



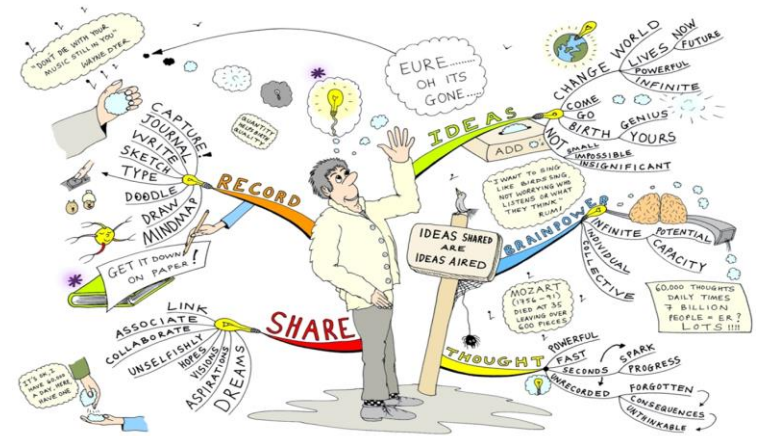
# Remote Monitoring & Diagnostics System for an LNG Loading Arm with the PI System Infrastructure

Presented by **Walter Flores**  
**Instrument Maintenance Supervisor**  
**Hunt LNG**



# Agenda

- About Hunt LNG & Peru LNG
- LNG Loading Facility/Arm Overview
- Business Challenge
- Solution
- Results and Benefits
- Summary



# Peru LNG Overview

- 1<sup>st</sup> LNG plant in South America
- Commissioned in June, 2010
- 4.4 MTPA Capacity
- Gas is supplied from [Repsol YPF](#) and [Petrobras](#) developed fields near the [Camisea fields](#) via a 34-inch (860 mm) supply pipeline runs 408 kilometres
- The LNG plant is operated by Peru LNG which is a consortium of [Hunt Oil Company](#) (50%), [SK Energy](#) (20%), Shell (20%), and [Marubeni](#) (10%)



# LNG Loading Arm – A Complex & Critical Asset



	Type	Common	On Each Arm	Total on 4 Arms	TOTAL	
	IS NAMUR	2	23	92	94	
	Control Units on CP	37	3	12	49	
	Control lights on CP	20	9	36	56	
PLC station I/Os	Normal	Digital Inputs (+24Vdc)	44	18	72	116
		Digital Outputs (+24Vdc / 0,5 A)	36	10	40	76
		Digital Outputs (+24Vdc / 2 A)	0	0	0	0
		Digital Outputs (Relays)	5	25	100	105
		Analog Inputs	7	2	8	15
		Analog Outputs	4	0	0	4
PLC station I/Os	Safety	Digital Inputs (+24Vdc)	7	8	32	39
		Digital Outputs (+24Vdc / 2 A)	4	3	12	16
		Analog Inputs	0	0	0	0
		Analog Outputs	0	0	0	0
TOTAL		166	101	404	<b>570</b>	

