

<b>From:</b>	Johnson, Brad [/O=CCC/OU=CCC-CLY-BACK END/CN=RECIPIENTS/CN=JOHNSONB]	5/30/2008 3:36 PM
<b>To:</b>	Gaude, Edward C.; Coronado, Richard; Kennedy, Mac M	
<b>Cc:</b>	Cooper, Nathan	
<b>Bcc:</b>		
<b>Subject:</b>	MUX Presentation to Transocean	
<b>Attachments:</b>	image001.gif; MK1-2 vs MK3 053008.ppt	

Gents,

This is the "canned" presentation that I carry around and have given on several occasions..... This will be the basis for our meeting on Wednesday with Transocean unless someone has a better idea. I am totally open to suggestions, changes and additions.

Please, please take a look and comment..... Your input is very much appreciated and important!! Apologize for the size of the file, I love photos, they are worth a thousand words (think I've heard this before somewhere).

Thanks,

**Brad Johnson**

Product Manager, Controls  
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## FILE PRODUCED NATIVELY

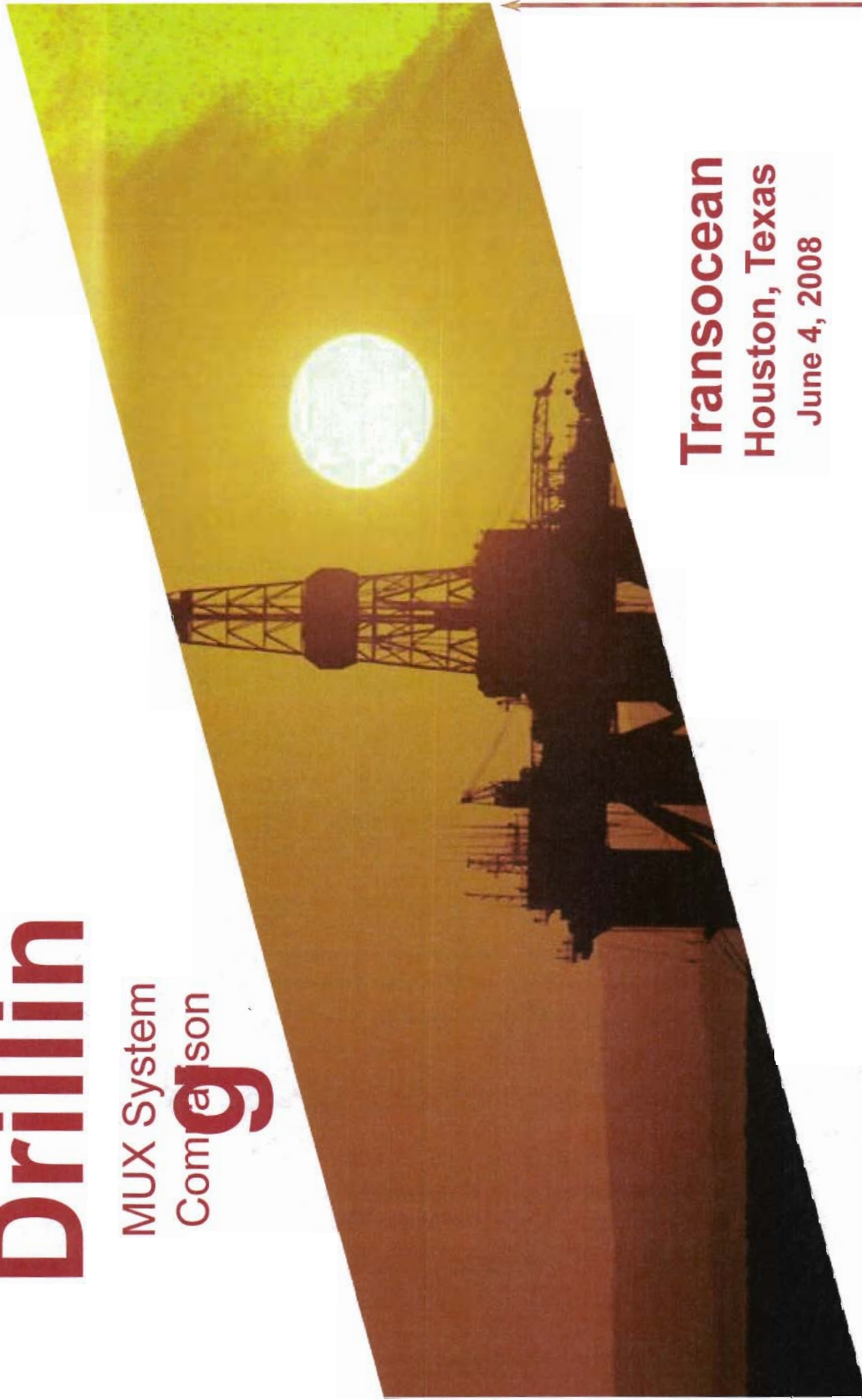
Filename : MK1-2 vs MK3 053008.ppt



DRILLING SYSTEMS

# Drillin

MUX System  
Comparison



**Transocean**  
Houston, Texas  
June 4, 2008

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# Agenda

- History
- Build Cycle
- MUX Comparison



# History of Cameron Controls

**1947**

Hershel Payne starts Payne Manufacturing, responsible for pioneering early Land & Subsea Control Systems

**1969**

Martin Marietta Offshore Systems purchases Payne Mfg, MMOS's focus was Acoustic Communications and Nuclear Power Generation

**1971**

Cameron Iron Works purchases Martin Marietta Offshore Systems and retains the Offshore Systems and Payne Trademarks (Old West Belt Facility)

**1976**

Manufacturing of Controls begins in Celle Germany to support Europe and the Eastern Hemisphere markets

**1983**

Closure of the West Belt facility and a refocus of Controls due to a down market

**1984**

Controls continues in various modes based on market conditions in Houston, Celle and eventually Woodchester England

**1997**

Cameron Controls Division is formed and ground is broken for full scale plants in Houston and Celle Germany. CAMTROL and the next generation MUX Drilling Controls are introduced

# History of Cameron Controls

**To date Cameron has.....**

- ✓ Over 50 years experience in Control Systems
- ✓ Over 40% of the overall market
- ✓ 100+ Subsea Drilling Systems installed worldwide
- ✓ 280+ Camtrol Production SCM's installed worldwide



# Types of Control Systems we Design and Manufacture

- Land, Platform and Jack-up BOP Controls
- Subsea BOP Controls
- Land and Platform Production Controls
- Subsea Production Controls
- Subsea Installation & Workover Controls
- Choke Controls

# Installed Base 1996 to 2004

Transocean	Leader	1997	Schahin	Lancer	1997
Sedco Forex	Discoverer Enterprise	1999	Saipem	Scarabeo 5	1997
	Sedco Express	1997	Ocean Rig	Leiv Eiriksson	1998
	Sedco Energy	1997		Eirik Raude	1998
	Cajun Express	1998	Pride	Pride Africa	1997
	Sovereign Explorer	1997		Pride Angola	1998
R&B Falcon	Peregrine III	1997		Pride Africa II	1997
	Deepwater Navigator (PVII)	1997	Marine Drilling	Marine 500 (PSP)	1997
	Deepwater Nautilus	1997		Marine 700 (PNA)	1997
	Deepwater Horizon	1997	Pride/Petrodrill	Pride Brazil	1998
Global Marine	Celtic Sea	1996		Pride Carlos Walter	1998
	Explorer	1996		Rio de Janeiro	1998
	C.R. Luigs	1998		Pride Portland	1998
	Jack Ryan	1998	Petrobras	P23	1997
Marinor/Stena	Stena Tay	1997	BP	Thunderhorse	2004
	Stena Don	1998			

Red & Blue = Consolidation

**31 Systems**



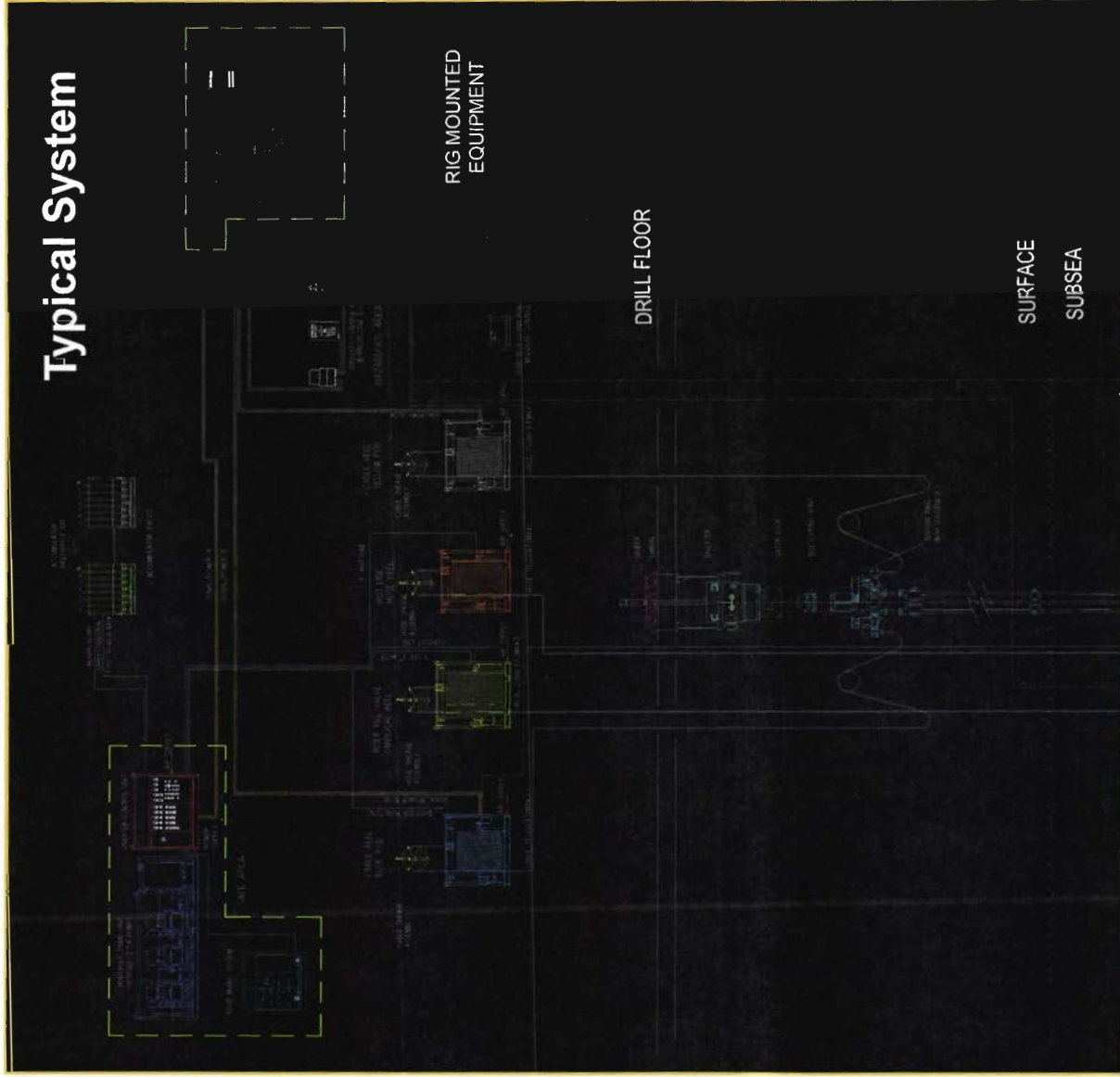
# Current Build Cycle

Marinor	Stena DrillMAX I	Mark 1.5	Daewoo (DSME)	Seadrill 10	Mark III Model 120
	Stena DrillMAX II	Mark 1.5		Seadrill 11	Mark III Model 120
	Sena DrillMAX I & II Spares	Mark 1.5	Sevan Marine	New Build #1	Mark III Model 120
	Stena DrillMAX III	Mark III Model 80	Schahin	Schahin 1	Mark III Model 120
	Stena DrillMAX III Spares	Mark III Model 80	Saipem	Scarabeo 8	Mark III Model 120
AKMH	Aker H6 Rig 1	Mark III Model 120	OSAT	OSAT	Hyd Mod Pod
	Aker H6 Rig 2	Mark III Model 120	Global Santa Fe	Arctic 1 Upgrade	Hyd Mod Pod
	Jurong#6 (Seadrill 13)	Mark III Model 120	Schahin	Casablanca	Mark III Model 120
	Aker H6 Rig 4	Mark III Model 120	Daewoo (DSME)	Group R	Mark III Model 120
	West E-Drill #1	Mark III Model 120		TMT Drillship #1	Mark III Model 120
	West E-Drill #2	Mark III Model 120	Swiber	Equatorial Driller	Mark III Model 120
	PetroRig 1	Mark III Model 120	Songa	Songa Trym Upgrade	Hyd Mod Pod
	PetroRig 2	Mark III Model 120	Murphy	Azurite ESG Project	Acoustic
	PetroRig 3	Mark III Model 120	Pride	Pride Amethyst	Mark III Model 80
	Seadrill 8	Mark III Model 120	Aban Drilling	Aban Abraham	Mark I
	Seadrill 9	Mark III Model 120		Middle Technologies	Hyd Mod Pod
	Blue = Shipped				

