- ✓ Bumps along the way

High Performance Graphic Upgrade

Enhance operational awareness

- ✓ Low contrast depiction / Limited use of color
- ✓ Values are presented in context (information)
- ✓ Critical values included in embedded trends
- ✓ Alarm colors are reserved for only indicating alarms
- ✓ Hierarchy design

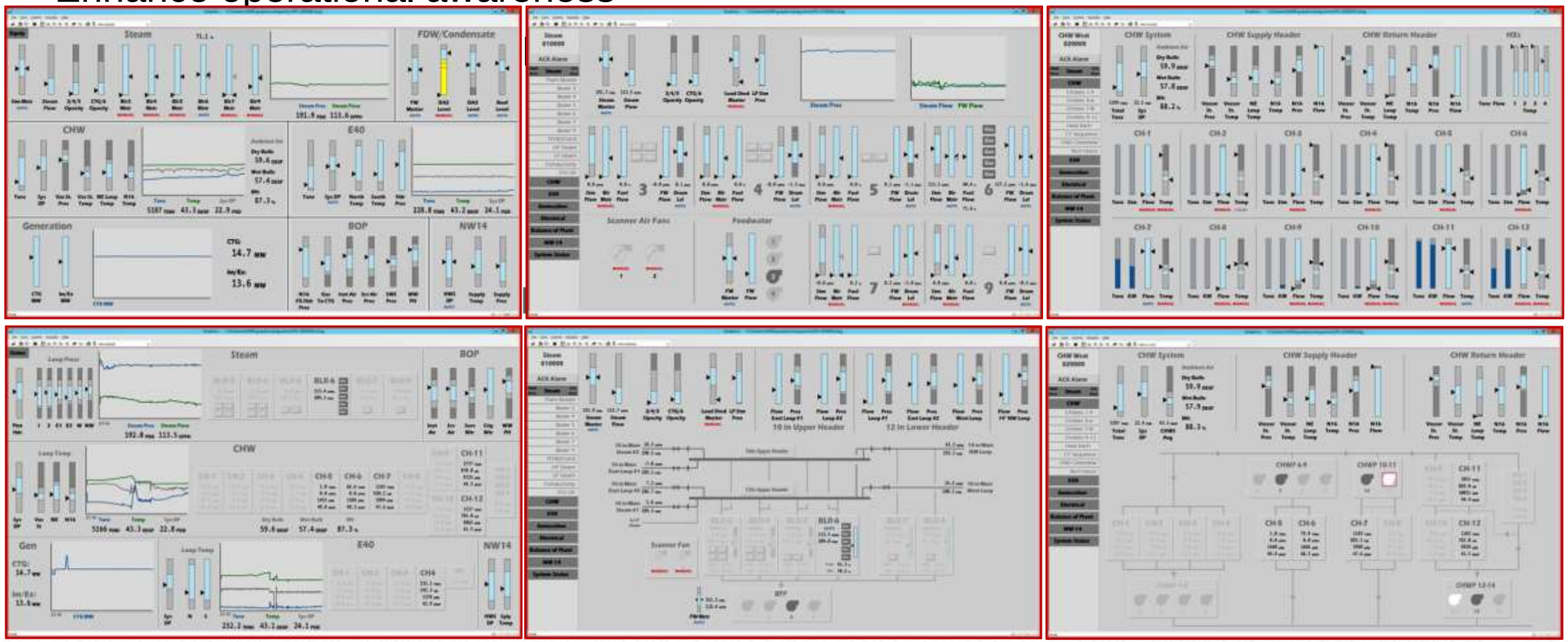
High Performance Graphic Upgrade

Enhance operational awareness

- ✓ Execution Plan
  1. Investigative Site Visits
  2. Philosophy Development Meetings
  3. Design Review
  4. Factory Acceptance Testing
  5. Training
  6. Deployment

High Performance Graphic “Upgrade”

Enhance operational awareness



Lessons learned (halftime)

- ✓ Knowledge is power
  - Ask questions!
- ✓ More than one solution
- ✓ ~~Bumps along the way~~
- ✓ Detours
- ✓ Trade-offs
- ✓ Disappointments
- ✓ Technical challenges