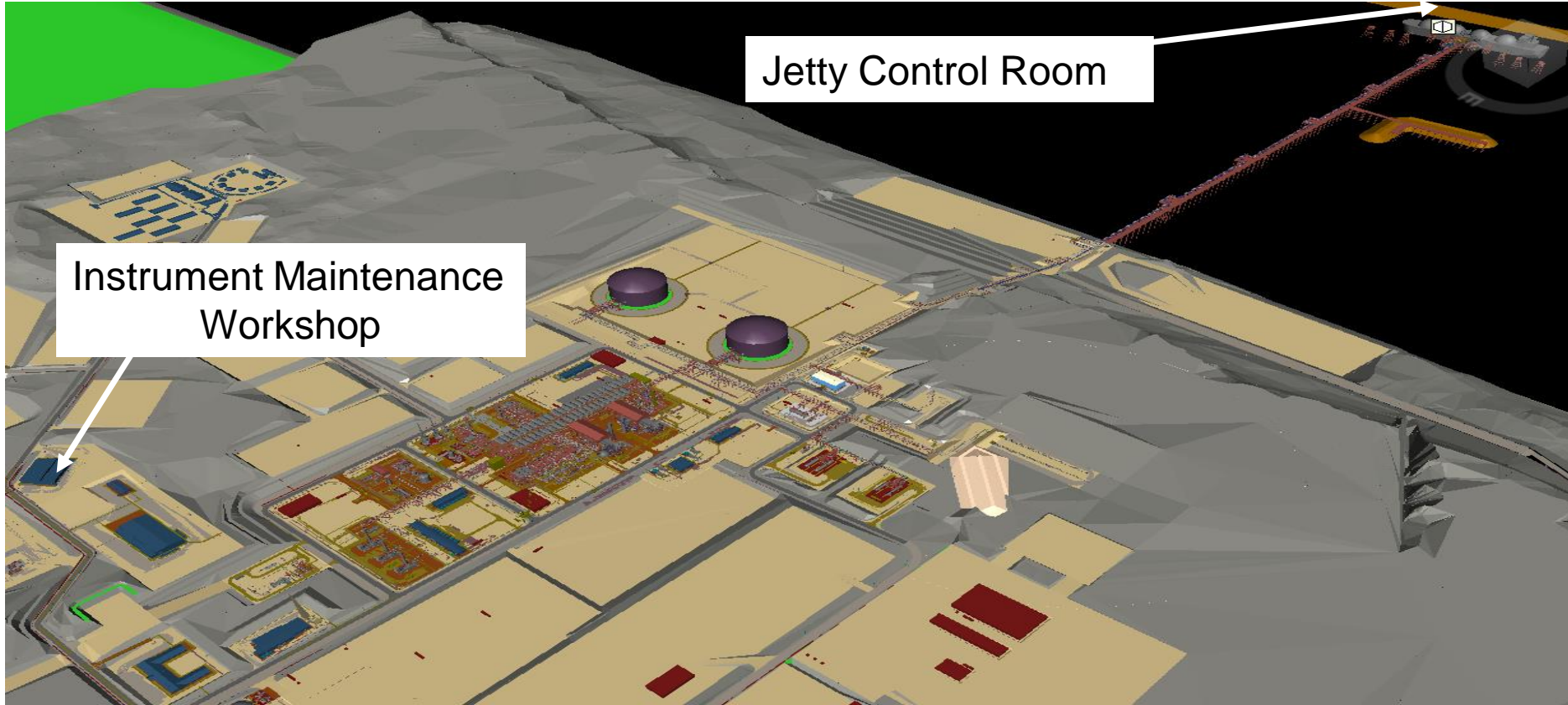
# Business Challenge – Time is



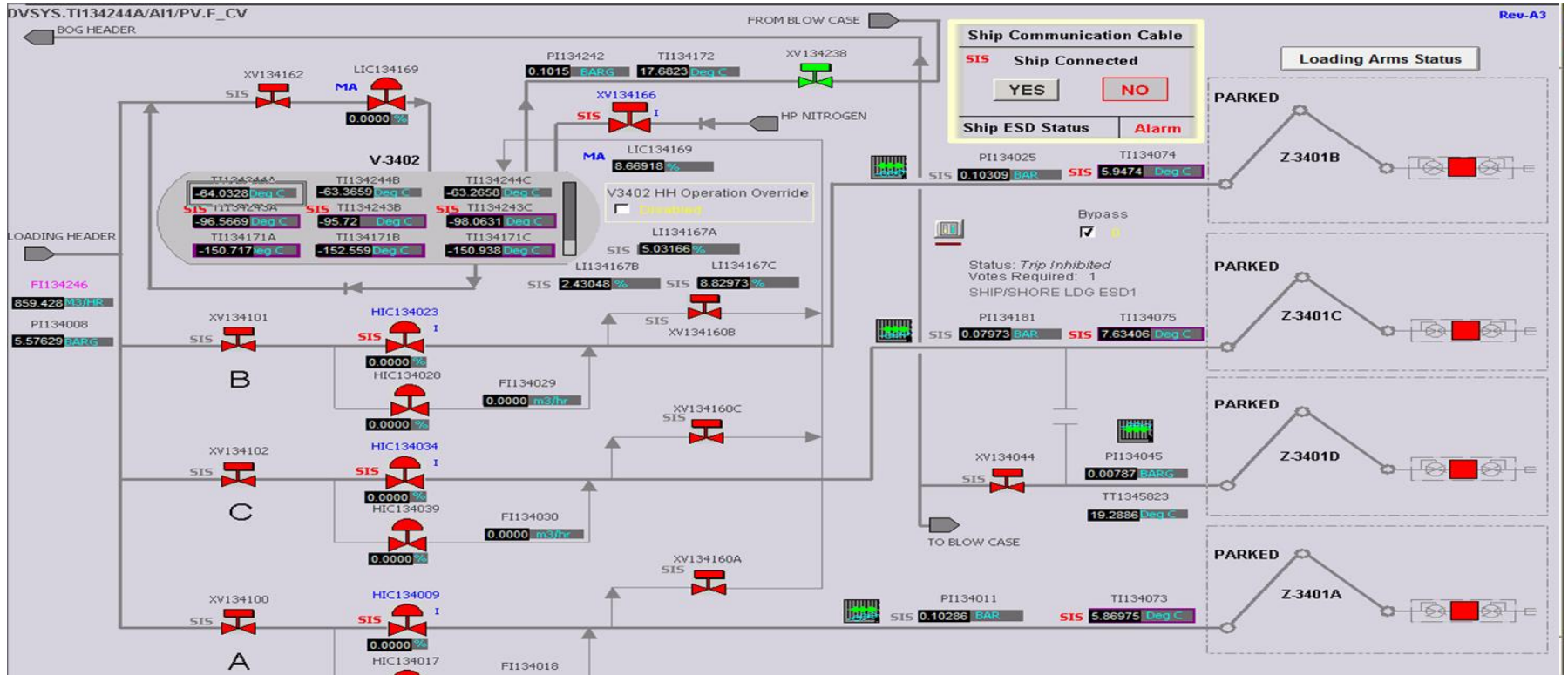
- Loading Arm issue resolution delayed due to:
  - No Limit switch status in any HMI
  - Limited field data in the HMI including limit switches
  - Distance between loading arm and instrument maintenance shop
  - Different descriptors in DCS and PLC/HMI for same failures
  - Very difficult to troubleshoot and resolve issues in a timely manner

Inability to quickly resolve loading arm issues resulted in over 700 hrs downtime/yr (~2%) resulting in increased demerge cost and lost capacity equating to over \$1M/yr