**26 Systems + 6 Other**



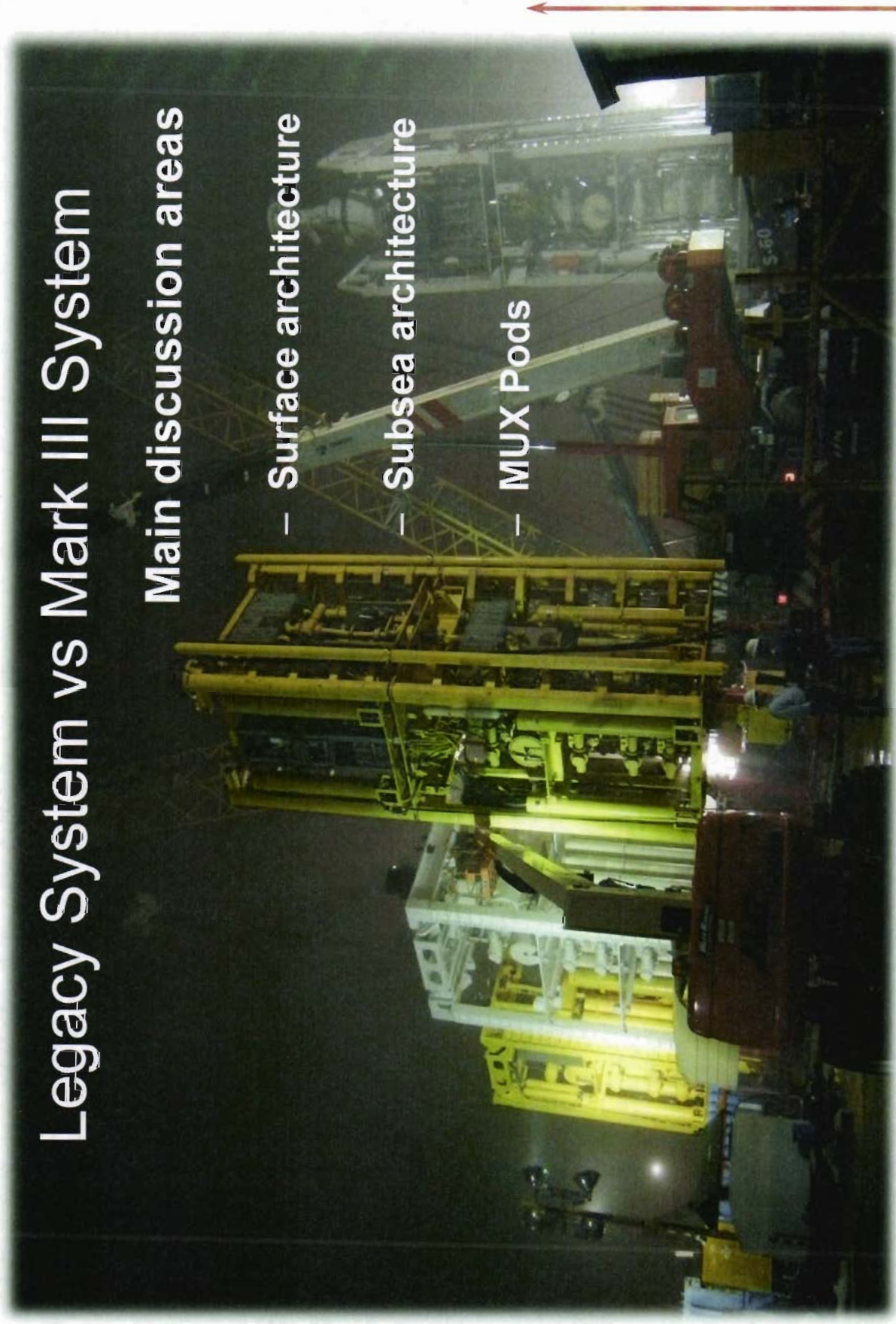
## Typical System



# Legacy System vs Mark III System

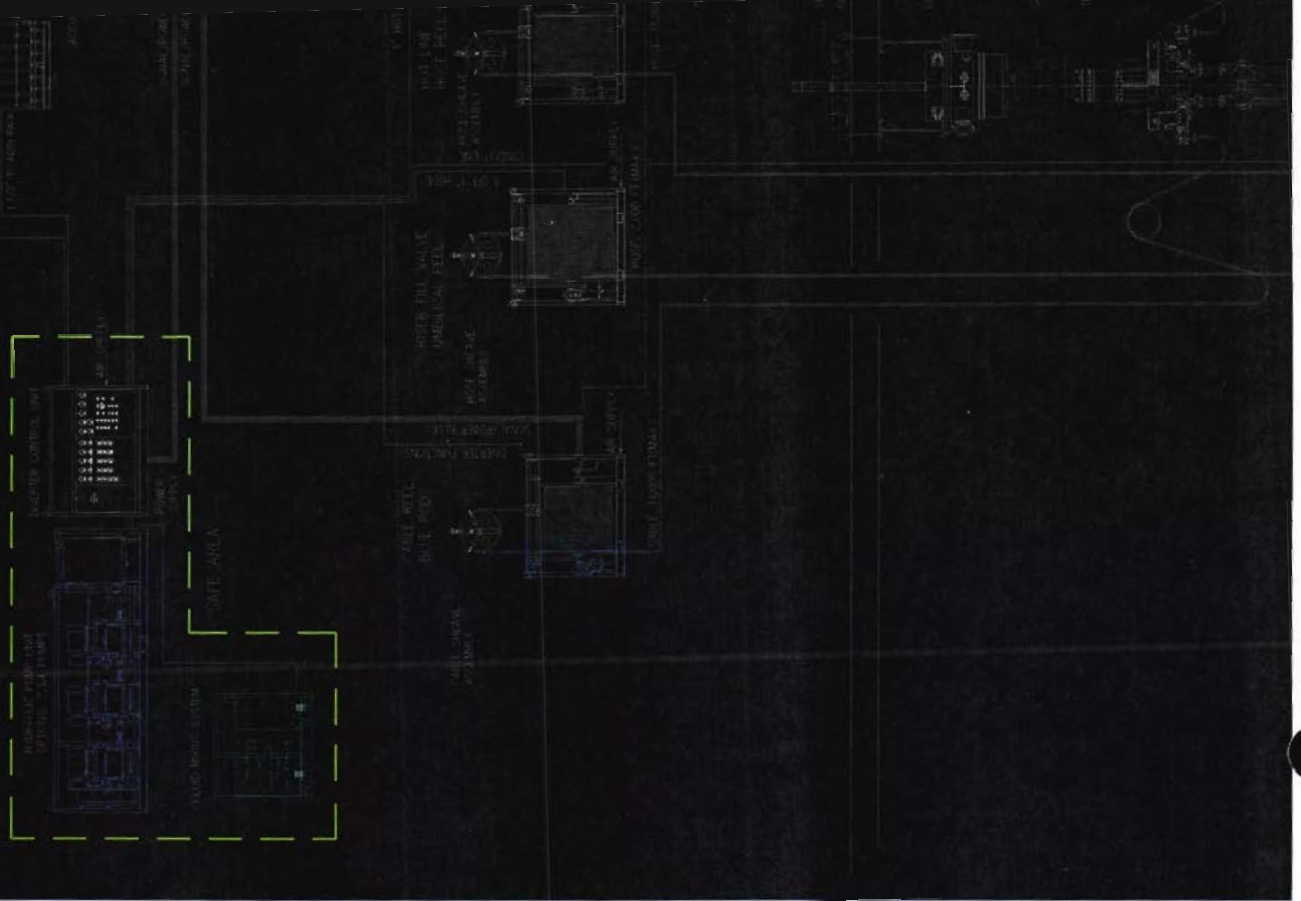
## Main discussion areas

- Surface architecture
- Subsea architecture
- MUX Pods





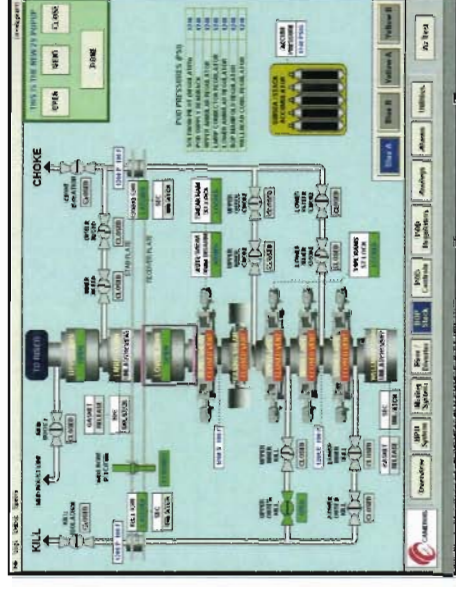
# Surface Overview – Typical



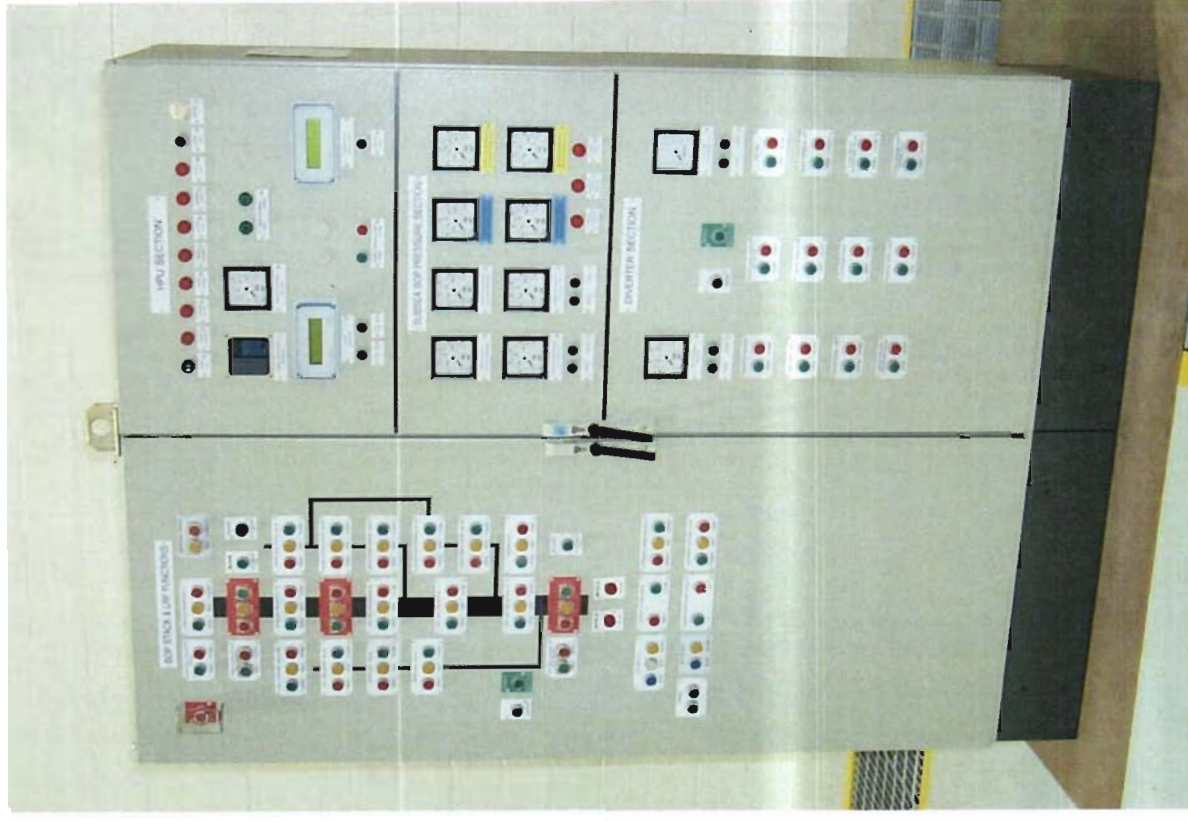


# Surface Changes

- **Surface Communications**
  - Legacy used Profibus via Fiber Optics with OLM's  
(Star type network with poor diagnostic capabilities)
  - Mark III utilizes Ethernet technology via Fiber Optics with field proven Siemens Fiber Converters/Switches  
(robust network management for increased uptime with enhanced diagnostics)
- **Touch Screen Panels have been developed to replace hardware push-button panels**
- **Wonderware HMI Software utilized for enhanced graphics and ease of use**
- **Field proven Siemens S7 PLC's utilizing Step 7 software**



# Legacy Hardwire Push-button Panels

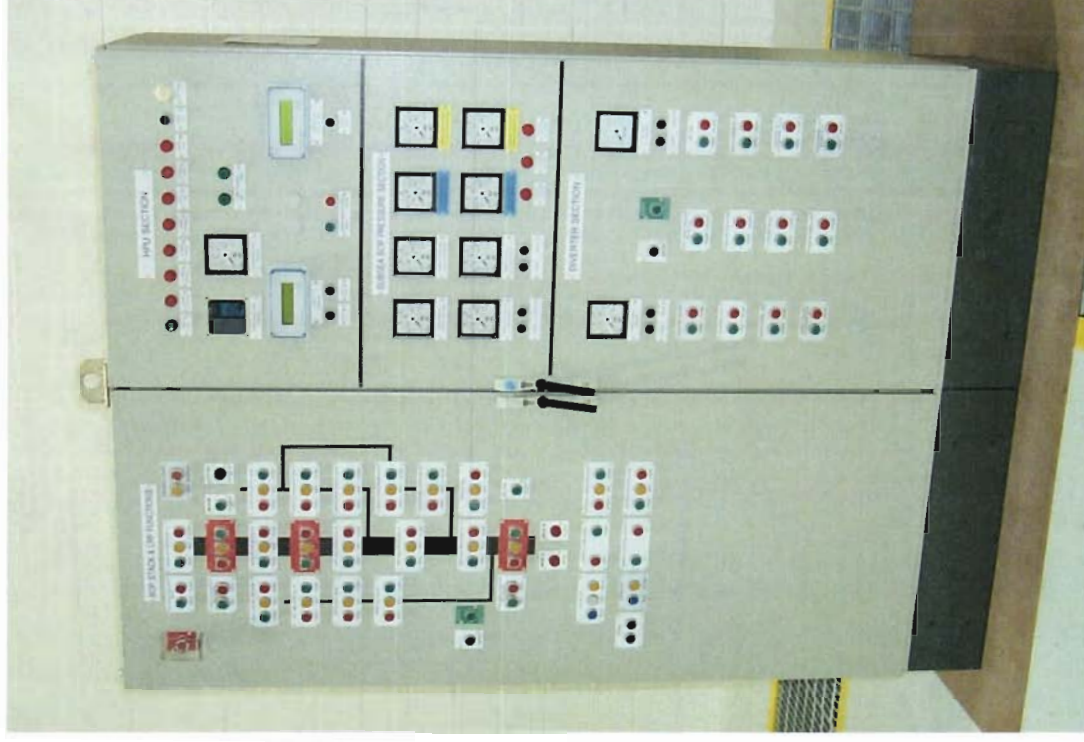






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# Legacy DCP & TCP



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# Touch Screen Panels

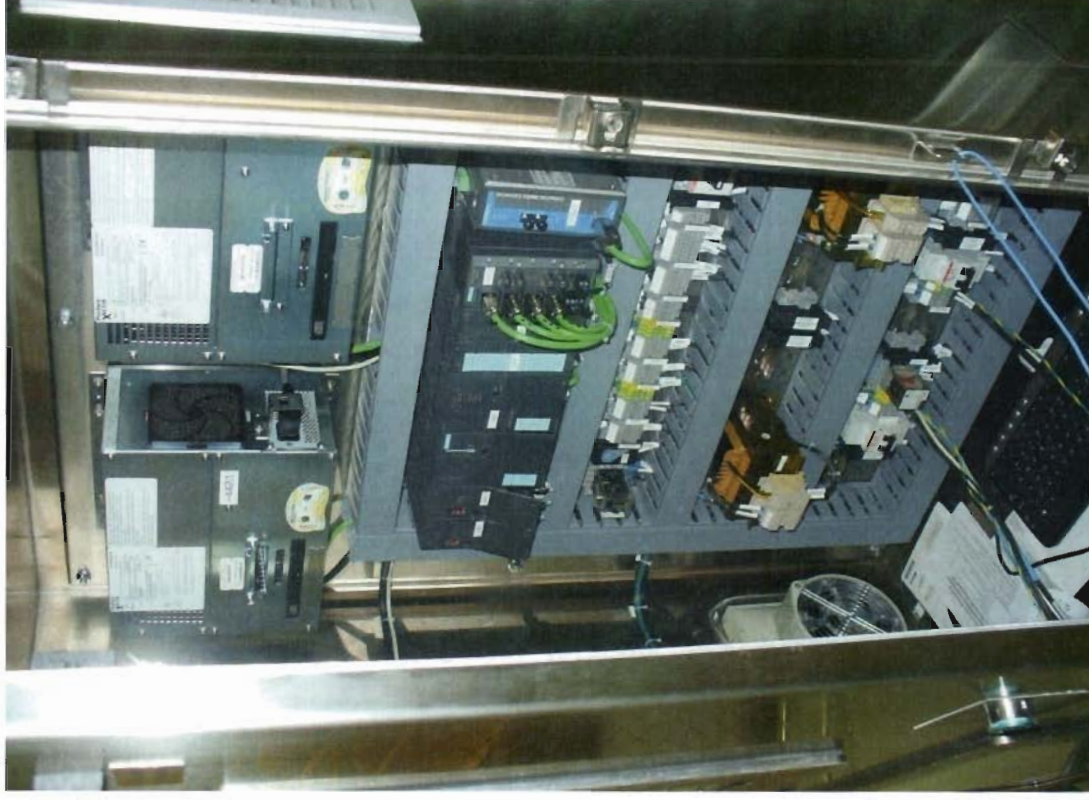
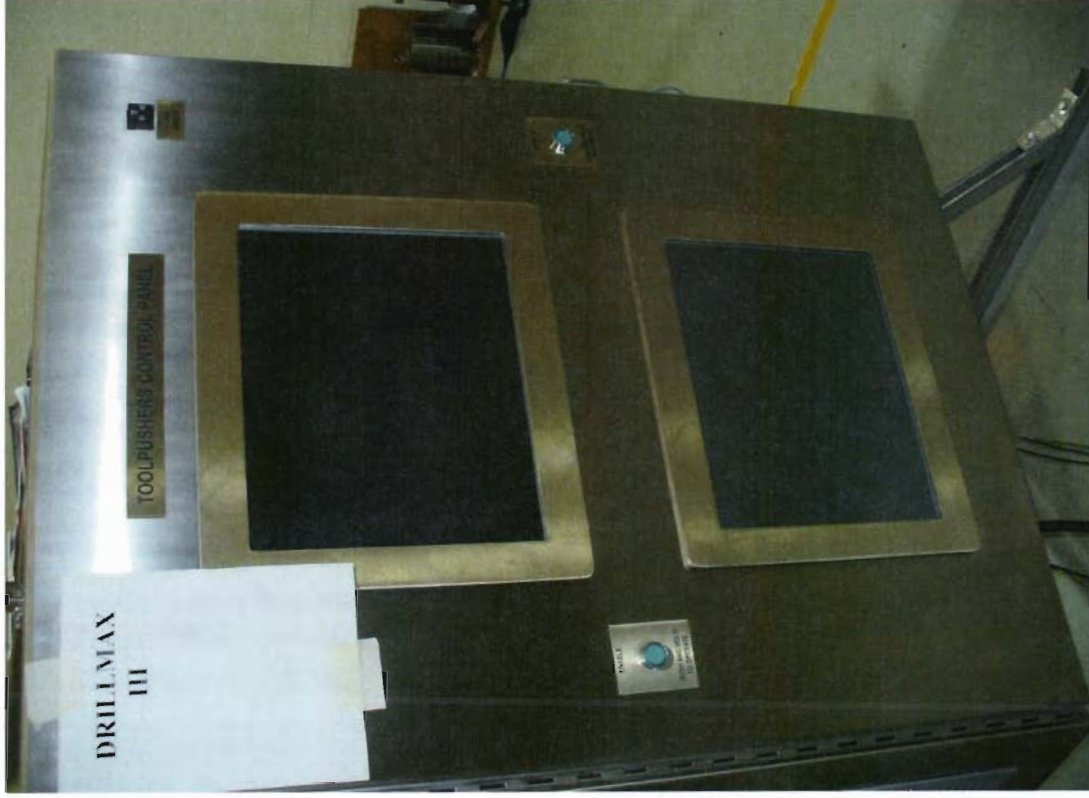






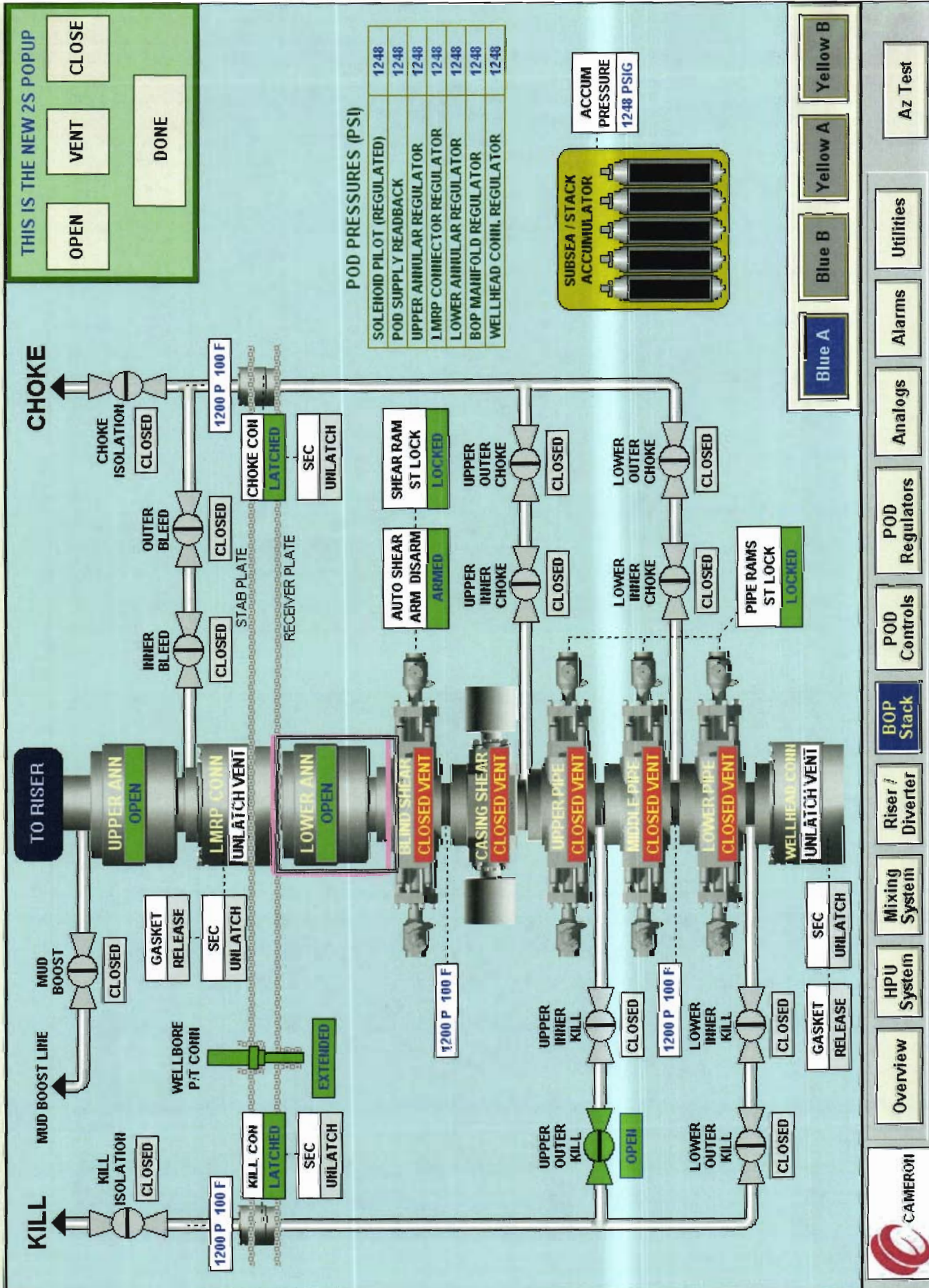
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# Touch Screen Panels

