



# 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

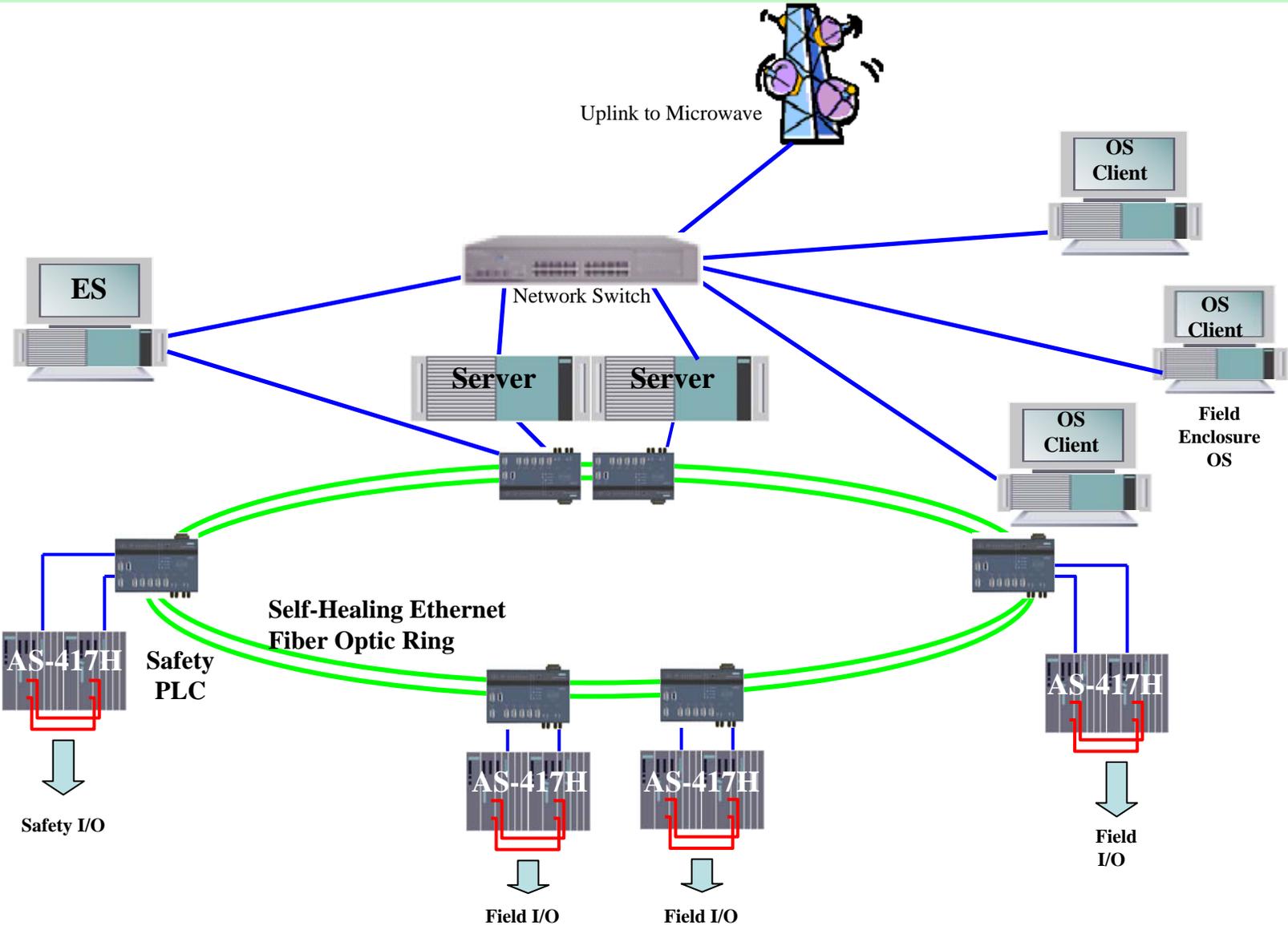
- Power and Air required to maintain operations.
- Valves fail to predefined positions on loss of power or air
- System response predefined for transmitter failure