# Illustration of Challenge



# Loading Arm HMI - Limited Information



# Many descriptions, one Failure

DESCRIPTION IN HMI FROM FMC

Low Pressure in HPU ACCU on Berth1

DESCRIPTION IN DCS

Low Oil Press in HPU ACCU

DESCRIPTION IN TRAINING MANUAL

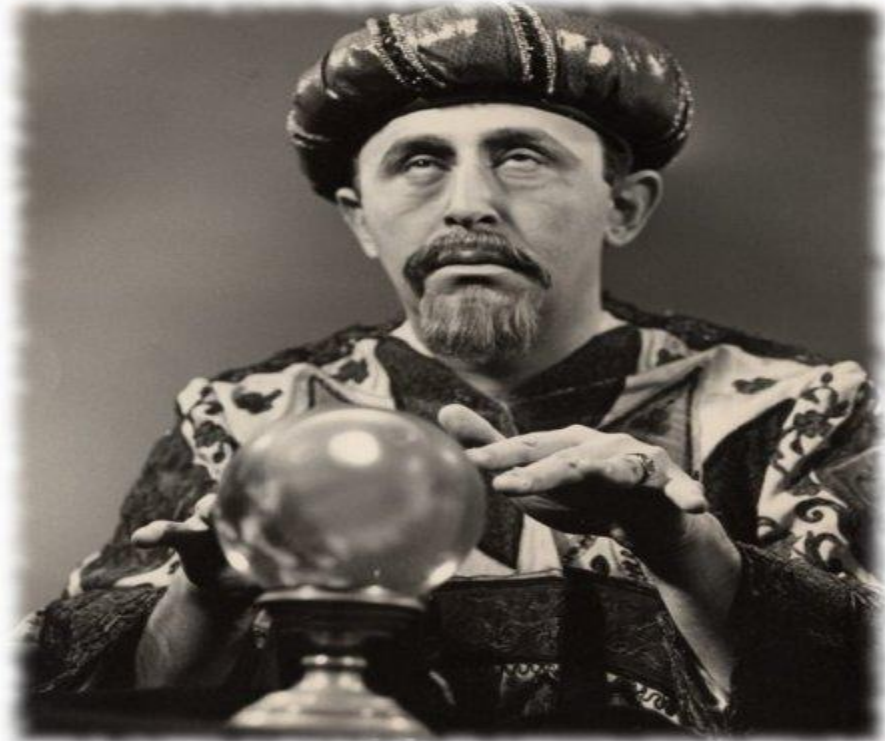
Low oil pressure in HPU Accumulator

DESCRIPTION CONTROL LOGIC DIADRAM

Oil Low pressure



# We had to be fortune tellers to see what the instrument alarm refers to.....



# And now what to do?

Low Pressure in HPU ACCU on Berth1

Low Oil Press in HPU ACCU



Oil Low pressure

Low oil pressure in HPU Accumulator

# Solution – Leverage the PI System to:

Identify Tag number

Identify place in plant

Find information quickly

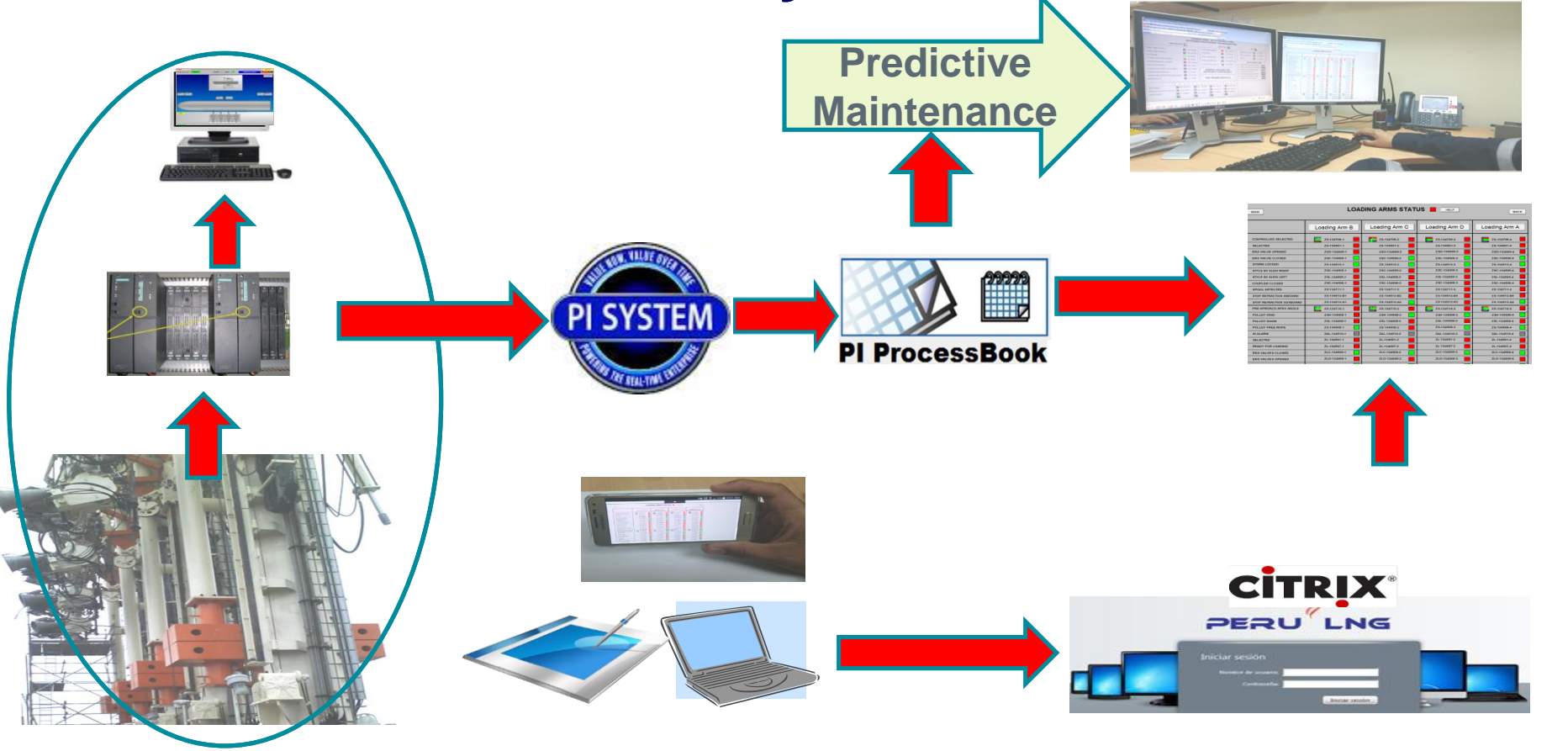
Colabórate with stakeholders



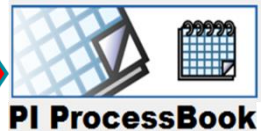
Identify location in plant from any part of the network

Solve the problem in less time

# Solution Overview- PI System to the Rescue!



Predictive Maintenance



LOADING ARMS STATUS				
	Loading Arm B	Loading Arm C	Loading Arm D	Loading Arm A
CONTROL ROOM STATUS	PLC STATUS	PLC STATUS	PLC STATUS	PLC STATUS
ARM VALVE STATUS	ARM VALVE	ARM VALVE	ARM VALVE	ARM VALVE
ARM MOTOR STATUS	ARM MOTOR	ARM MOTOR	ARM MOTOR	ARM MOTOR
ARM DRIVE STATUS	ARM DRIVE	ARM DRIVE	ARM DRIVE	ARM DRIVE
ARM POSITION STATUS	ARM POSITION	ARM POSITION	ARM POSITION	ARM POSITION
ARM SPEED STATUS	ARM SPEED	ARM SPEED	ARM SPEED	ARM SPEED
ARM TORQUE STATUS	ARM TORQUE	ARM TORQUE	ARM TORQUE	ARM TORQUE
ARM CURRENT STATUS	ARM CURRENT	ARM CURRENT	ARM CURRENT	ARM CURRENT
ARM VOLTAGE STATUS	ARM VOLTAGE	ARM VOLTAGE	ARM VOLTAGE	ARM VOLTAGE
ARM TEMPERATURE STATUS	ARM TEMPERATURE	ARM TEMPERATURE	ARM TEMPERATURE	ARM TEMPERATURE
ARM PRESSURE STATUS	ARM PRESSURE	ARM PRESSURE	ARM PRESSURE	ARM PRESSURE
ARM FLOW STATUS	ARM FLOW	ARM FLOW	ARM FLOW	ARM FLOW
ARM LEVEL STATUS	ARM LEVEL	ARM LEVEL	ARM LEVEL	ARM LEVEL
ARM WEIGHT STATUS	ARM WEIGHT	ARM WEIGHT	ARM WEIGHT	ARM WEIGHT
ARM FORCE STATUS	ARM FORCE	ARM FORCE	ARM FORCE	ARM FORCE
ARM POWER STATUS	ARM POWER	ARM POWER	ARM POWER	ARM POWER
ARM ENERGY STATUS	ARM ENERGY	ARM ENERGY	ARM ENERGY	ARM ENERGY
ARM EFFICIENCY STATUS	ARM EFFICIENCY	ARM EFFICIENCY	ARM EFFICIENCY	ARM EFFICIENCY
ARM SAFETY STATUS	ARM SAFETY	ARM SAFETY	ARM SAFETY	ARM SAFETY
ARM INTERLOCK STATUS	ARM INTERLOCK	ARM INTERLOCK	ARM INTERLOCK	ARM INTERLOCK
ARM ALARM STATUS	ARM ALARM	ARM ALARM	ARM ALARM	ARM ALARM
ARM DIAGNOSTIC STATUS	ARM DIAGNOSTIC	ARM DIAGNOSTIC	ARM DIAGNOSTIC	ARM DIAGNOSTIC
ARM MAINTENANCE STATUS	ARM MAINTENANCE	ARM MAINTENANCE	ARM MAINTENANCE	ARM MAINTENANCE