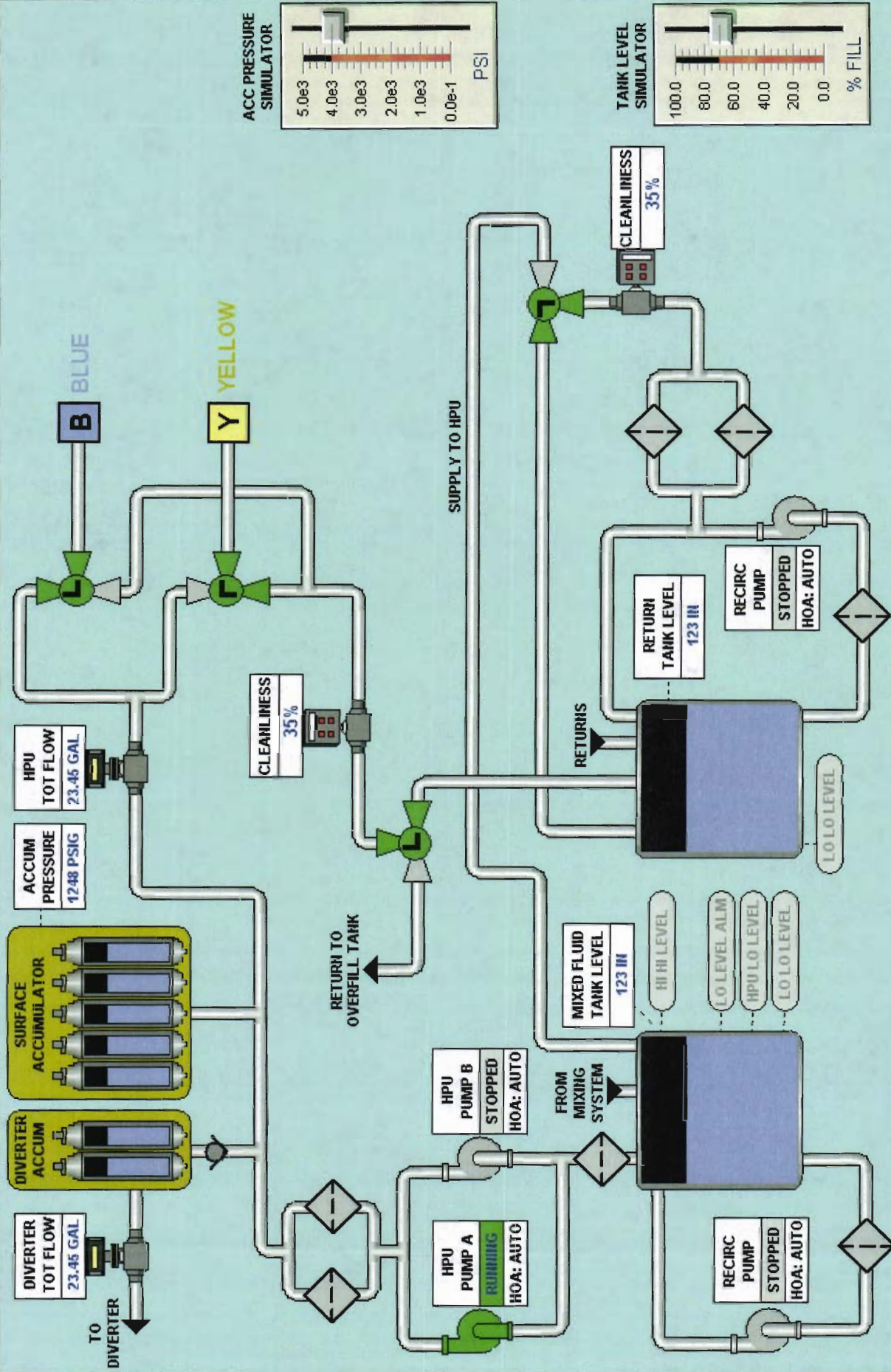


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Overview

HPU System

Mixing System

Riser / Diverter

BOP Stack

POD Controls

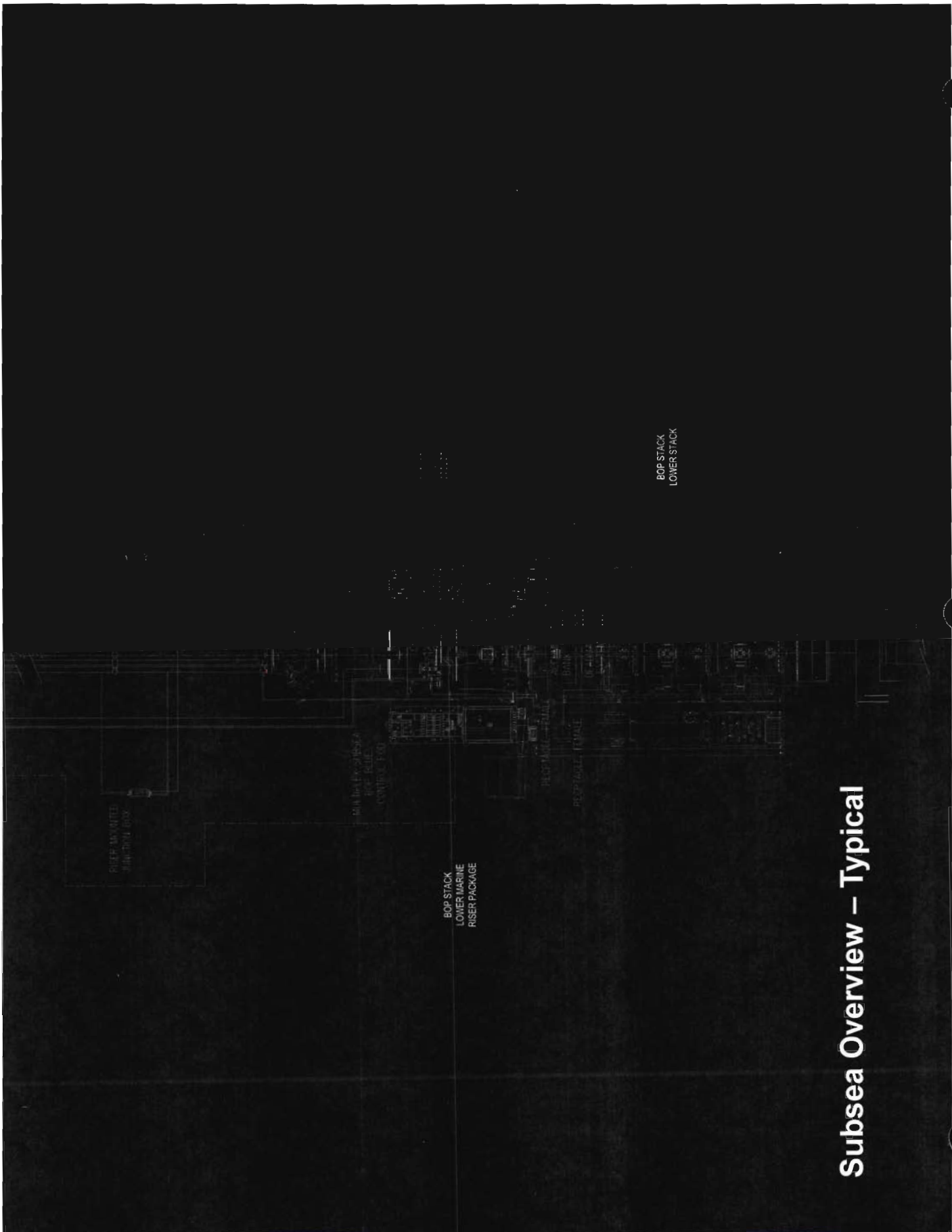
POD Regulators

Analog

Alarms

Utilities

Az Test



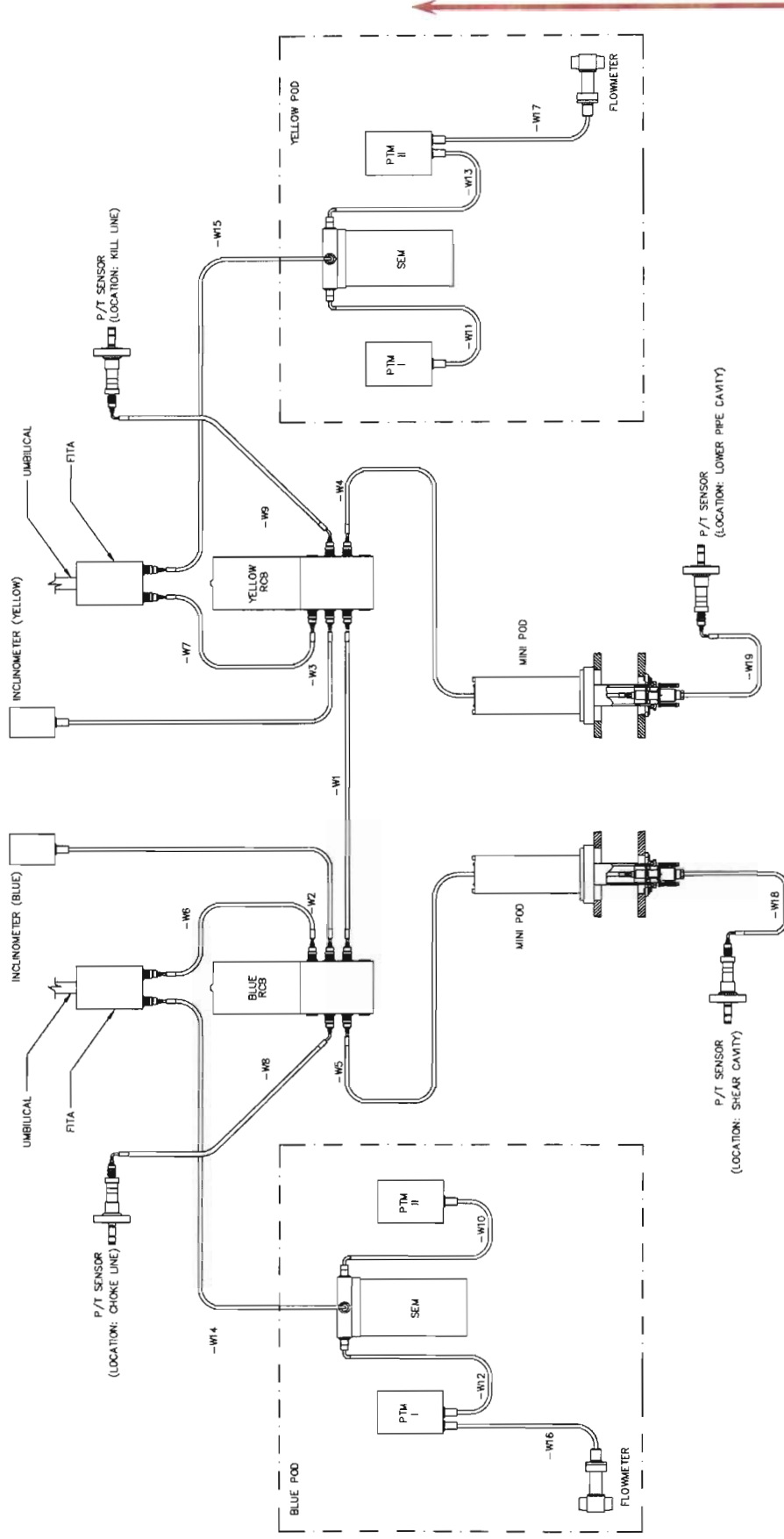
Subsea Overview – Typical



# Subsea Changes

- Number of 1atm chambers reduced
- Power and signal go directly to SEM
- RCB has separate power and signal
- All interconnection cabling is Version 2 PBOF with testable connections and field reparability

# PBOF Interconnection Diagram



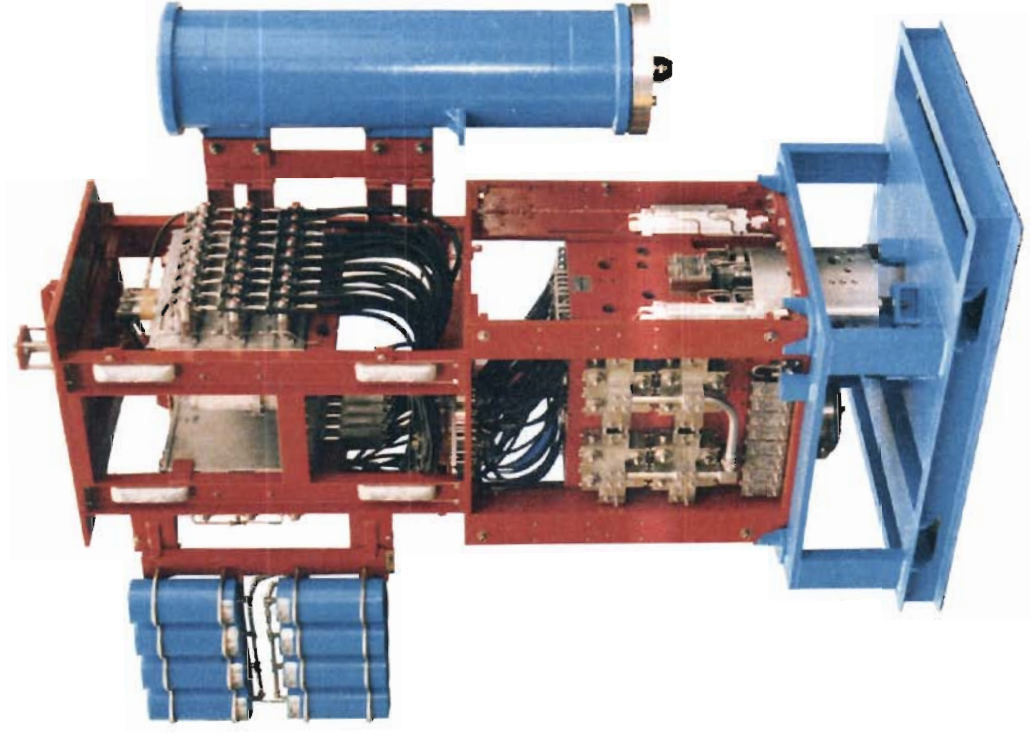
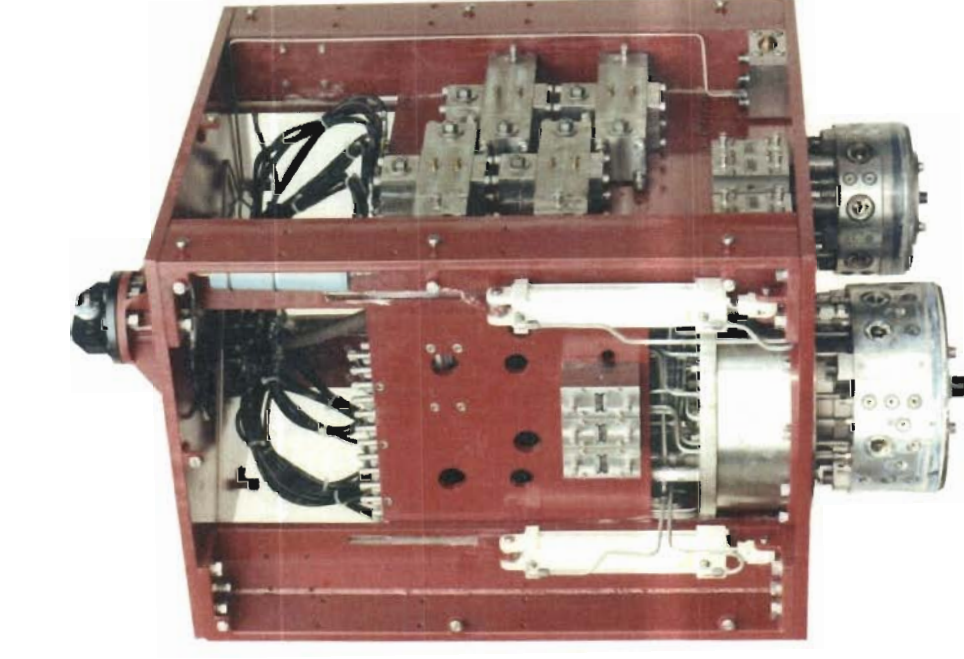
# PODS

- Ben Ocean Lancer – 1st Gen MUX circa 1976
- Mark I – 2nd Gen 77 Functions circa 1995
  - Used Direct Hyd Mod Section developed in the late 70's
- Mark II – 2nd Gen Extended 107 functions circa 1998
  - Larger rectangular footprint

## Current Generation (began development 2004)

- Mark III Model 80 (80 functions, base footprint)
- Mark III Model 120 (120 functions, rectangular footprint)