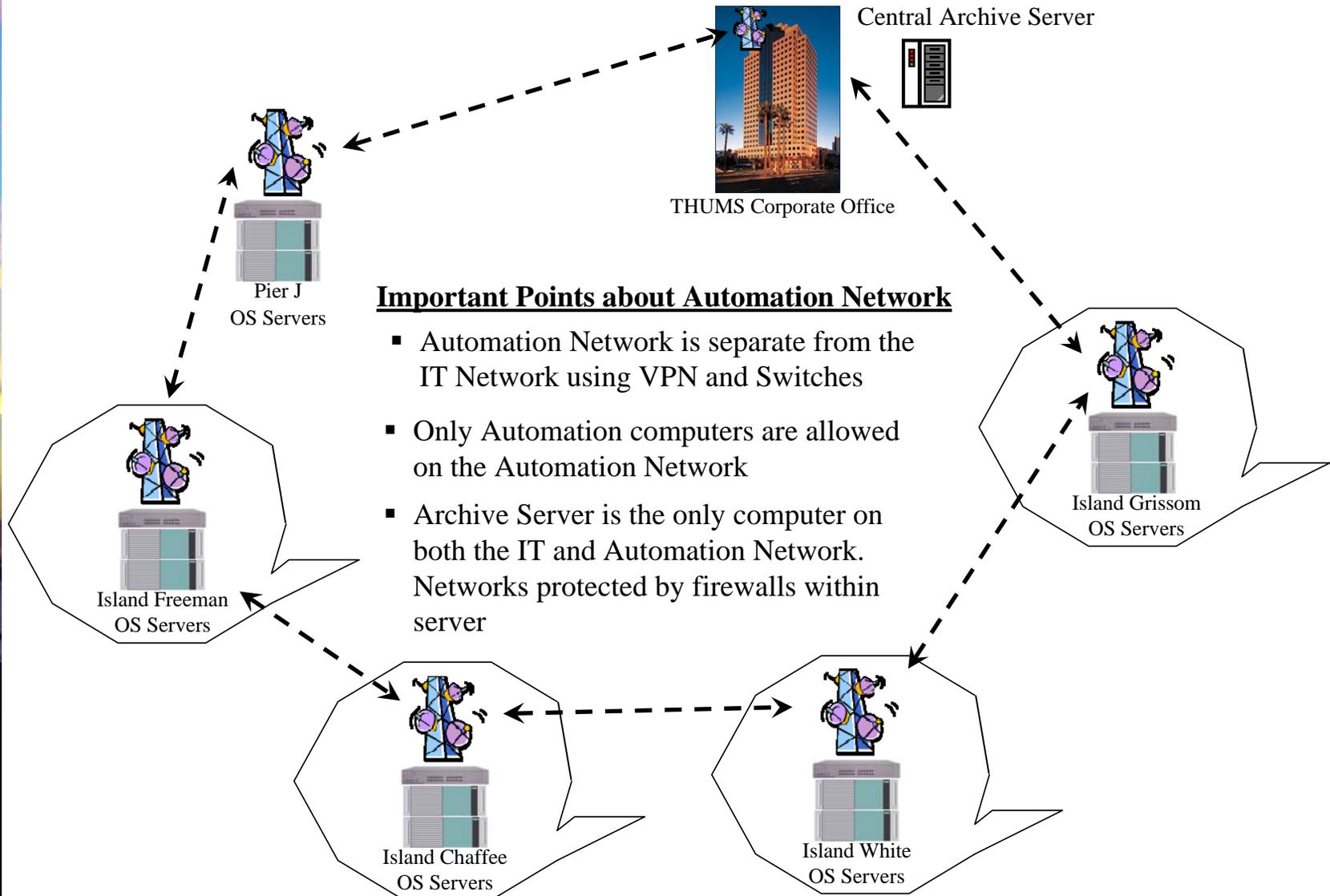
# Safety System Architecture

- 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



# Automation Network



## Important Points about Automation Network

- Automation Network is separate from the IT Network using VPN and Switches
- Only Automation computers are allowed on the Automation Network
- Archive Server is the only computer on both the IT and Automation Network. Networks protected by firewalls within server