# Loading Arms Monitoring Screen

**LOADING ARMS - JETTY CONTROL PANEL**

**DESCRIPTION FROM FMC PANEL**

Pump 1 fault on berth 1	<input type="checkbox"/>	XA-134530A
Pump 2 fault on berth 1	<input type="checkbox"/>	XA-134530B
PLC running	<input checked="" type="checkbox"/>	XL-134596
Proximity switch fault on berth 1	<input type="checkbox"/>	XL-134588
Oil high temperature on berth 1	<input type="checkbox"/>	TAH-134590
Oil low level on berth 1	<input type="checkbox"/>	LAL-134583
Low pressure in HPU accu on berth 1	<input type="checkbox"/>	PAL-134581
Radio/Pendant Control on	<input checked="" type="checkbox"/>	XL-134587
Circuit Healthy & Anti-condensation heater	<input type="checkbox"/>	TA-134596
Maintenance on	<input type="checkbox"/>	XL-134586

**SHOW TREND FOR ANALYSIS**

Low pressure targeting	<input checked="" type="checkbox"/>	PAL-134780
Cable failure	<input type="checkbox"/>	PAL-134704
Pump 1 targeting fault	<input type="checkbox"/>	XA-134531A
Pump 2 targeting fault	<input type="checkbox"/>	XA-134531B
Exchanger Running/Fault	<input type="checkbox"/>	XA-134500

**GENERAL INFORMATION**  
**INSTRUMENT MAINTENANCE**

**FMC TRAINING MANUALS**

**SHOW ALARM**

	ARM Z-3401B	ARM Z-3401C	ARM Z-3401A
Arm in Alarm	<input type="checkbox"/> ZAL-134510-1	<input type="checkbox"/> ZAL-134510-2	<input type="checkbox"/> ZAL-134510-3
Abnormal pressure in Perc line	<input type="checkbox"/> PAH-134507-1	<input type="checkbox"/> PAH-134507-2	<input type="checkbox"/> PAH-134507-3
Product in Arm	<input type="checkbox"/> TL-134582-1	<input type="checkbox"/> TL-134582-2	<input type="checkbox"/> TL-134582-3

**DESCRIPTION FROM FMC panel**

**Show Trend for Analysis**

**Tag from description**

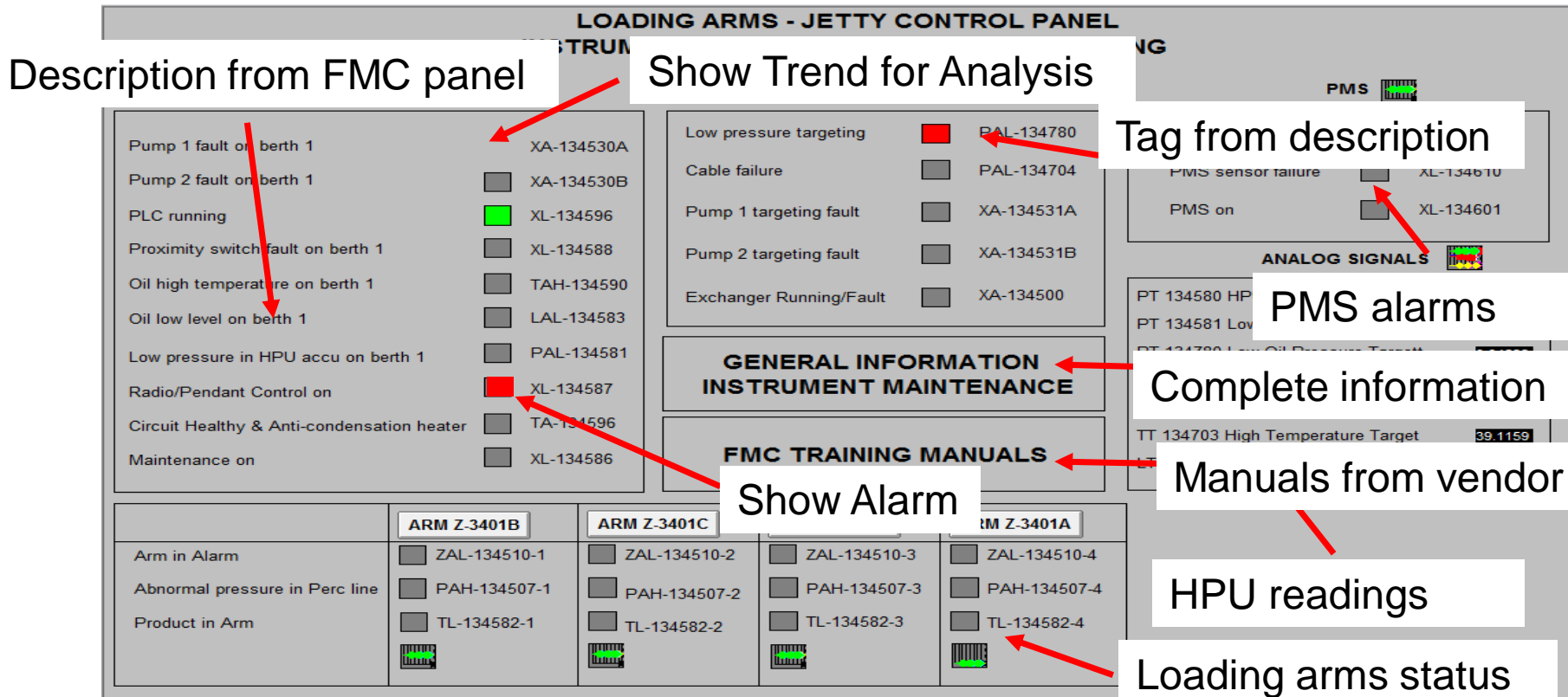
**PMS alarms**

**Complete information**

**Manuals from vendor**

**HPU readings**

**Loading arms status**



# Window Application per tag

**LOADING ARMS - JETTY CONTROL PANEL**  
**INSTRUMENT MAINTENANCE TROUBLESHOOTING**  
FMC Instrument Maintenance HUNT LNG