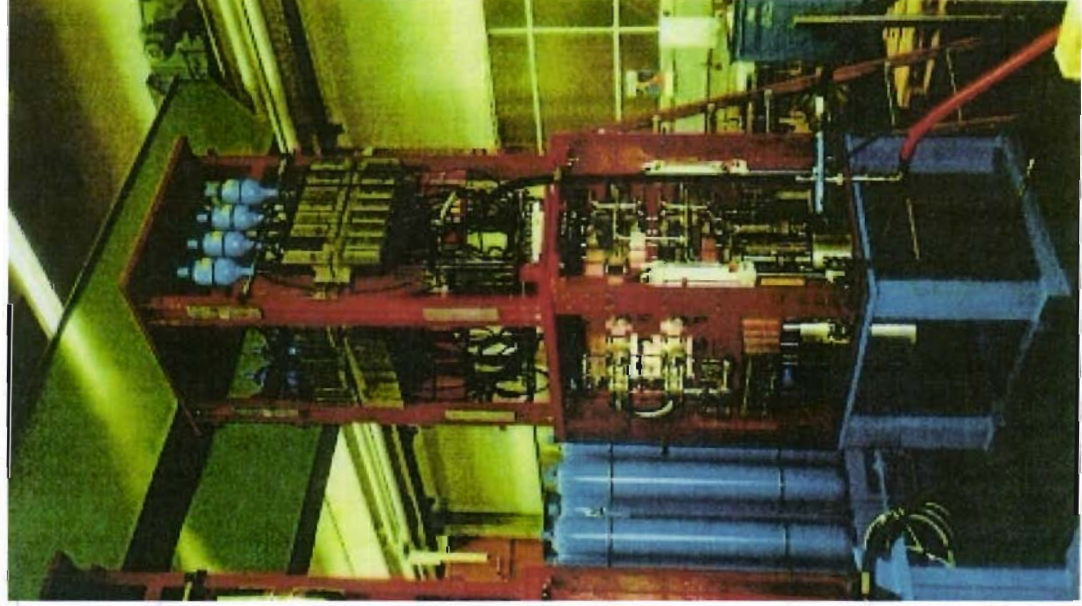
# PODS



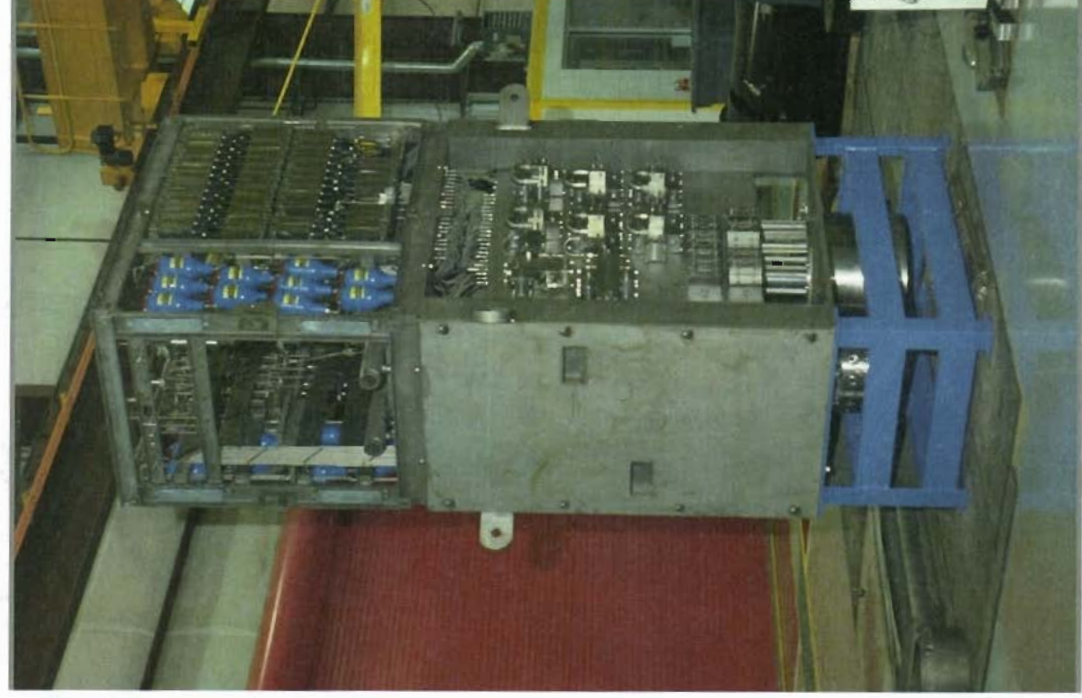
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# PODS

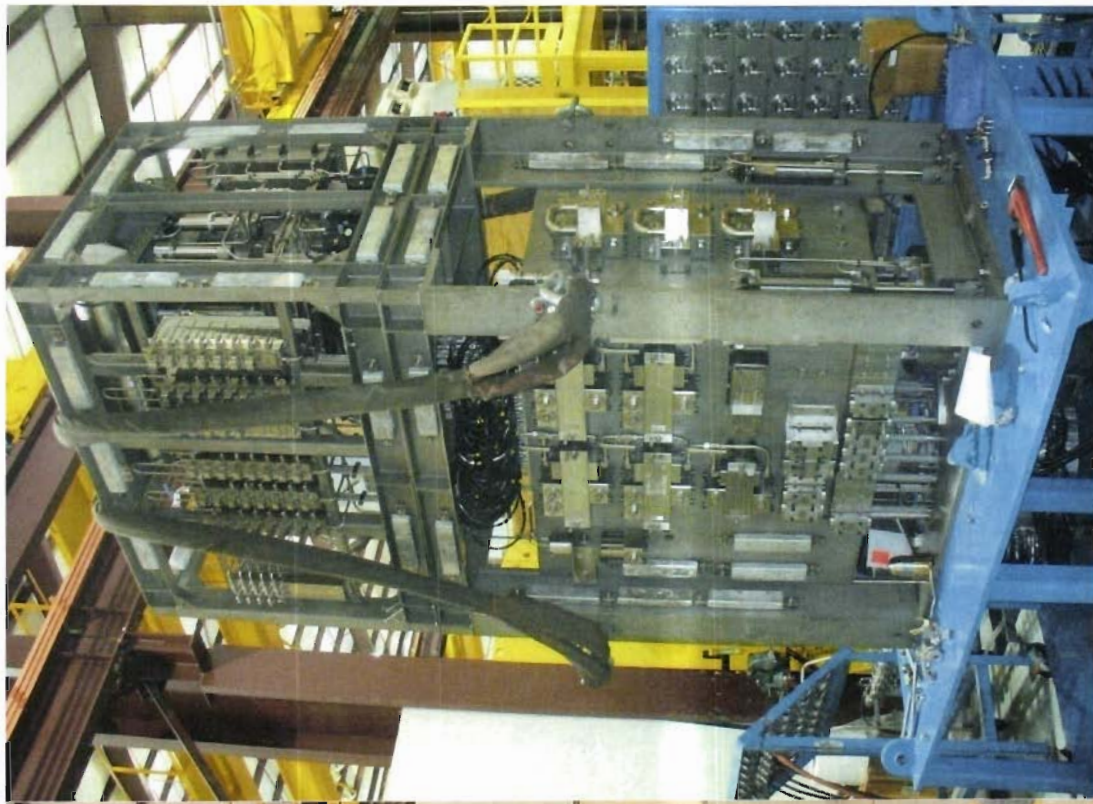
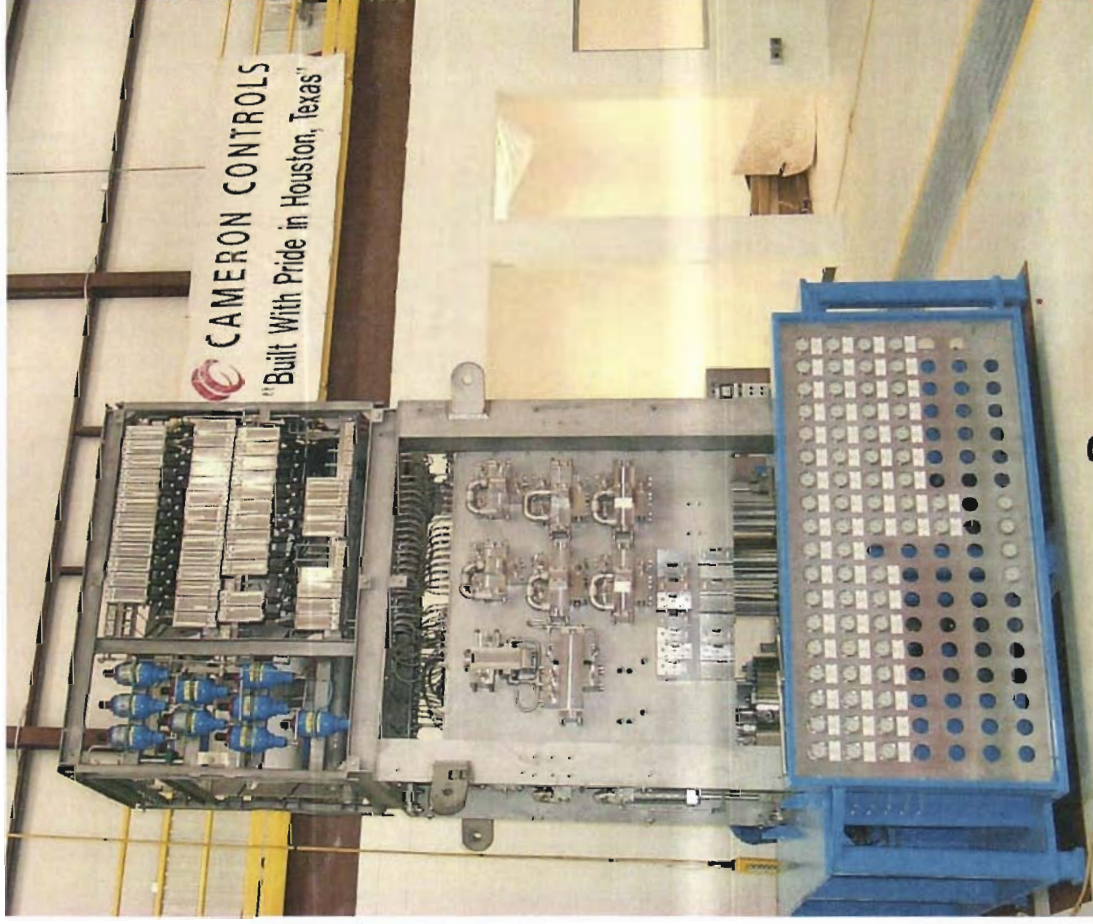


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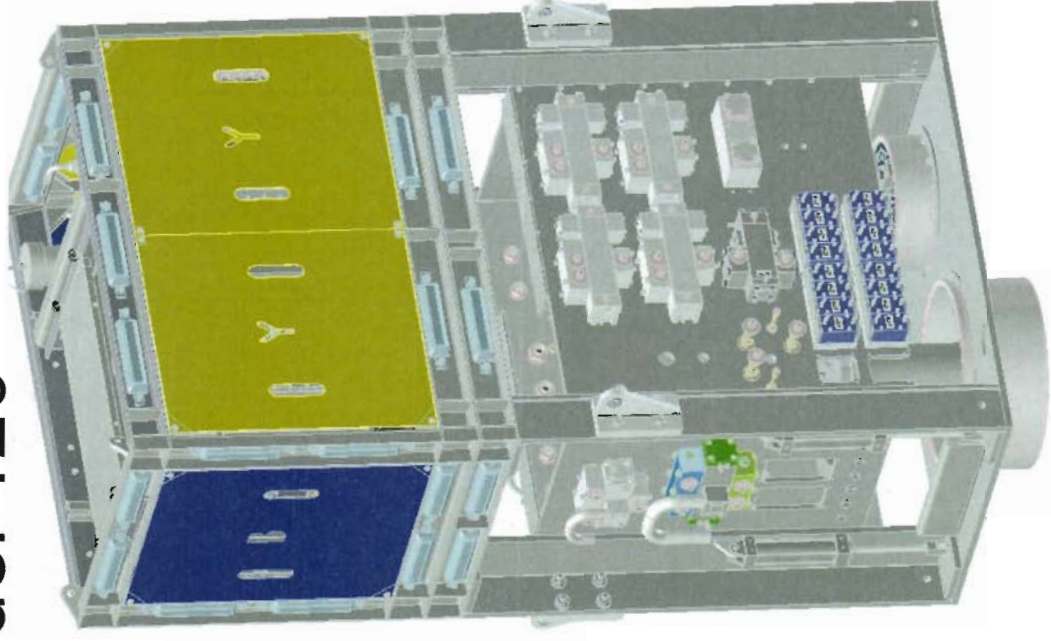
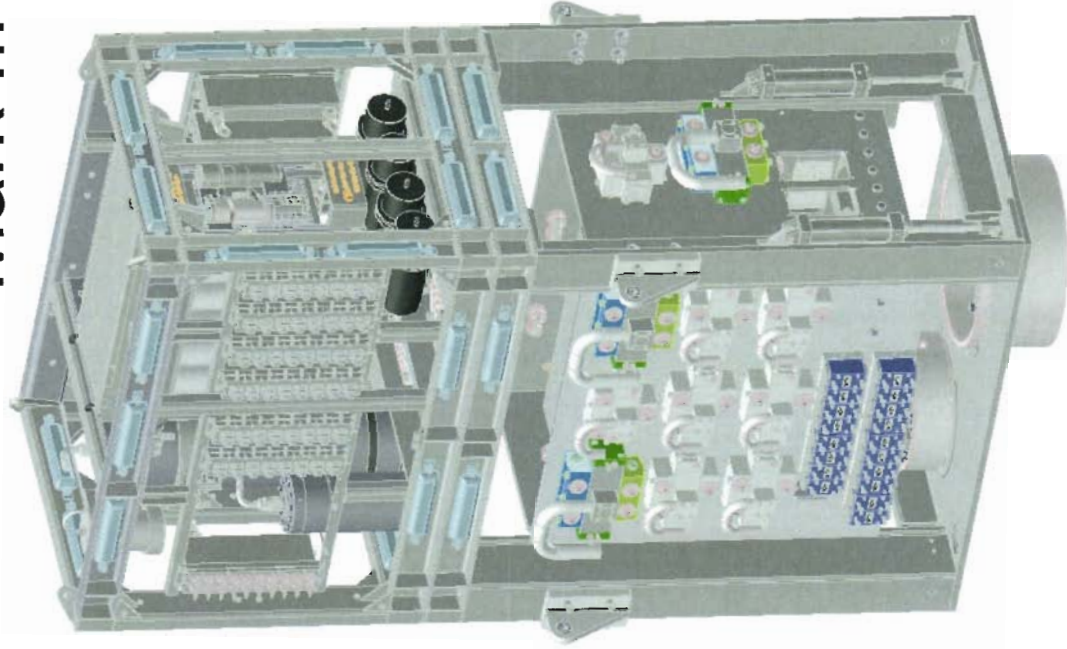