# Safety PLC and Server Racks



# Operator Control Station (HMI)



# Operator Shut-in System Graphic

14/07/08 15:45:35.126 10 DB15\_TK005\_LAHH023\_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			
A-Grissom Overview					A-Produced Water	W				A-Production Wells				
A-Utilities		H			A-Produced Gas					A-Injection Wells				
A-Vent Gas					A-Cellar Pumps					A-AWT	A			

Server: PIER\_J W

GRISSOM A W M

WHITE A W S X

CHAFFEE A W S

FREEMAN A W S

BROADWAY A W S

Dusko Dimovski

**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		
<b>MANUAL EMERGENCY SHUTDOWN</b>	Island Production Shutdown Switch in Prod. Office	HS-0100							Normal	
	Subsea Line Shut-In ESD Pushbutton in Prod. Office	HS-0111							Normal	
<b>SHALLOW GAS</b>	<b>SHALLOW GAS EMERGENCY SHUTDOWN</b>	HS-1400							Normal	
<b>SUBSEA PIPELINES</b>	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								
<b>FWKO #1</b>	High-High Level Shutdown Switch	LSHH-0100								
	Oil Level	LT-4101	9.11	FT	11.00	10.00	9.00	8.00		FWKO ACTIVE
	Pressure	PT-0100	102.64	PSI	185.00	160.00	0.00	0.00		
<b>FWKO #2</b>	High-High Level Shutdown Switch	LSHH-0101								
	Oil Level	LT-4201	9.38	FT	11.00	10.00	9.00	8.00		FWKO ACTIVE
	Pressure	PT-0101	100.62	PSI	185.00	160.00	0.00	0.00		
<b>FWKO #3</b>	High-High Level Shutdown Switch	LSHH-0102								
	Oil Level	LT-4301	9.29	FT	11.00	10.00	9.00	8.00		FWKO ACTIVE
	Pressure	PT-0102	104.81	PSI	185.00	160.00	0.00	0.00		
<b>VENT GAS</b>	High-High Level Shutdown Switch	LSHH-0131								FWKO #3 Pressure
	High Level Switch	LSH-0132								
<b>INST. AIR/BLOCK &amp; BLD</b>	Instr. Air Compressors Low-Low Pressure	PSLL-2812								
<b>I-6 ALARM</b>	I-6 Shutdown Alarm	XS-3116								

SHUTDOWN RESET

# Operator Cellar Isolation Graphic

14/07/08 15:45:35.126 10 DB15\_TK005\_LAH023\_ALM Oil Wash Tank TK-005 Level High High Alarm X 7/14/2008 4:19:40 PM Restore

A-Facility Overview	A-Produced Oil	A-Shut In	Server:	PIER_J	CHAFFEE
A-Grissom Overview	A-Produced Water	A-Production Wells	GRISSOM	FREEMAN	BROADWAY
A-Utilities	A-Produced Gas	A-Injection Wells	WHITE		
A-Vent Gas	A-Cellar Pumps	A-AWT			

**MAIN INSTRUMENT AIR & BLOCK/BLEED STATIONS**

ISLAND SHUT-IN SCREEN

ALARM RESET

MAIN INSTRUMENT AIR COMPRESSOR #1

MAIN INSTRUMENT AIR COMPRESSOR #2

FROM AUXILIARY INSTRUMENT AIR COMPRESSORS

PSV SET AT 100 PSIG

MAIN AIR RECEIVER

MAIN AIR DRYER

PSL-2811

PSL-2812

B&B 1 CELLAR A-1

B&B 2 CELLAR A-2

B&B 3 CELLAR A-3

B&B 4 CELLAR A-4

B&B 5 CELLAR A-5

B&B 6 CELLAR A-6

B&B 7 CELLAR A-7

UV-2831

UV-2832

UV-2833

UV-2834

UV-2835

UV-2836

UV-2837

LAMP/HORRI TEST

GAS BYPASS

LO-LO AIR PRESS

HI-HI LEL GAS

OFFICE S/D SW

FIELD S/D SW

S/D TRIPPED

# 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



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