



# THUMS Long Beach Automated Safety Systems



# Presentation Agenda

- Introduction to Thums
- Evolution of Safety Systems at Thums
- Safety System Requirements
- Safety System Architecture
- Safety System Testing
- Questions and Answers



# THUMS – A Unique Facility



**THUMS/Occidental Petroleum**



Field Contractor for oil producing property in Long Beach, Ca

## ■ Background information

- State of California –Owns 90% of the Wilmington Oil and Gas Field, Fourth largest in the USA
- Operator – City of Long Beach
- Field Contractor -THUMS/Occidental
  - Facilities 4 man-made islands
    - 1 pier facility
    - 1 gas processing facility
    - 1 power plant
  - Peak rate 150,000 BOPD in 1969
  - Present rate 30,000 BOPD
  - Injection rate 1,000,000 BPD
  - 737 producers and 455 injection wells
  - 50 MW/H annual electrical load



# Thums Islands and Subsea Pipelines





# Evolution of Safety Systems at Thums

## **Safety by Design**

- Production and Injection Wells located in Cellars
- Secondary Containment on Islands

## **Automation Safety System Upgrade**

- Process Hazard Review for Critical Systems
- Subsea Line Emergency Shutdown Valves
- Segregation of Process and Critical Shutdowns
- Redundant Safety System Processor
- Inter-Island Communication

# Safety in Original Design

Secondary Containment  
At Seawall

Production Cellars





# Subsea Line ESD Valves



# Safety System Requirements

## **Shutdown Production**

- FWKO Levels and Pressures
- High Tank Levels
- Cellar Gas Detection

## **Isolate Subsea Lines**

- High and Low Subsea Line Pressure
- ESD Valve Closure

## **Divert at J-2 (Shore Facilities)**

- Divert oil on high FWKO level
- Divert water on high pressure

## **Failsafe**

- Power and Air required to maintain operations.
- Valves fail to predefined positions on loss of power or air
- System response predefined for transmitter failure