# Mark II & Mark III Model 120 Pods





# Mark III Model 120





## Mark I MUX Package

Subsea Electronics  
Module

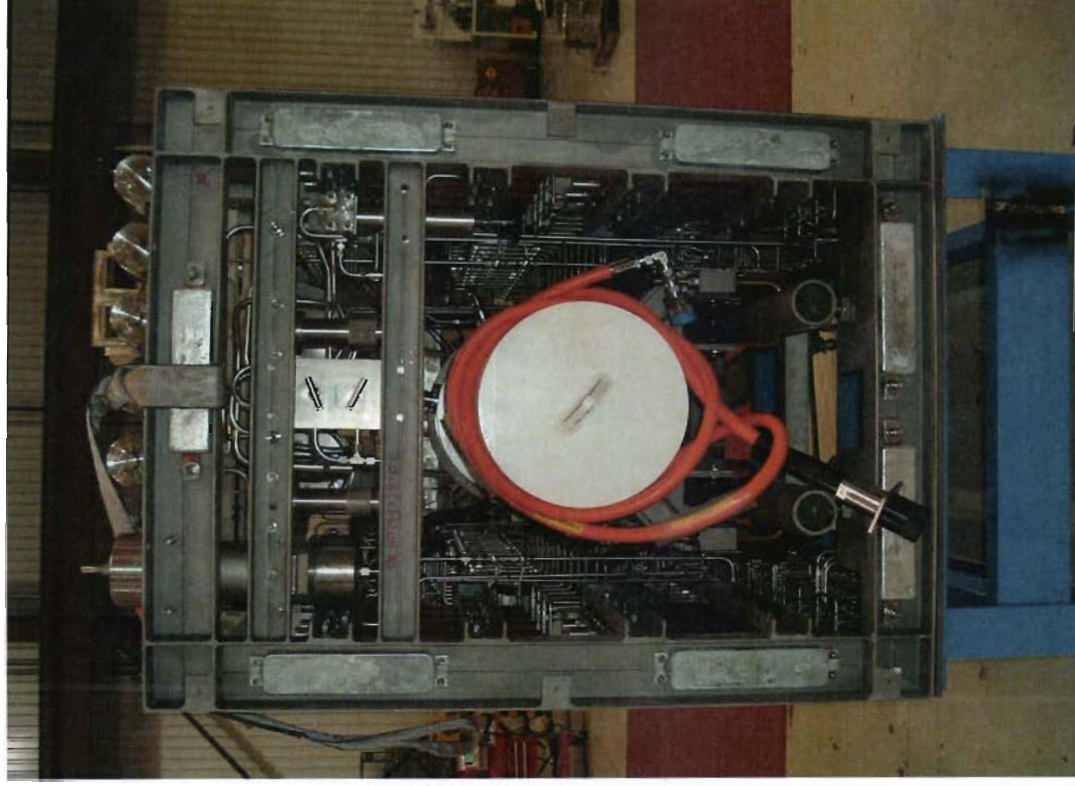
Subsea Transmitter  
Module

Accumulators

Solenoid Valves



# Mark II MUX Package



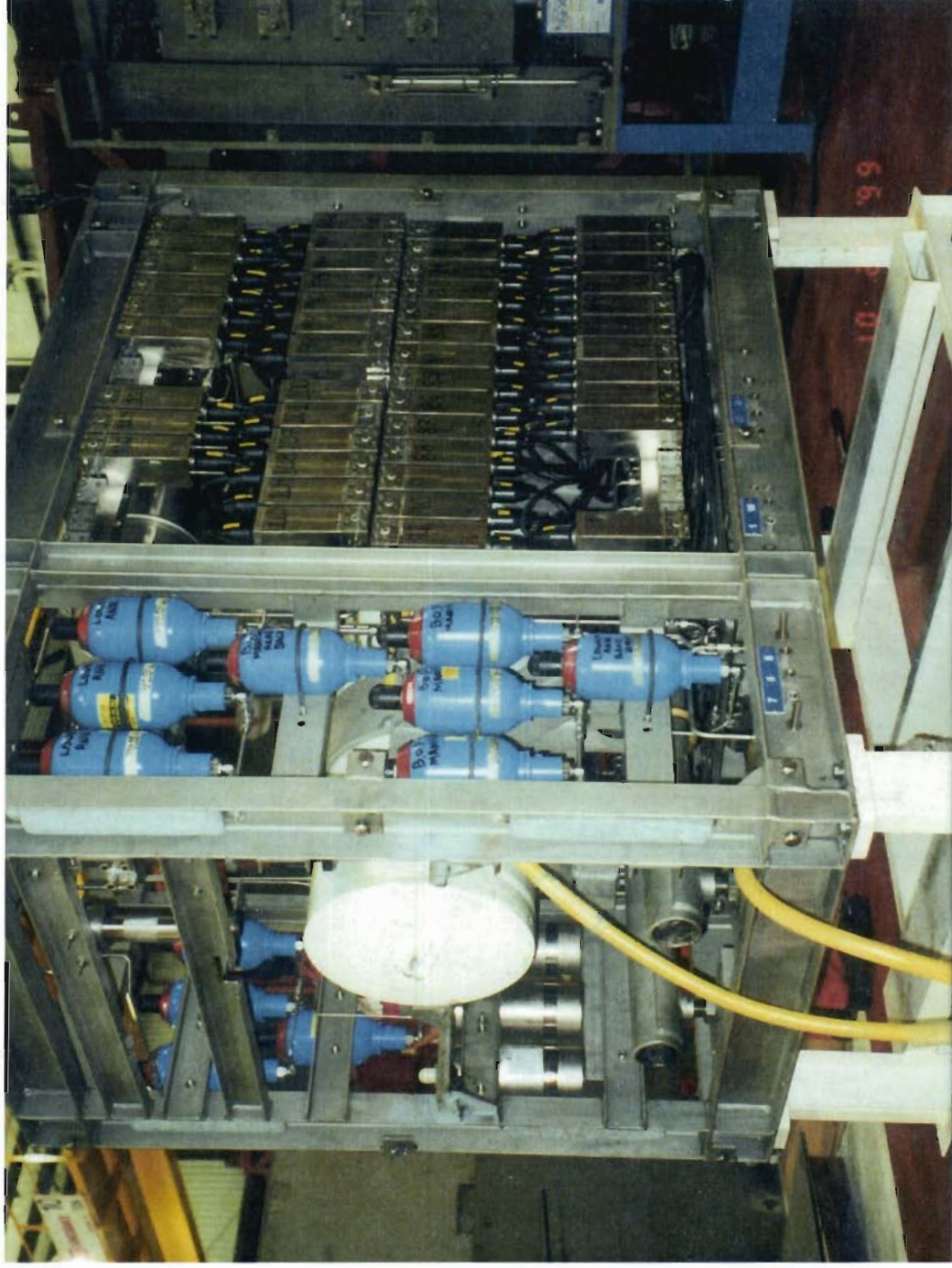


# Mark II MUX Package





## Mark II MUX Package

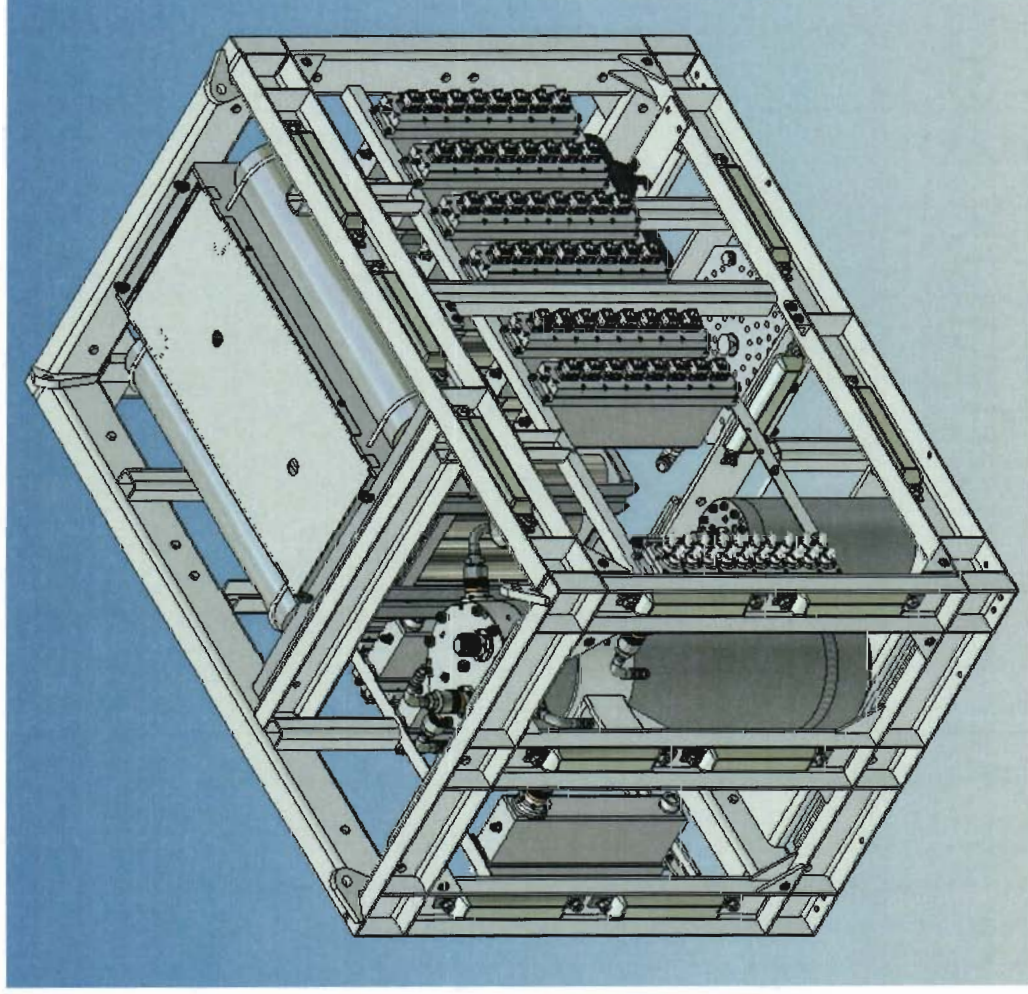


# Mark III MUX Section

- Completely Repackaged for ease of maintenance
- Pressure compensated dielectric filled chambers
  - Solenoids
  - Transducers
- Modular construction
  - Solenoid chambers
  - Transducer chambers
  - Pilot Accumulator, Regulator & Filter rack
- Junction Plate for hydraulic interface between MUX / Mod
- New compact SEM design with next-gen electronics
- Rechargeable batteries for AMF/Deadman System