**ARMS MOTION**

Pump 1 fault on berth 1

Pump 2 fault on berth 1

PL **Available pictures**

Proximity switch fault on berth 1

Oil high temperature on berth 1

Oil low level on berth 1

Low pressure in HPU accu on berth 1

Radio/Bandant Control on berth 1

**Available information**

**ARM Z-3401B**

Arm in Alarm  ZAL-134510

Abnormal pressure in Perc line  PAH-134507

Product in Arm  TL-134582-

**XL134596**

PICTURES

Nro PICTURE

MANUAL

PI&D

LOOP DIAGRAM

LOGIC

DIAGNOSTIC

OK

# Using Pictures to Help Identification

**LOADING ARMS - JETTY CONTROL PANEL**

FMC Instrument Maintenance HUNT LNG

**ARMS MOTION**

Pump 1 fault on berth 1

Pump 2 fault on berth 1

PLC running

Proximity switch fault on berth 1

Oil high temperature on berth 1

Oil low level on berth 1

Low pressure in HPU accu on berth 1

Radio/Pendant Control on

Circuit Healthy & Anti-condensation heater

Maintenance on

**ARM Z-3401B**

Arm in Alarm  ZAL-134510-

Abnormal pressure in Perc line  PAH-134507

Product in Arm  TL-134582-

**PAL134581**

PICTURES

Nro PICTURE

MANUAL

PI&D

LOOP DIAGRAM

LOGIC













































































HYDRAULIC

OK

**Identification picture**

PT-134581

# Limit switches overview for Loading Arms

MAIN		LOADING ARMS STATUS				HELP	
		Loading Arm B	Loading Arm C	Loading Arm D	Loading Arm A		
		 ZS-134706-1 	 ZS-134706-2 	 ZS-134706-3 	 ZS-134706-4 		
SELECTED		ZS-134501-1 	ZS-134501-2 	ZS-134501-3 	ZS-134501-4 		
ERS VALVE OPENED		ZSO-134509-1 	ZSO-134509-2 	ZSO-134509-3 	ZSO-134509-4 		
ERS VALVE CLOSED		ZSC-134509-1 	ZSC-134509-2 	ZSC-134509-3 	ZSC-134509-4 		
STORM LOCKED		ZS-134513-1 	ZS-134513-2 	ZS-134513-3 	ZS-134513-4 		
STYLE 80 SLEW RIGHT		ZSC-134505-1 	ZSC-134505-2 	ZSC-134505-3 	ZSC-134505-4 		
STYLE 80 SLEW LEFT		ZSL-134505-1 	ZSL-134505-2 	ZSL-134505-3 	ZSL-134505-4 		
COUPLER CLOSED		ZSC-134506-1 	ZSC-134506-2 	ZSC-134506-3 	ZSC-134506-4 		
SPOOL DETECTED		ZS-134711-1 	ZS-134711-2 	ZS-134711-3 	ZS-134711-4 		
STOP RETRACTION INBOARD		ZS-134512-B1 	ZS-134512-B2 	ZS-134512-B3 	ZS-134512-B4 		
STOP RETRACTION OUTBOARD		ZS-134512-A1 	ZS-134512-A2 	ZS-134512-A3 	ZS-134512-A4 		
PRE-APPROACH APEX ANGLE		 ZS-134710-1 	 ZS-134710-2 	 ZS-134710-3 	 ZS-134710-4 		
PULLEY HIGH		ZSH-134508-1 	ZSH-134508-2 	ZSH-134508-3 	ZSH-134508-4 		
PULLEY DOWN		ZSL-134508-1 	ZSL-134508-2 	ZSL-134508-3 	ZSL-134508-4 		
PULLEY FREE ROPE		ZS-134508-1 	ZS-134508-2 	ZS-134508-3 	ZS-134508-4 		
IN ALARM		ZAL-134510-1 	ZAL-134510-2 	ZAL-134510-3 	ZAL-134510-4 		
SELECTED		ZL-134501-1 	ZL-134501-2 	ZL-134501-3 	ZL-134501-4 		