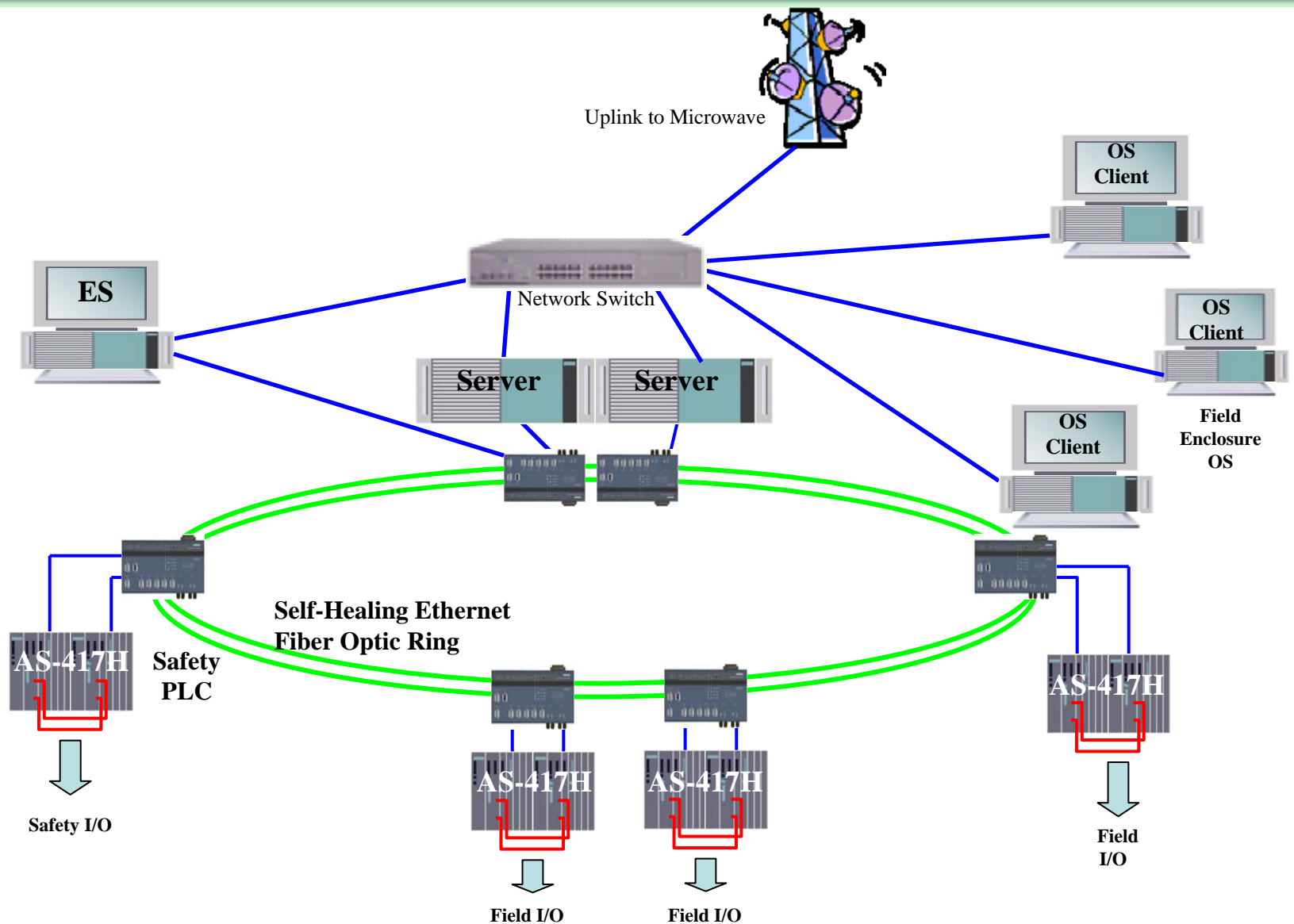




# Safety System Architecture

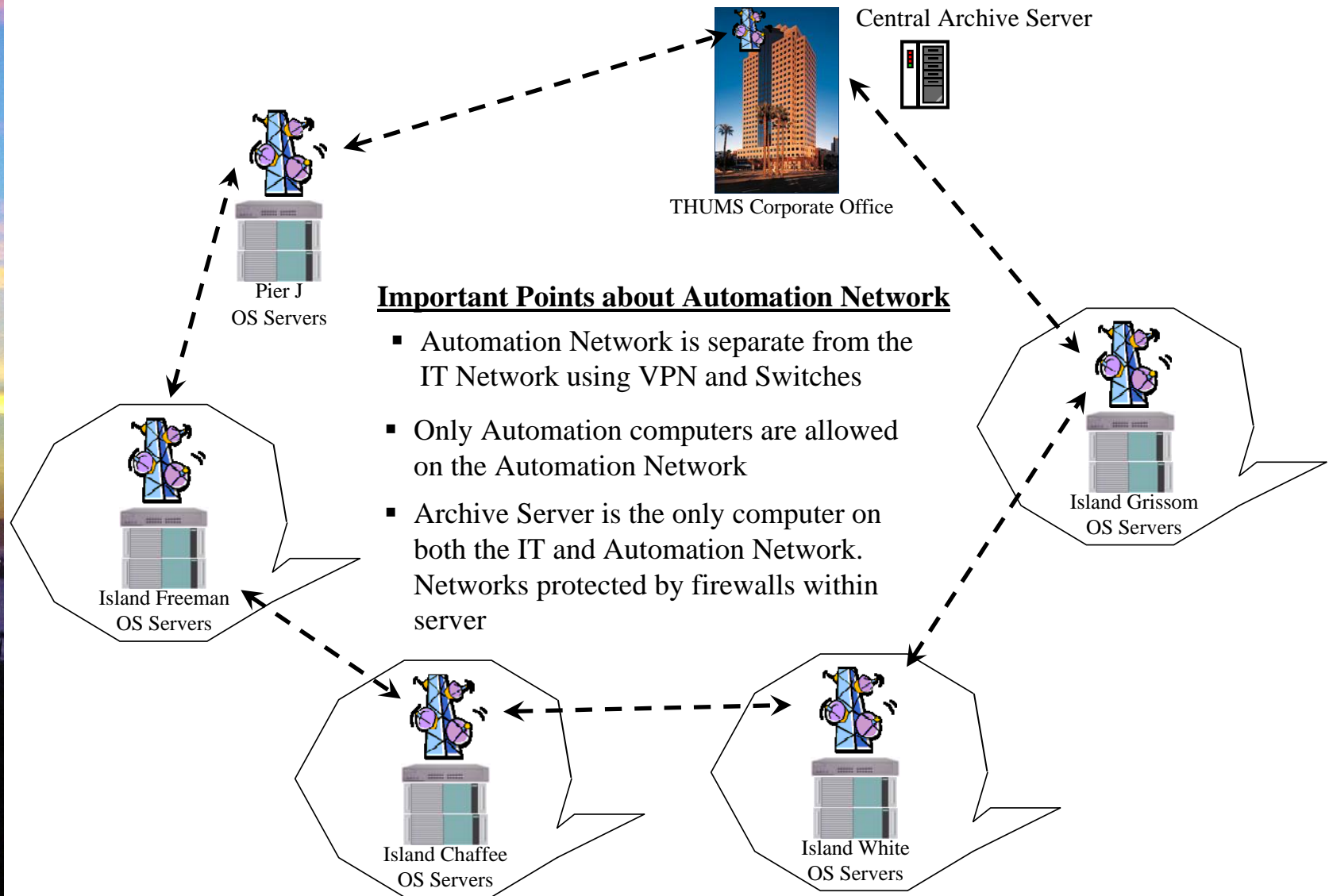
- Redundant Safety PLC for each location
- Segregation of Critical and Process Interlocks
- Dedicated Safety system transmitters and valves
- Microwave Ring to communicate with other locations
- Separate IT network for Automation system
- Hand shaking communication between Safety PLCs on each location
- Uninterruptible Power Supply for Safety PLC
- Safety PLC in secured location, limited access
- Operator Paging System for Alarms