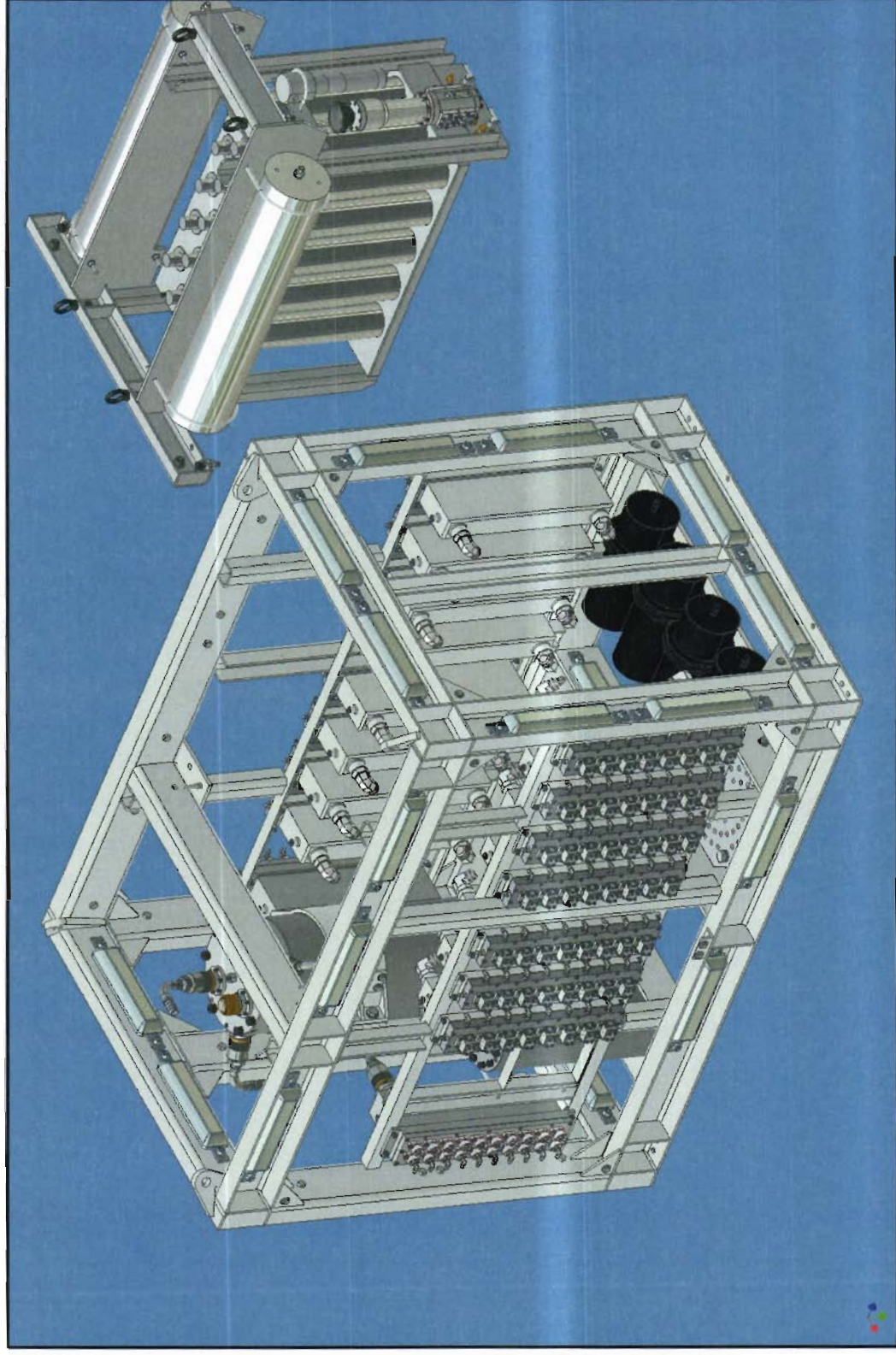


## Mark III Model 120 MUX Section



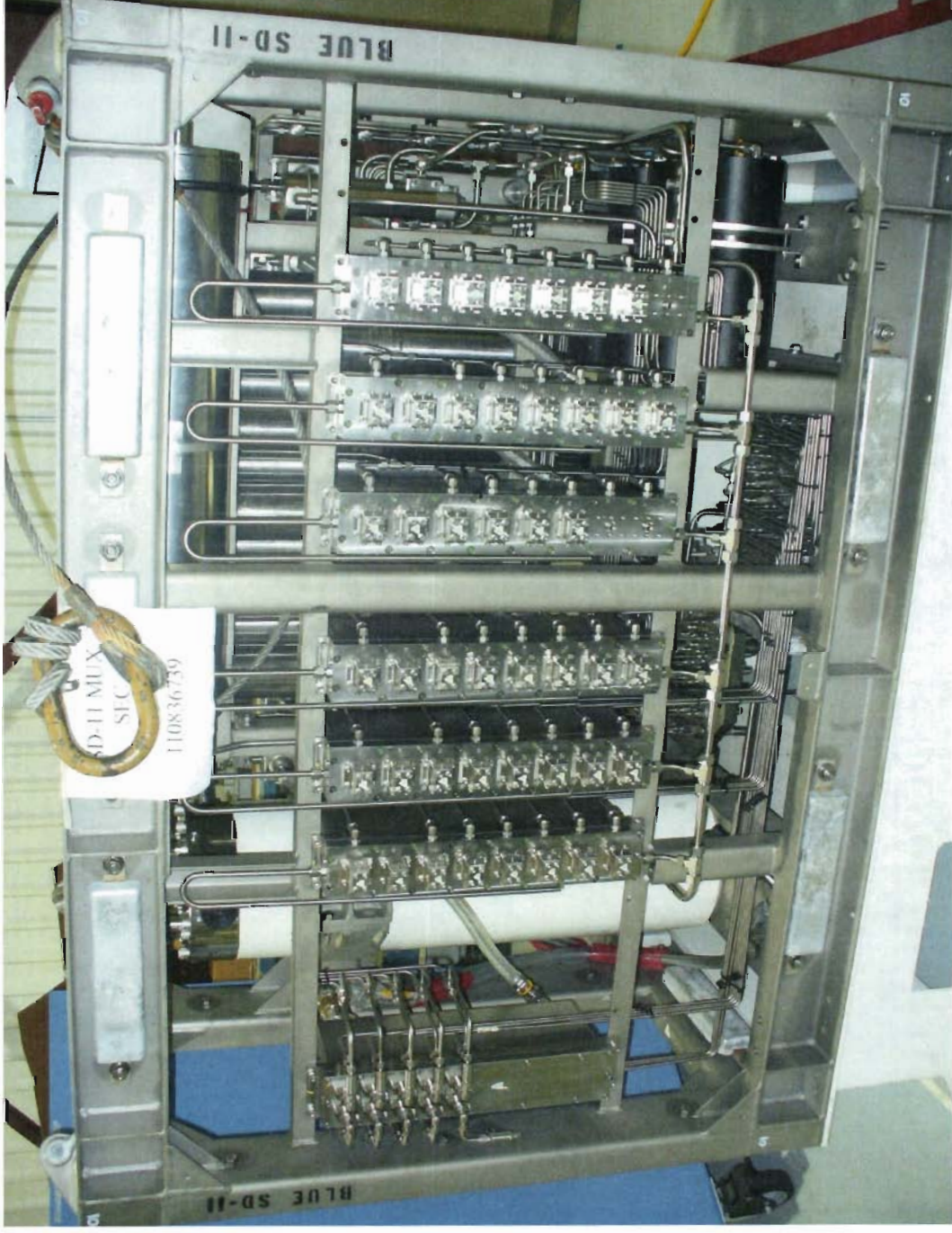


# Mark III Model 120 MUX Section

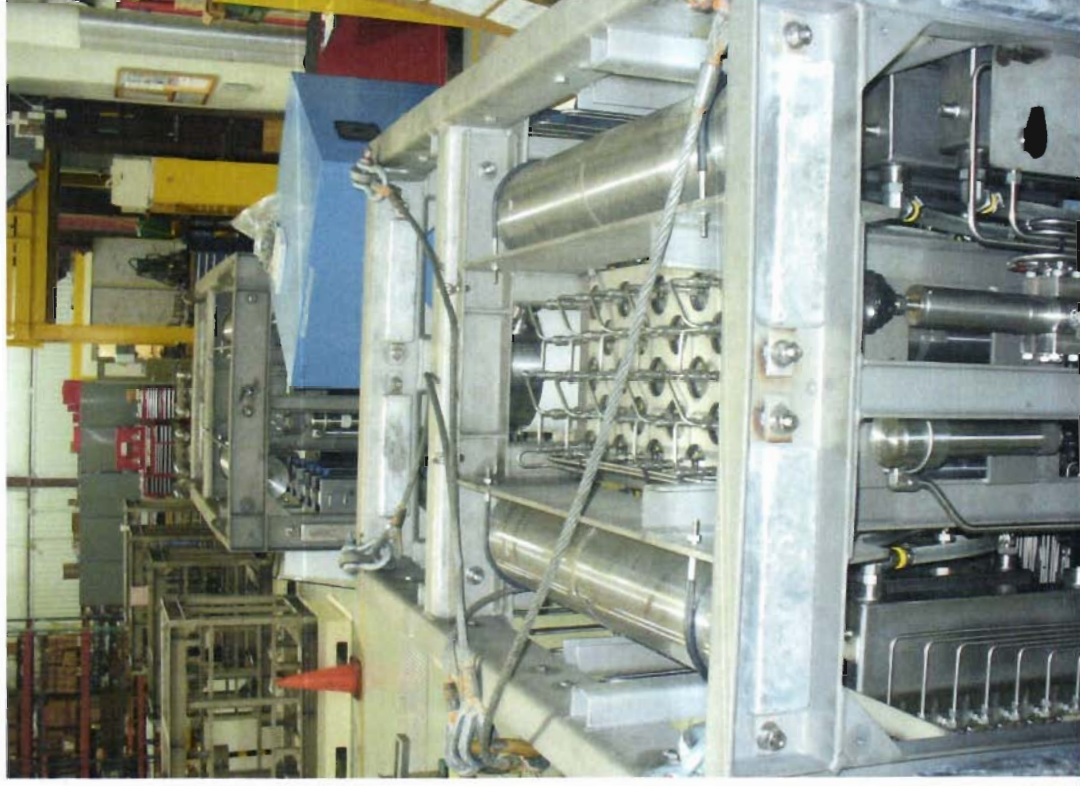




## Mark III Model 120 MUX Section

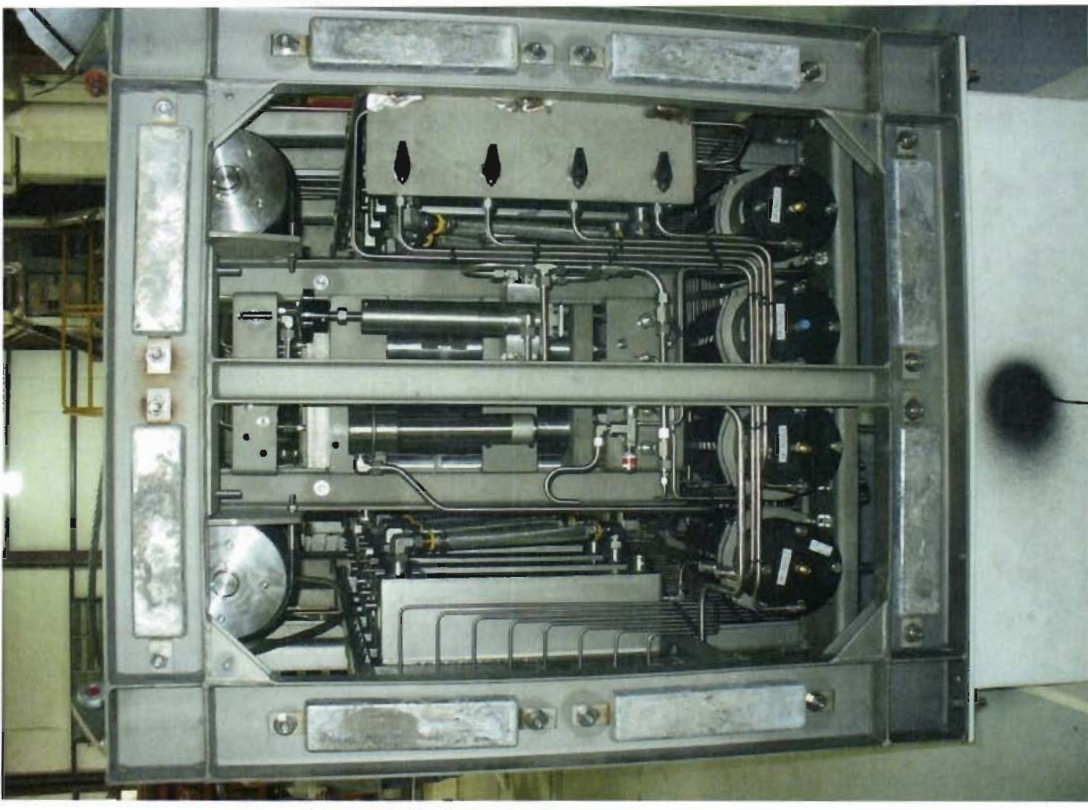
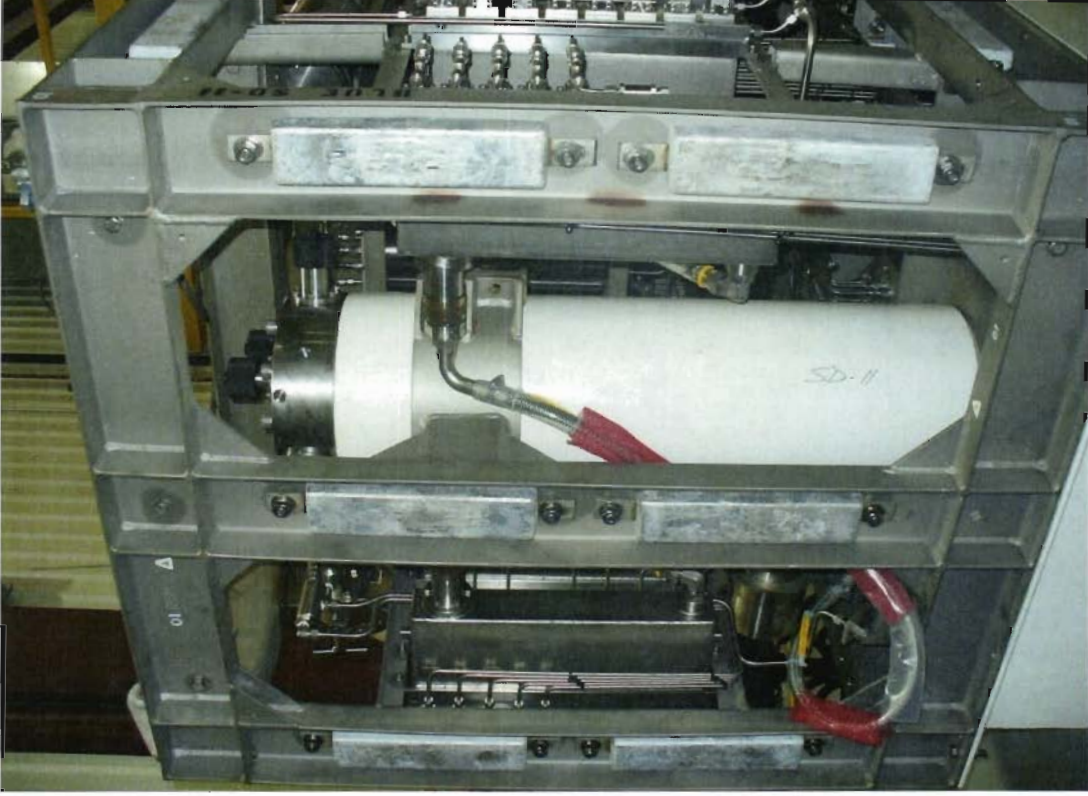


# Mark III Model 120 MUX Section



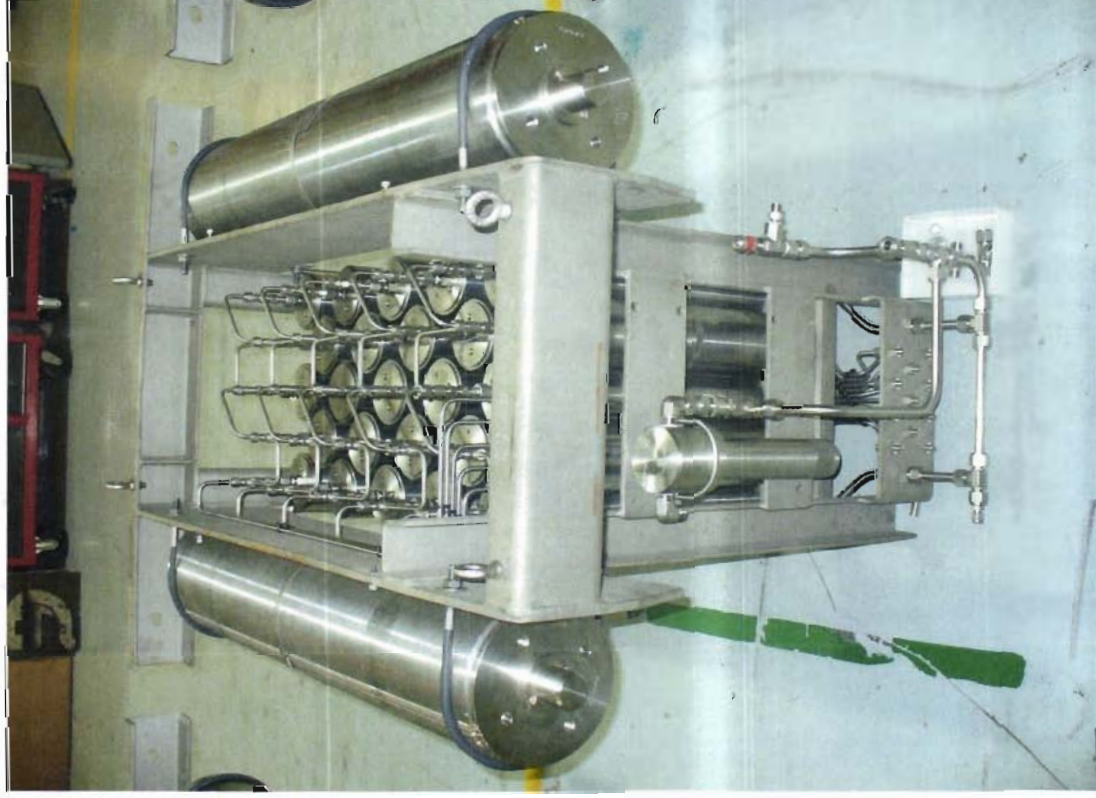


## Mark III Model 120 MUX Section

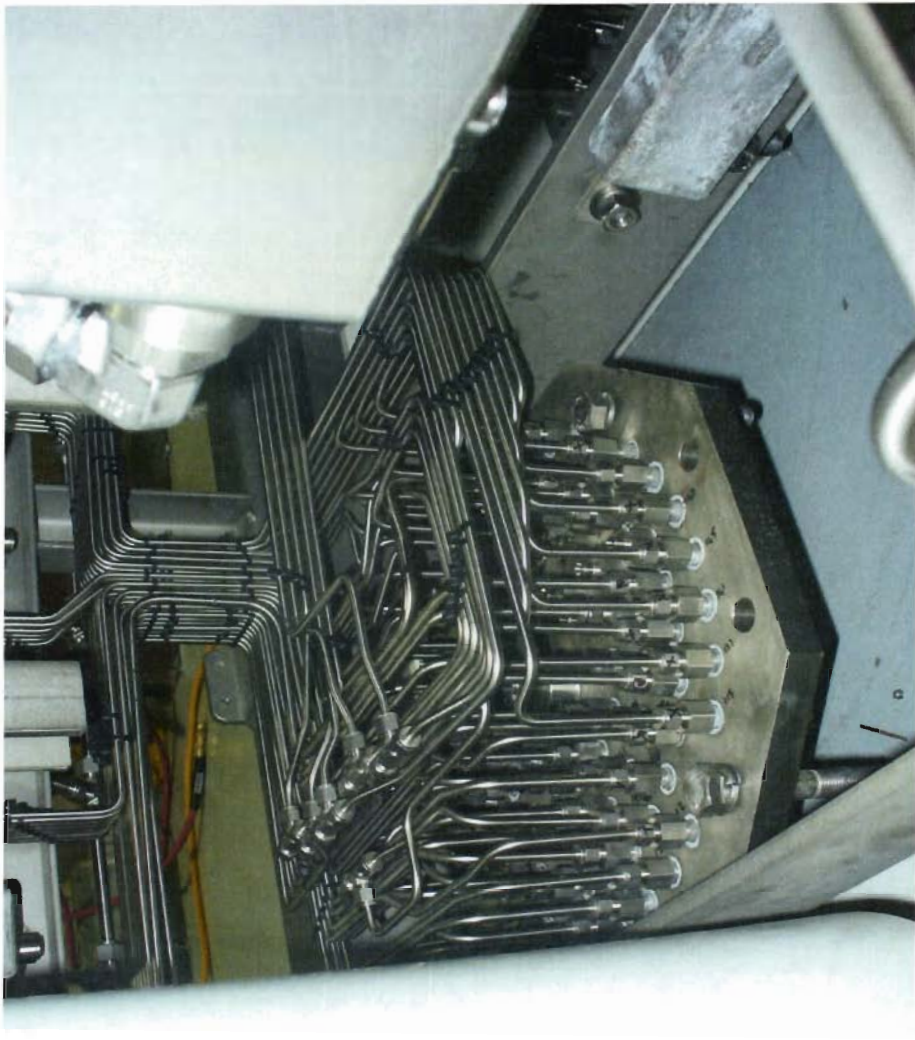




# Mark III Model 120 Pilot Accumulator Rack



# Mark III Model 120 Junction Plates

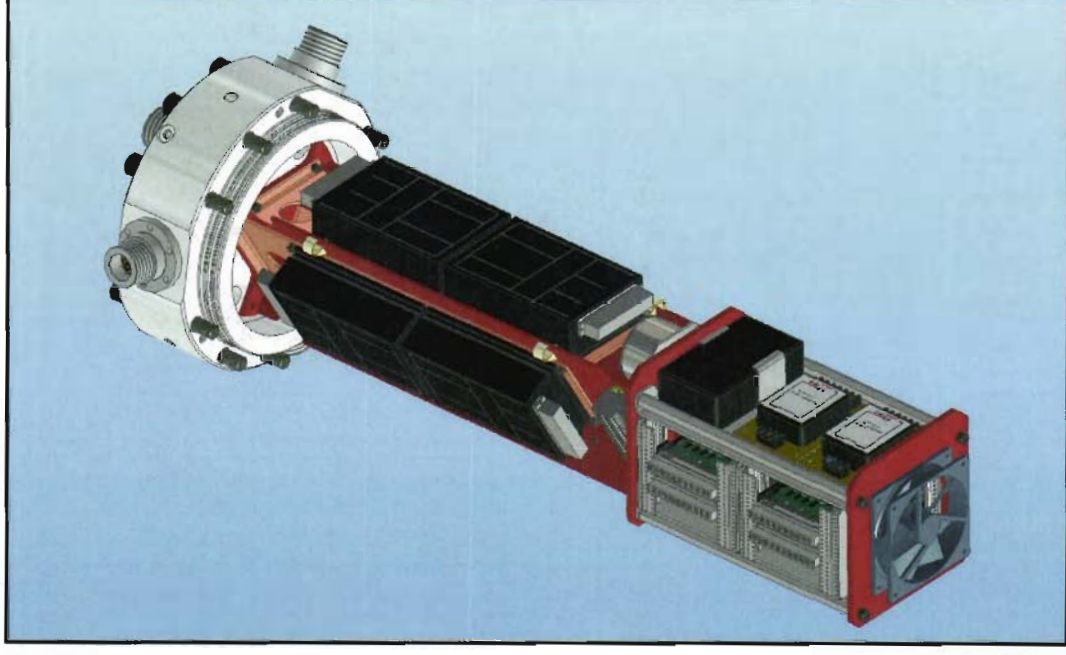
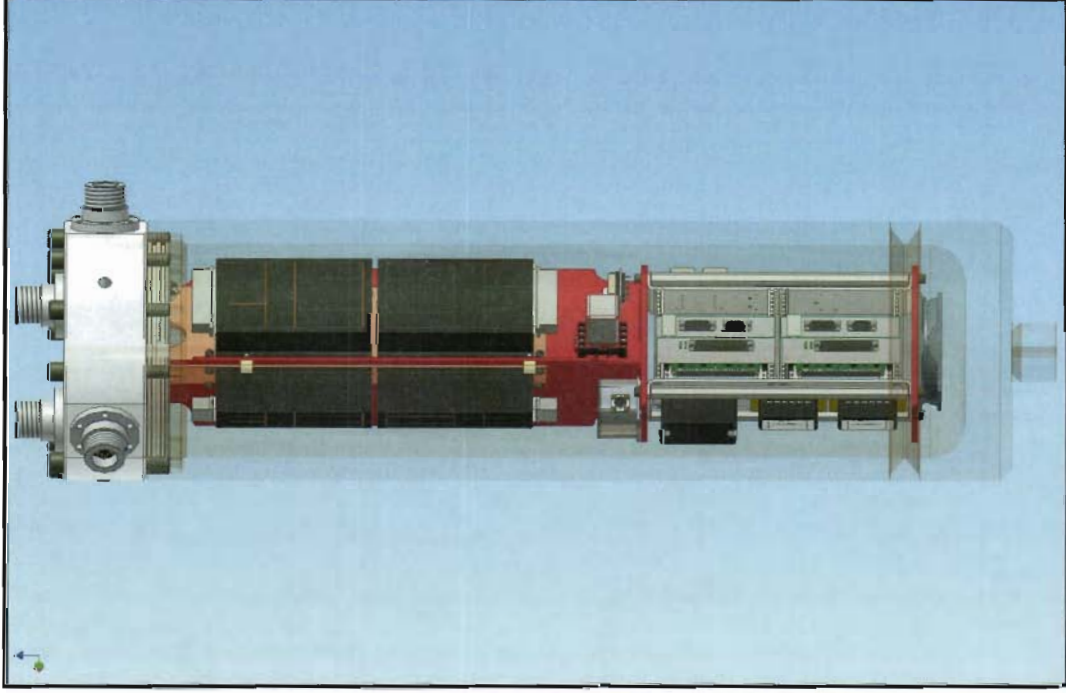




## Mark III SEM Features

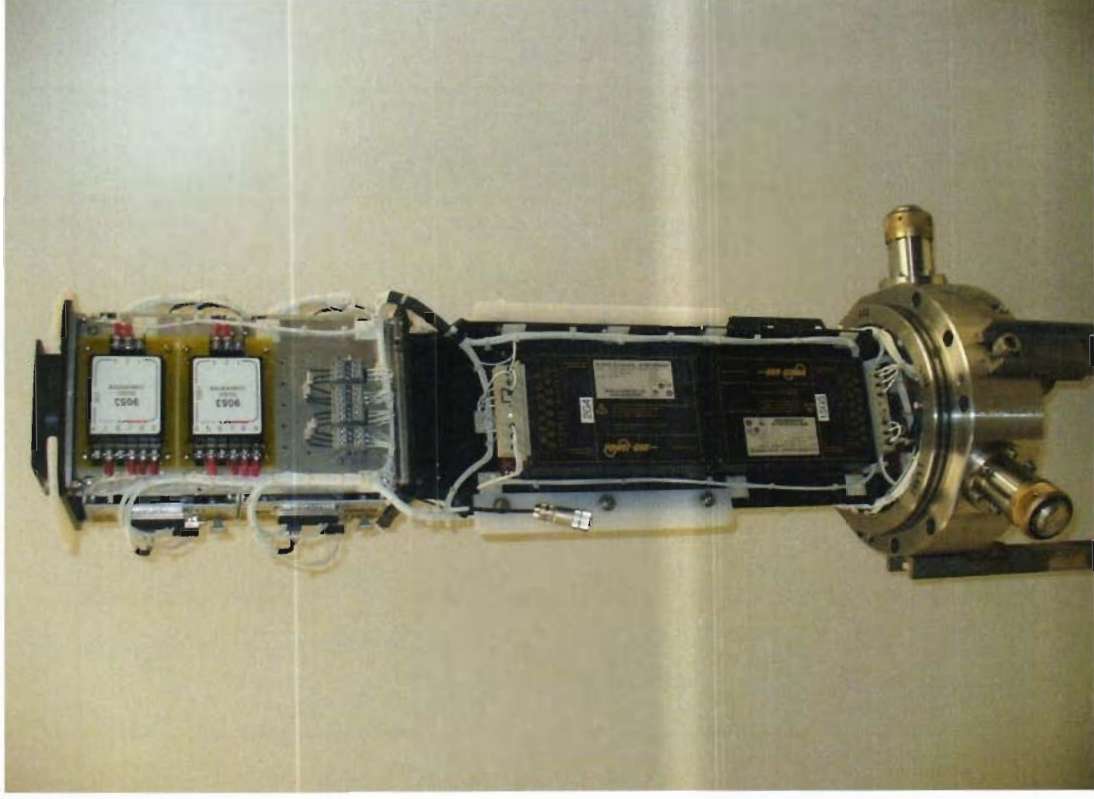
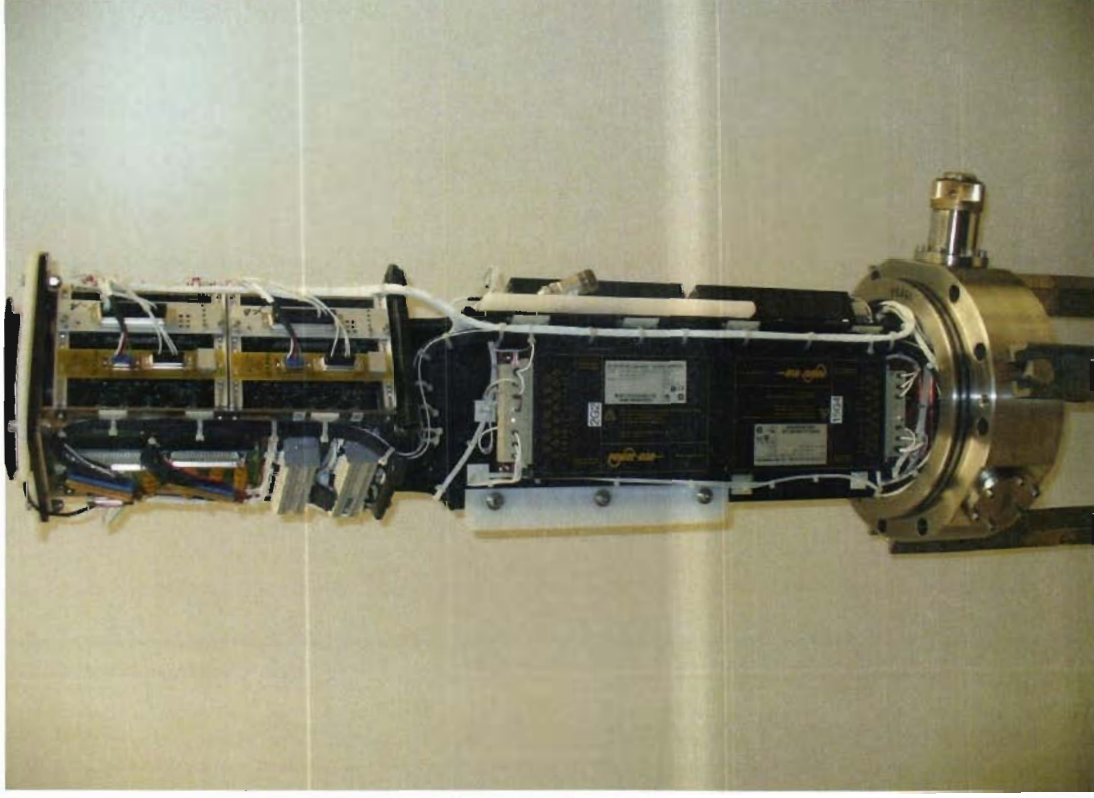
- Major SEM Electronics, SEM Controller I/O Board, Solenoid Drivers & Pressure Transducers are derivatives of the field proven CamTrol technology and are Proprietary to Cameron
- Electronics packaged to increase efficiency of heat dissipation
- Solenoid driver modules removed from SEM
- Mark III SEM is smaller than Mark I & Mark II
- 1 SEM for both the Model 80 or 120
- Pie connectors eliminated