Limit switches name

Limit switches tag and status

Trend of limit switches

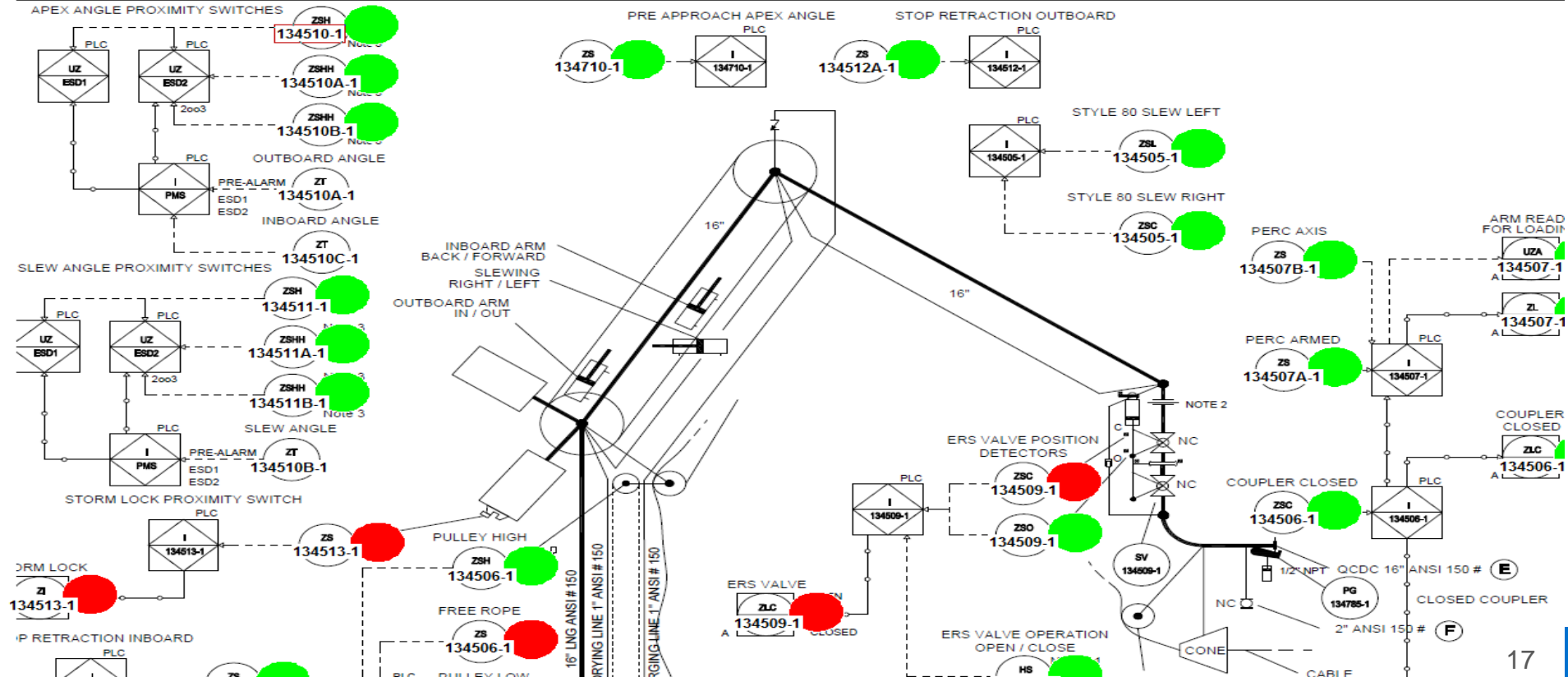


# Limit switches locations overview

BACK

ZSH1345101

LNG LOADING ARM Z-3401B



# Window application per limit switch

BACK ZSH1345101 LNG LOADING ARM Z-3401B

FMC Instrument Maintenance HUNT LNG

ZSH1345101

PICTURES

Nro PICTURE 1

MANUAL

LOOP DIAGRAM

LOGIC

ELECTRICAL SCH

TBD

OK

APEX ANGLE PROXIMITY SWITCHES

UZ ESD1 PLC

UZ ESD2 PLC

ZSH 134510-1

ZSHH 134510A-1

ZSHH 134510B-1

OUTBOARD ANGLE

PMS I PRE-ALARM ESD1 ESD2

ZT 134510A-1

INBOARD ANGLE

ZT 134510C-1

SLEW ANGLE PROXIMITY SWITCHES

UZ ESD1 PLC

UZ ESD2 PLC

ZSH 134511-1

ZSHH 134511A-1

ZSHH 134511B-1

SLEW ANGLE

PMS I PRE-ALARM ESD1 ESD2

ZT 134510B-1

STORM LOCK PROXIMITY SWITCH

PLC

ZS 134513-1

ARM LOCK

ZI 134513-1

IP RETRACTION INBOARD

PLC

134506-1

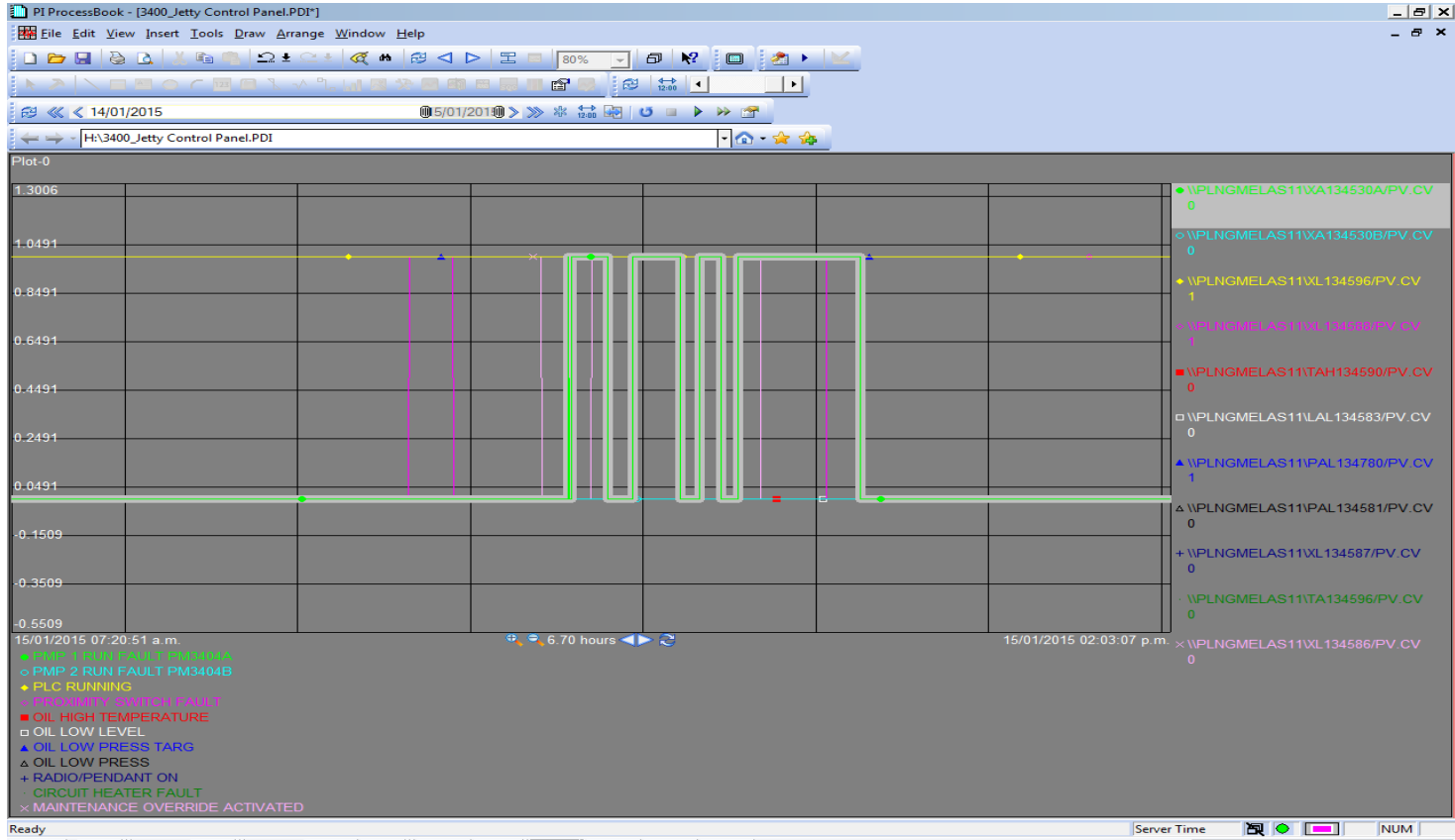
OPEN / CLOSE

HS

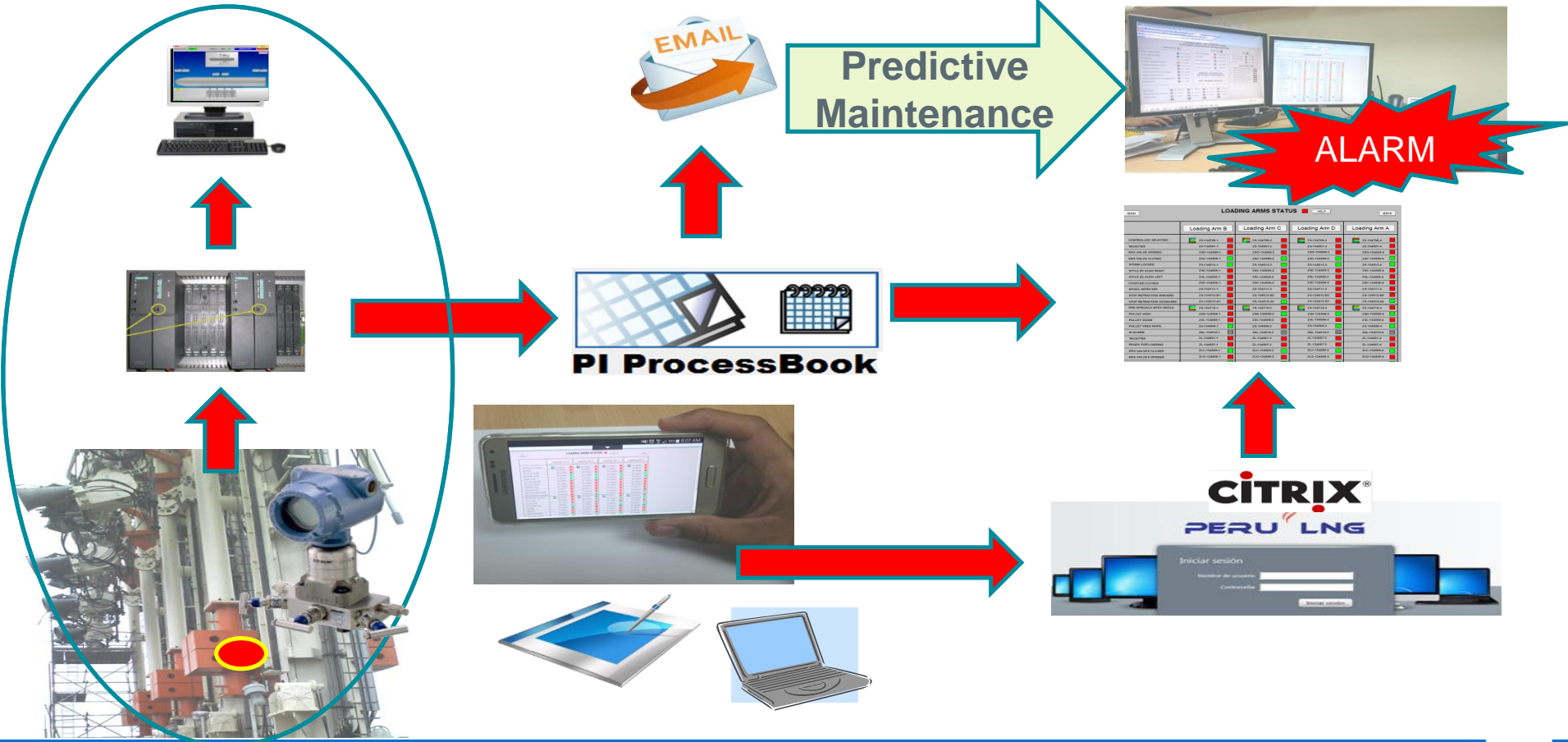
CONE

CABLE

# Limit Switches Trends



# Send Notification if there are some Failures

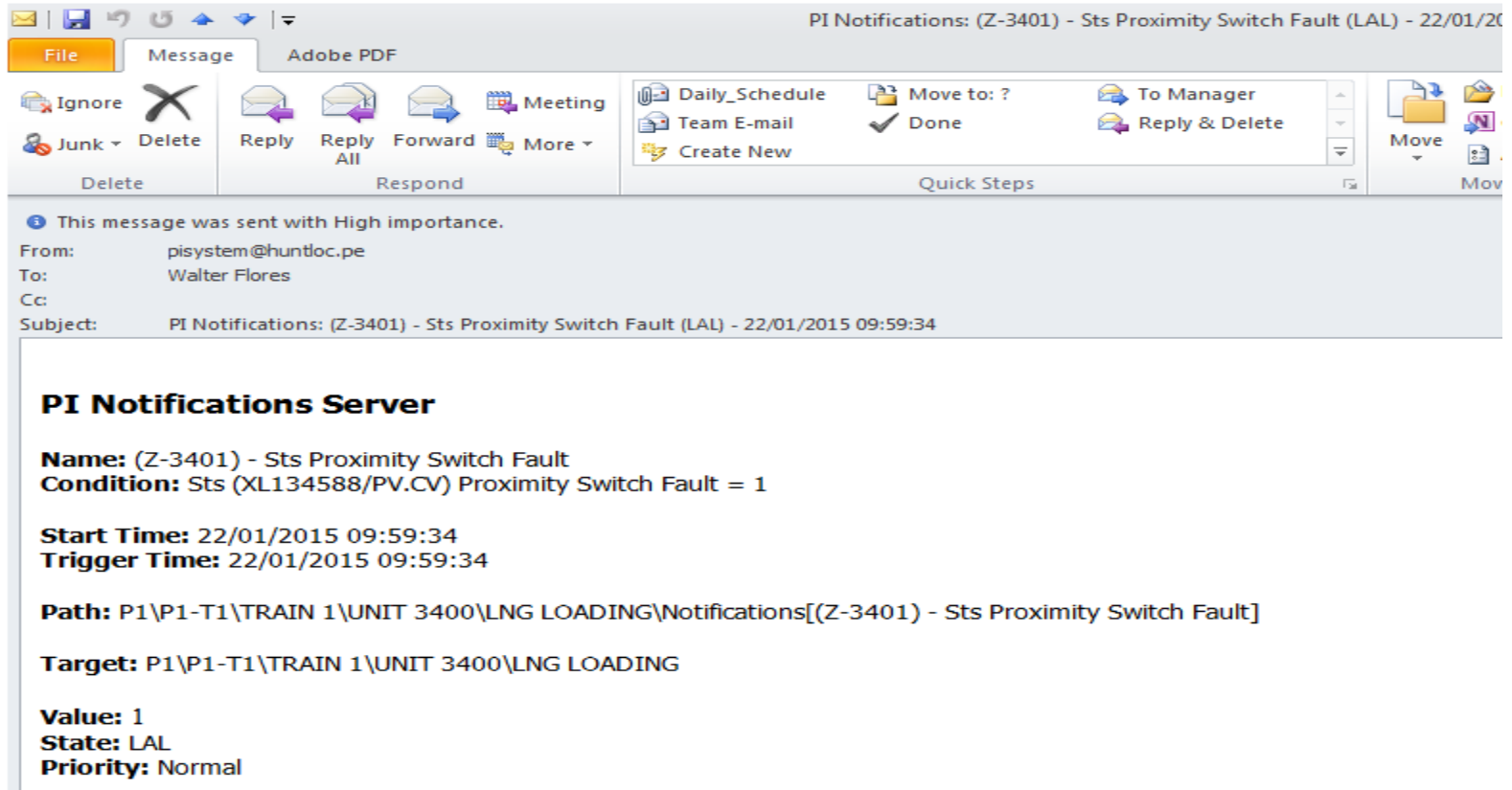


**ALARM**

LOADING ARMS STATUS			
Loading Arm B	Loading Arm C	Loading Arm D	Loading Arm A
COMPRESSOR ASSOCIATED	OK	OK	OK
ARM POSITION	OK	OK	OK
ARM SPEED	OK	OK	OK
ARM PRESSURE	OK	OK	OK
ARM TEMPERATURE	OK	OK	OK
ARM VIBRATION	OK	OK	OK
ARM OIL LEVEL	OK	OK	OK
ARM OIL PRESSURE	OK	OK	OK
ARM OIL TEMPERATURE	OK	OK	OK