# Island Control System Architecture





---



# Safety PLC and Server Racks





# Operator Control Station (HMI)



# Operator Shut-in System Graphic

14/07/08 15:45:35.126 10 DB15\_TK005\_LAH023\_ALM Oil Wash Tank TK-005 Level High High Alarm C X 7/14/2008 4:17:20 PM

A-Facility Overview W A-Produced Oil A A-Shut In W Server: DUSKO DIMOVSKI

A-Grissom Overview A-Produced Water W A-Production Wells PIER J W CHAFFEE A W S

A-Utilities H A-Produced Gas A-Injection Wells GRISSOM A W M FREEMAN A W S

A-Vent Gas A-AWT A WHITE A W S X BROADWAY A W S

### ISLAND SHUT-IN SYSTEM

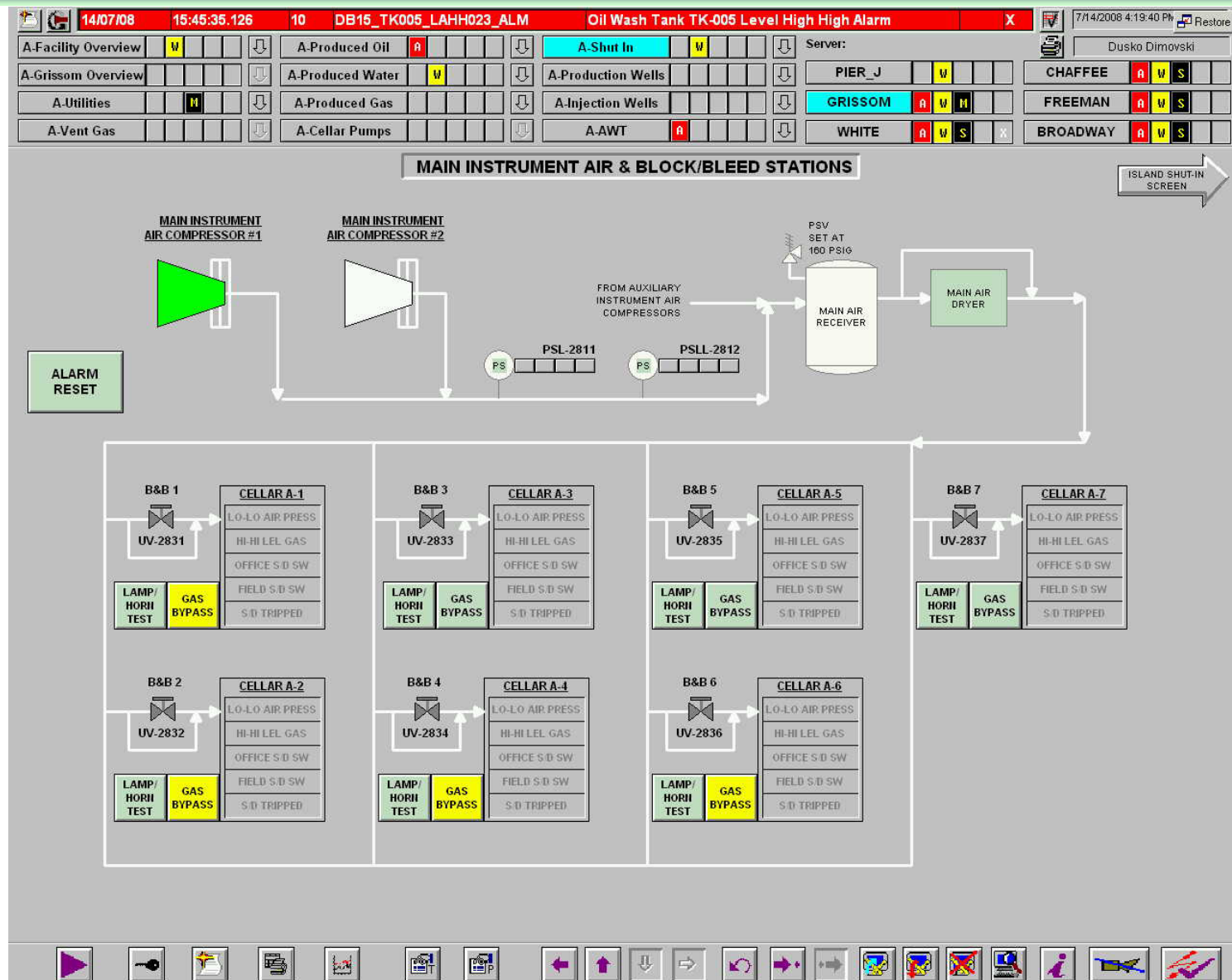
ISLAND SHUT-IN INITIATORS		INSTR. TAG #	ACTUAL READING	UNITS	ALARM SETPOINTS				ALARM STATUS	DEVICE STATUS (Active/Bypassed)
					HIGH-HIGH	HIGH	LOW	LOW-LOW		
MANUAL EMERGENCY SHUTDOWN	Island Production Shutdown Switch in Prod. Office	HS-0100							Normal	
	Subsea Line Shut-In ESD Pushbutton in Prod. Office	HS-0111							Normal	
SHALLOW GAS	SHALLOW GAS EMERGENCY SHUTDOWN	HS-1400							Normal	
SUBSEA PIPELINES	GJ-2 Pipeline Pressure A (Upstream)	PT-0115	41.45	PSI	400.00	60.00	30.00	15.00		ACTIVE GAS
	GJ-2 Pipeline Pressure B (Downstream)	PT-0116	39.02	PSI	400.00	60.00	30.00	15.00		ACTIVE GAS
	GJ-4 Pipeline Pressure	PT-0113	54.98	PSI	400.00	80.00	30.00	15.00		ACTIVE WATER LINE
	GJ-5 Pipeline Pressure	PT-0114	43.44	PSI	100.00	65.00	30.00	15.00		SHALLOW GAS
	GJ-6 Pipeline Pressure A (Upstream)	PT-0111	88.7	PSI	400.00	300.00	60.00	40.00		ACTIVE OIL
	GJ-6 Pipeline Pressure B (Downstream)	PT-0112	89.05	PSI	400.00	300.00	60.00	40.00		ACTIVE OIL
	Nitrogen Air Pressure Switch	PSL-0116								
FWKO #1	High-High Level Shutdown Switch	LSHH-0100								FWKO ACTIVE
	Oil Level	LT-4101	9.11	FT	11.00	10.00	9.00	8.00		
	Pressure	PT-0100	102.64	PSI	185.00	160.00	0.00	0.00		
FWKO #2	High-High Level Shutdown Switch	LSHH-0101								FWKO ACTIVE
	Oil Level	LT-4201	9.38	FT	11.00	10.00	9.00	8.00		
	Pressure	PT-0101	100.62	PSI	185.00	160.00	0.00	0.00		
FWKO #3	High-High Level Shutdown Switch	LSHH-0102								FWKO ACTIVE
	Oil Level	LT-4301	9.29	FT	11.00	10.00	9.00	8.00		
	Pressure	PT-0102	104.81	PSI	185.00	160.00	0.00	0.00		
VENT GAS	High-High Level Shutdown Switch	LSHH-0131								FWKO #3 Pressure
	High Level Switch	LSH-0132								
INST. AIR/BLOCK & BLD	Instr. Air Compressors Low-Low Pressure	PSLL-2812								
I-6 ALARM	I-6 Shutdown Alarm	XS-3116								

SHUTDOWN RESET

Navigation icons: Play, Stop, Previous, Next, Home, End, Search, etc.



# Operator Cellar Isolation Graphic



# Safety System Testing

## **Quarterly DOG Testing**

- Partial Stroke Testing of Subsea line ESD Valves
- Testing of Cellar Gas Detection
- Testing of Shut-in Devices
- Testing of Switches and Buttons

## **Annual DOG Testing**

- Full closure test of Subsea ESD Valves
- Quarterly DOG Tests



# Questions



John\_A\_Hogenson@oxy.com  
Automation Team Leader

Dusko\_Dimovski@oxy.com  
Automation Engineer