## Mark III SEM (Subsea Electronics Module)

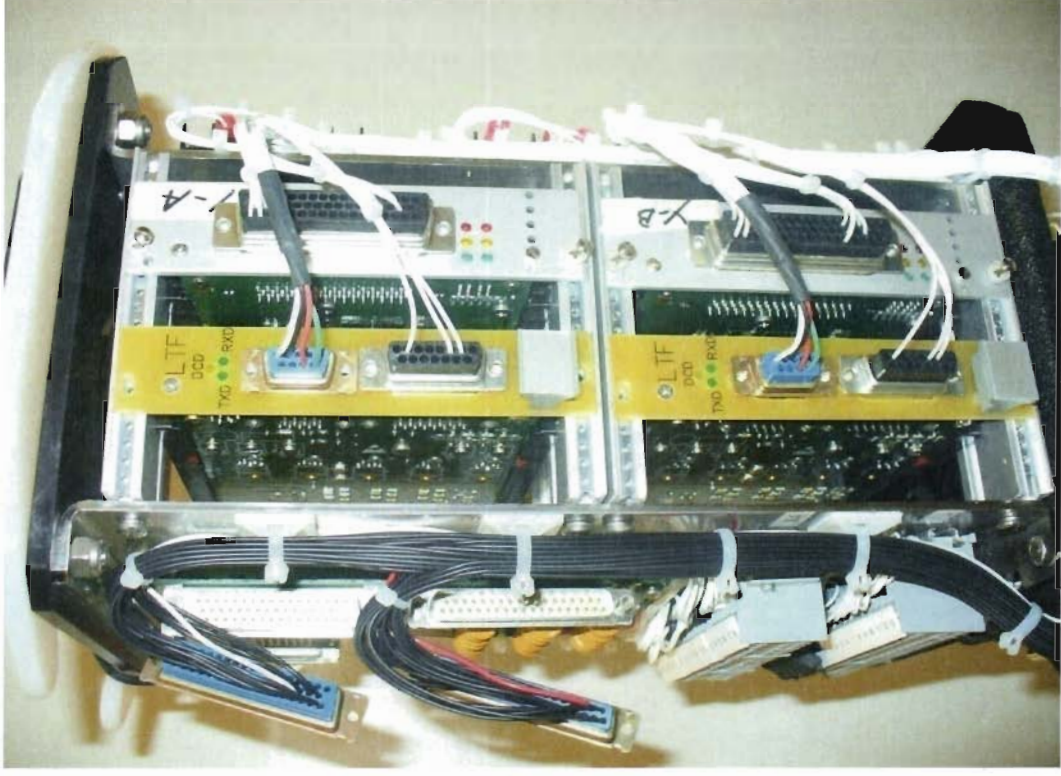




## Mark III SEM (Subsea Electronics Module)



## Mark III SEM (Subsea Electronics Module)



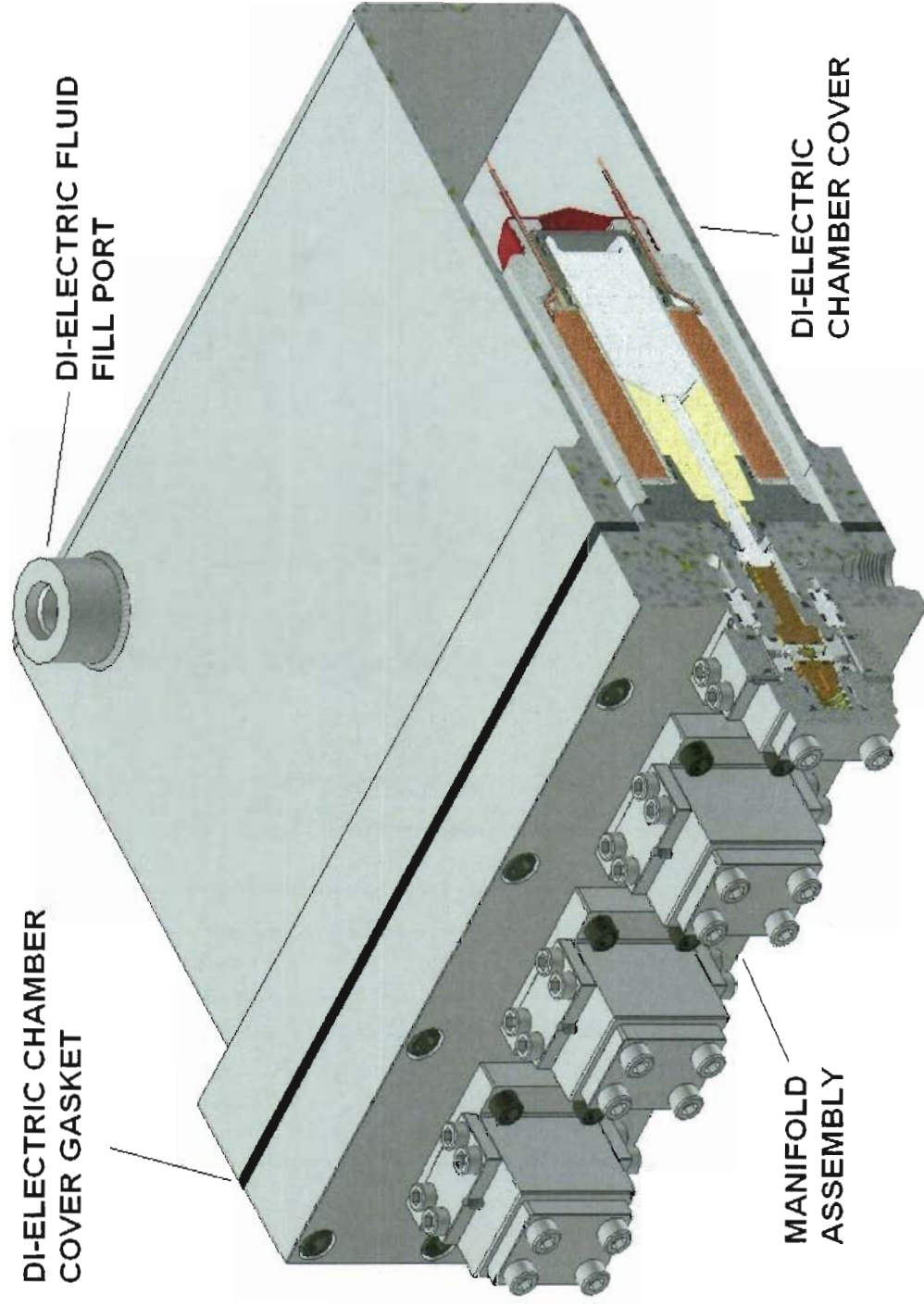




## SVM (Solenoid Valve Module)

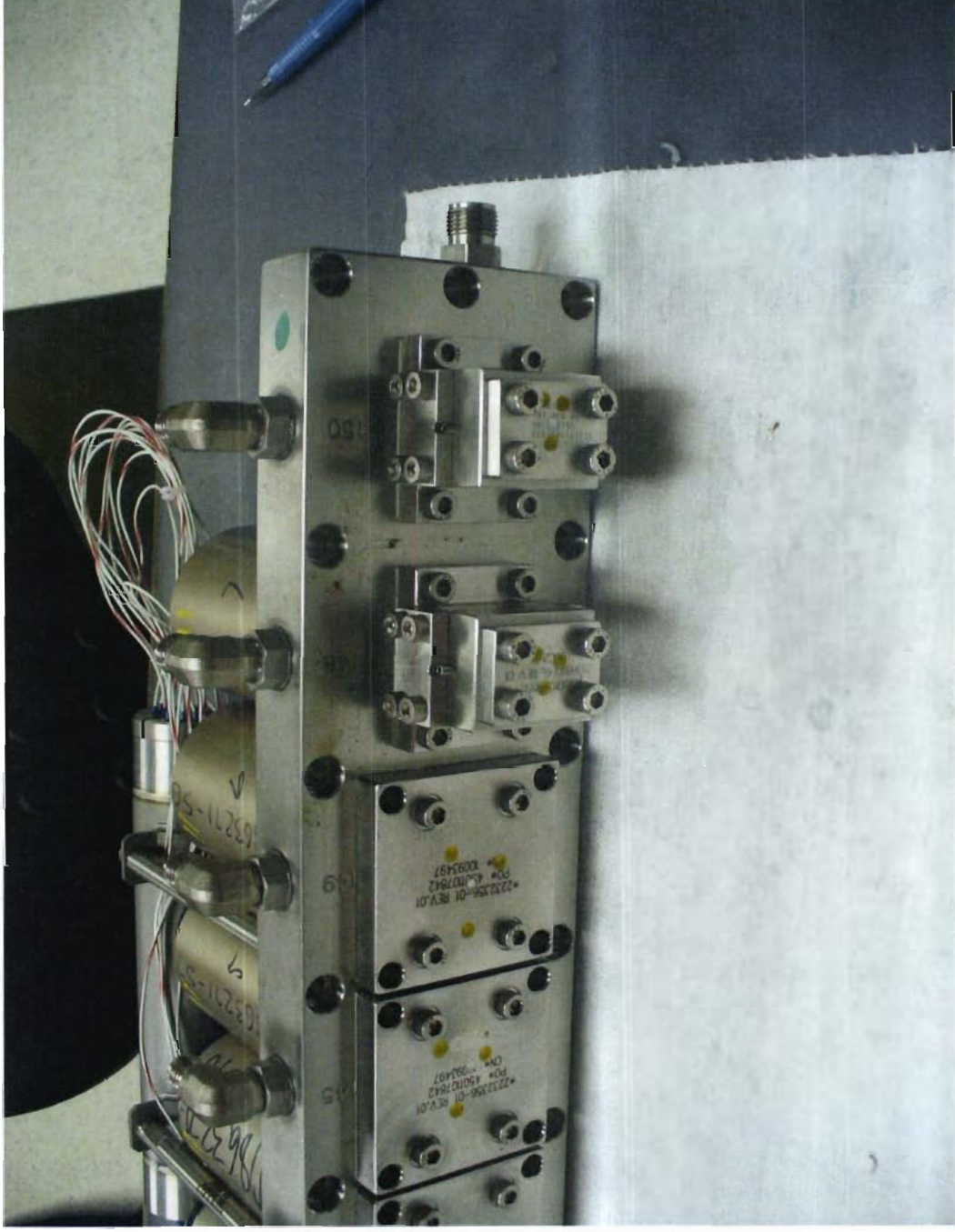
- **SDM (Solenoid Driver Module) included in each SVM**
- **Module is dielectrically compensated**
- **Wires between SDM and coils are booted**
- **PBOF hose for SVM interconnect**
- **CANBUS communication to SEM**