ARM OIL VIBRATION	OK	OK	OK
ARM OIL LEVEL	OK	OK	OK
ARM OIL PRESSURE	OK	OK	OK
ARM OIL TEMPERATURE	OK	OK	OK
ARM OIL VIBRATION	OK	OK	OK
ARM OIL LEVEL	OK	OK	OK
ARM OIL PRESSURE	OK	OK	OK
ARM OIL TEMPERATURE	OK	OK	OK
ARM OIL VIBRATION	OK	OK	OK
ARM OIL LEVEL	OK	OK	OK
ARM OIL PRESSURE	OK	OK	OK
ARM OIL TEMPERATURE	OK	OK	OK
ARM OIL VIBRATION	OK	OK	OK



# Send Notification if there are some Failures



PI Notifications: (Z-3401) - Sts Proximity Switch Fault (LAL) - 22/01/2015

**File** | **Message** | Adobe PDF

Ignore | Delete | Reply | Reply All | Forward | Meeting | More | Daily\_Schedule | Move to: ? | To Manager | Move | Team E-mail | Done | Reply & Delete | Create New | Quick Steps

**This message was sent with High importance.**

**From:** psystem@huntloc.pe  
**To:** Walter Flores  
**Cc:**  
**Subject:** PI Notifications: (Z-3401) - Sts Proximity Switch Fault (LAL) - 22/01/2015 09:59:34

**PI Notifications Server**

**Name:** (Z-3401) - Sts Proximity Switch Fault  
**Condition:** Sts (XL134588/PV.CV) Proximity Switch Fault = 1

**Start Time:** 22/01/2015 09:59:34  
**Trigger Time:** 22/01/2015 09:59:34

**Path:** P1\P1-T1\TRAIN 1\UNIT 3400\LNG LOADING\Notifications[(Z-3401) - Sts Proximity Switch Fault]

**Target:** P1\P1-T1\TRAIN 1\UNIT 3400\LNG LOADING

**Value:** 1  
**State:** LAL  
**Priority:** Normal

# Results and Benefits

- Deduced LNG Carrier demurrage
- Reduced LNG Loading arm downtime by >700 hrs/yr
- Increased LNG loading capacity by >2%
- Improved overall plant utilization
- Annual savings are estimated to be >\$1MM/yr

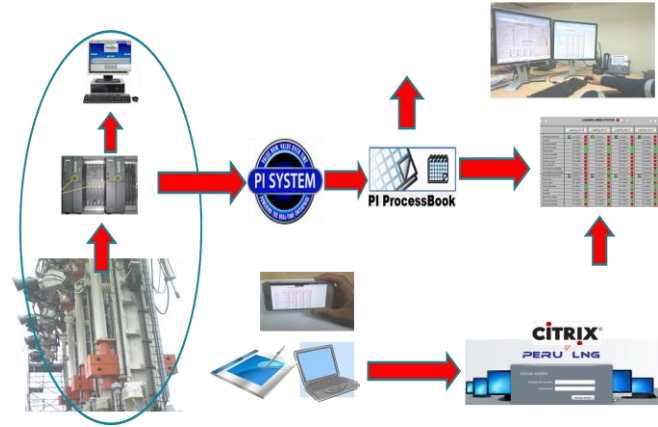


Leveraging the PI System to solve this business challenge is illustrative of the “art of the possible” and value now, value over time

# When Loading LNG, Time is Money

*“Using the PI System to integrate, normalize, analyze, visualize and notify instrument alarms and related information on 4 LNG loading arms reduced downtime, demerage costs, and increased LNG loading capacity by over 2% resulting in annual savings >\$1M/yr”.*

Mr. Walter Florez, Instrument Maintenance Supervisor  
Hunt LNG



## Business Challenge

- Inability to quickly troubleshoot LNG loading arm issues due to lack of data and information in context led to:
  - Increased demurrage
  - Decreased LNG loading & plant capacity

## Solution

- Use the PI System to integrate, normalize, analyze, visualize, and notify enabling a proactive, efficient approach to LNG loading arm issues

## Results and Benefits

- Reduced loading arm downtime by >2% resulting in:
  - Decreased LNG carrier demurrage
  - Increase LNG loading utilization and capacity
  - Annual savings >\$1MM/yr

# Walter Flores

- [wflores@huntloc.pe](mailto:wflores@huntloc.pe)
- Instrument Maintenance Supervisor
- Hunt LNG





Brought to you by  **OSIsoft.**