# Solenoid Valve Module

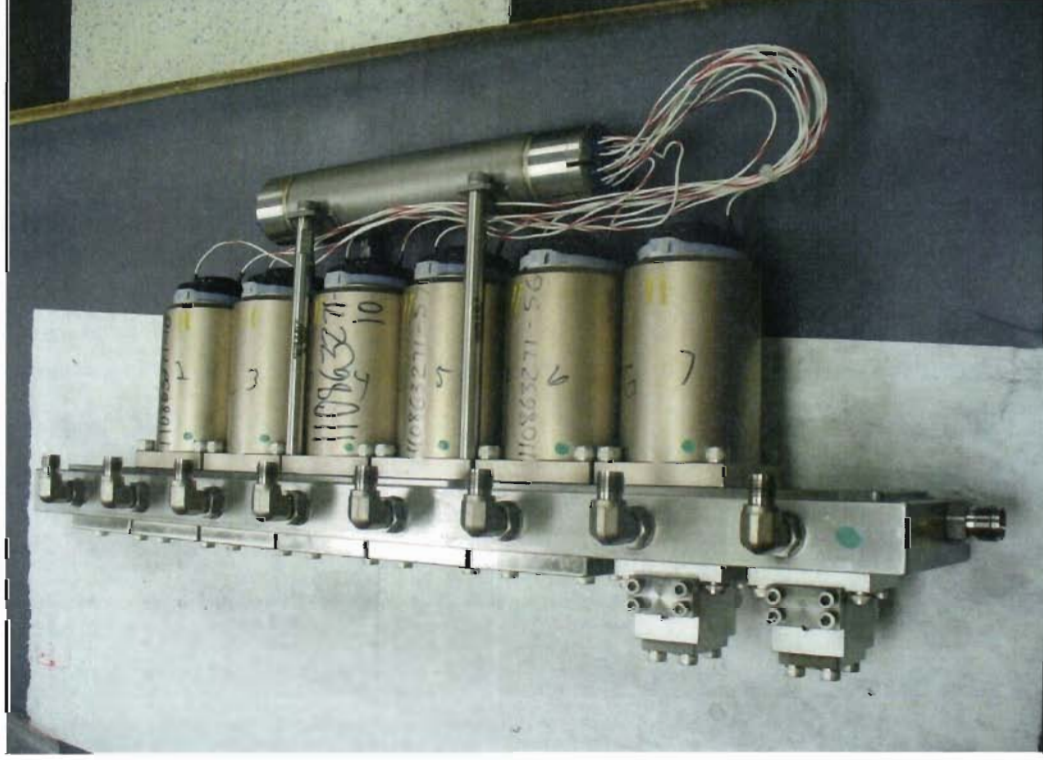




# Solenoid Valve Module



# Solenoid Valve Module

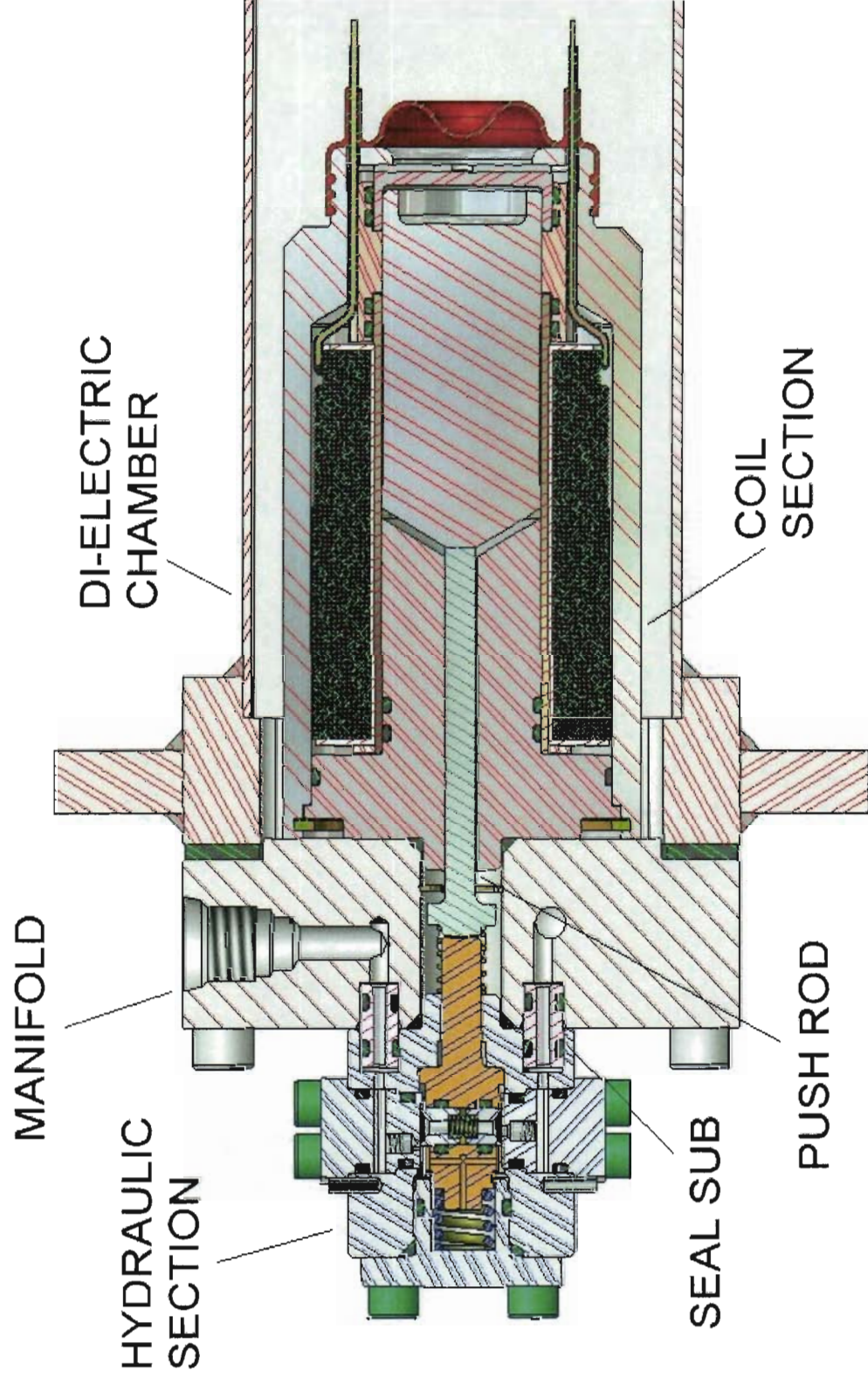




# Solenoid Valve Features

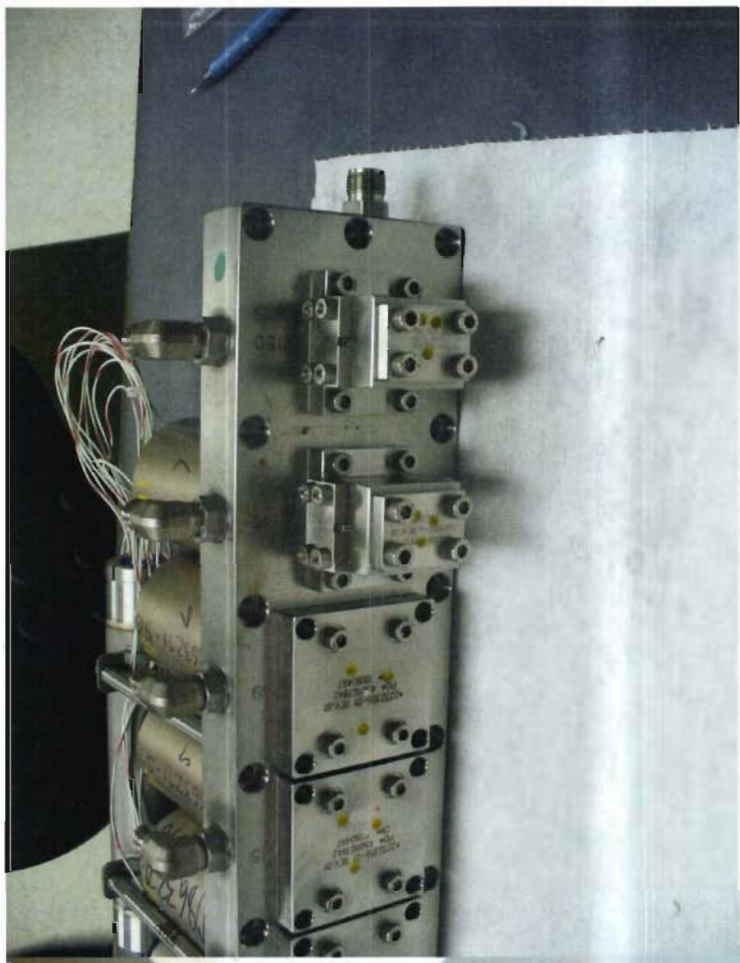
- Hydraulic section is divorce mounted
- Coil section is compensated with dielectric
- Single coil design with higher pull-in force
- Premium seal plates and seal ring materials

# Solenoid Valve Assembly

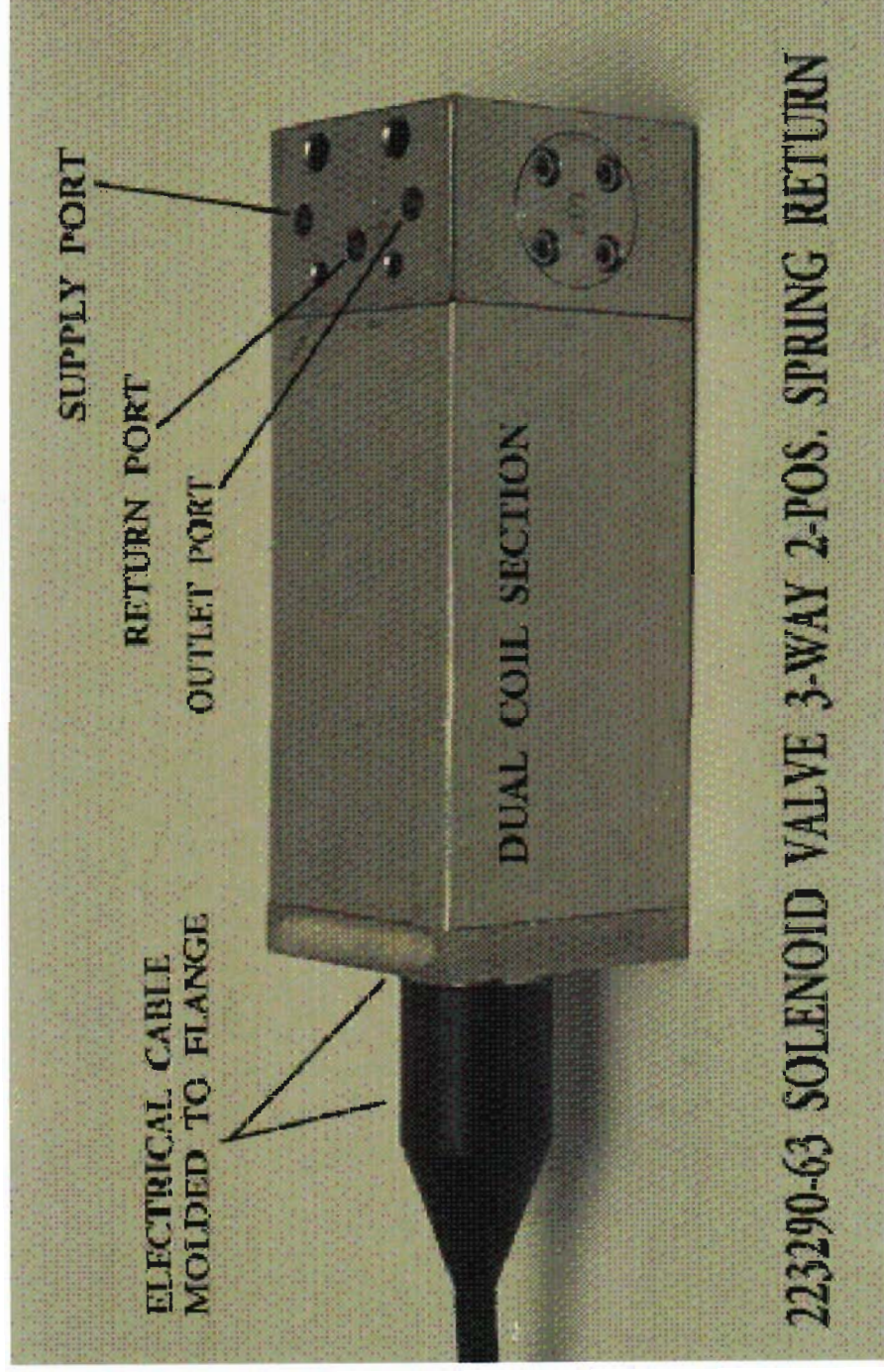




# Solenoid Valve Assembly



# Legacy -63 Solenoid Valve



223290-63 SOLENOID VALVE 3-WAY 2-POS. SPRING RETURN

With the -63 you get 77 to 107 1 ATM Chambers per POD



# Legacy -63 Solenoid Valve & Pie Connector

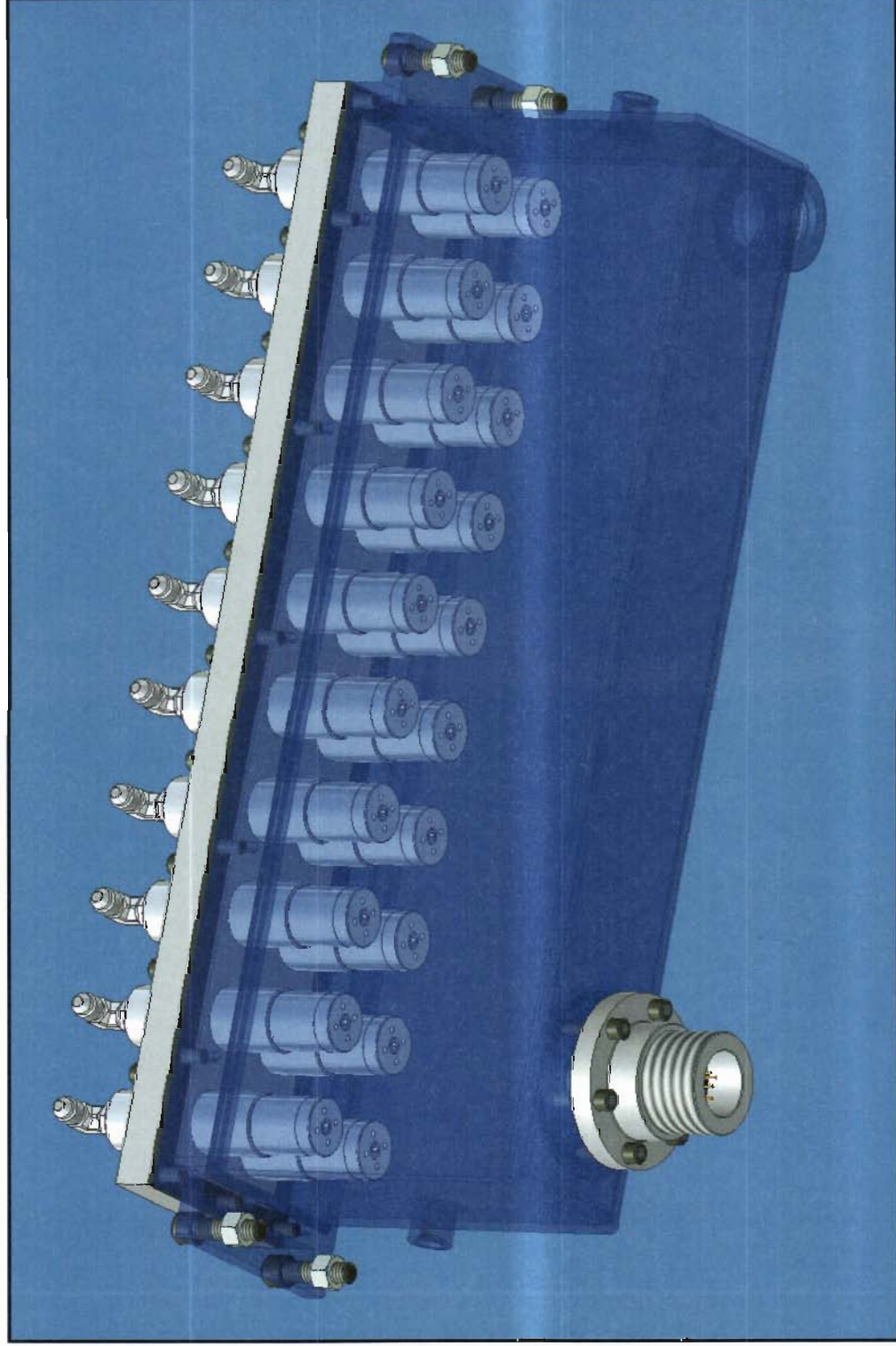


## PTM (Pressure Transducer Module)

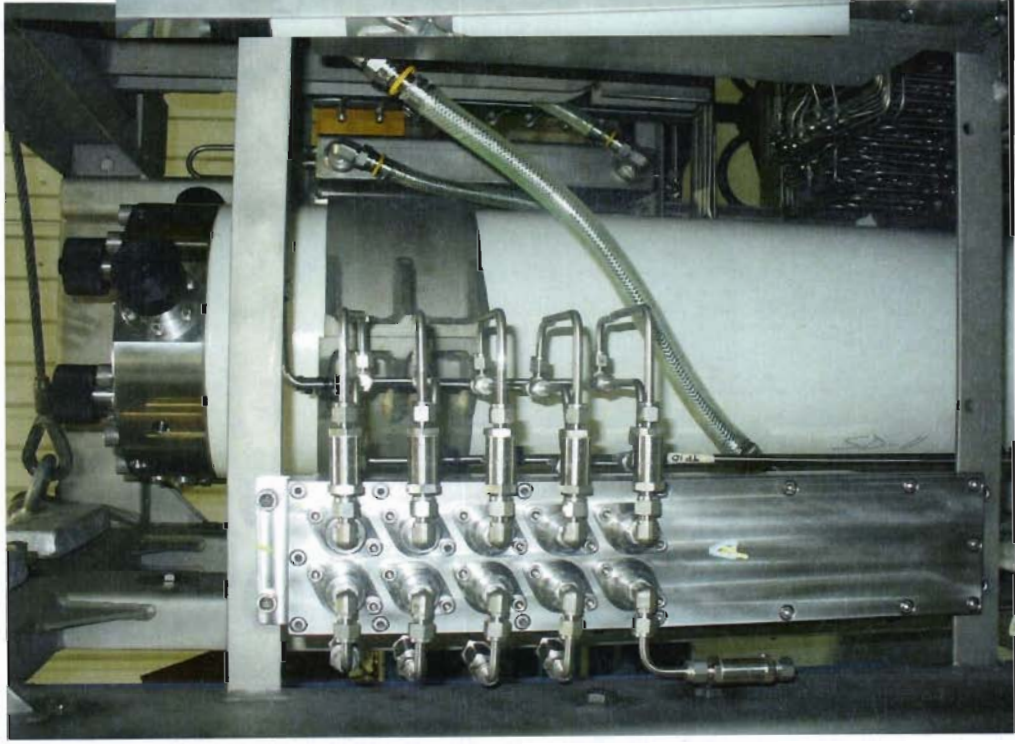
- Compensated Dielectric chamber
- External mounting
- Wires between Transducers are booted
- CANBUS communication to SEM
- Eliminates 1 ATM chambers



# Pressure Transducer Module



# Pressure Transducer Module

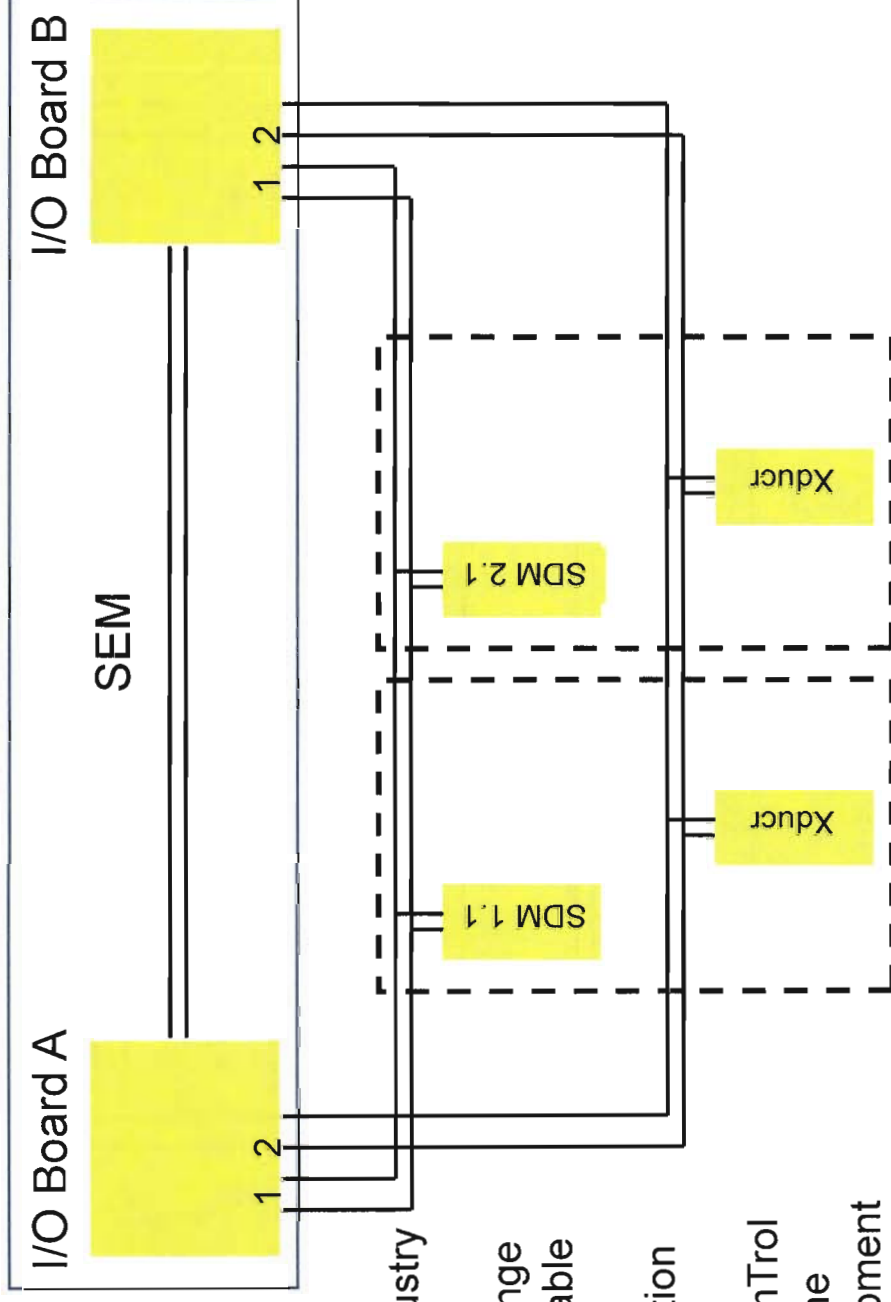




# Legacy Pressure Transducer Module



# MUX System Architecture

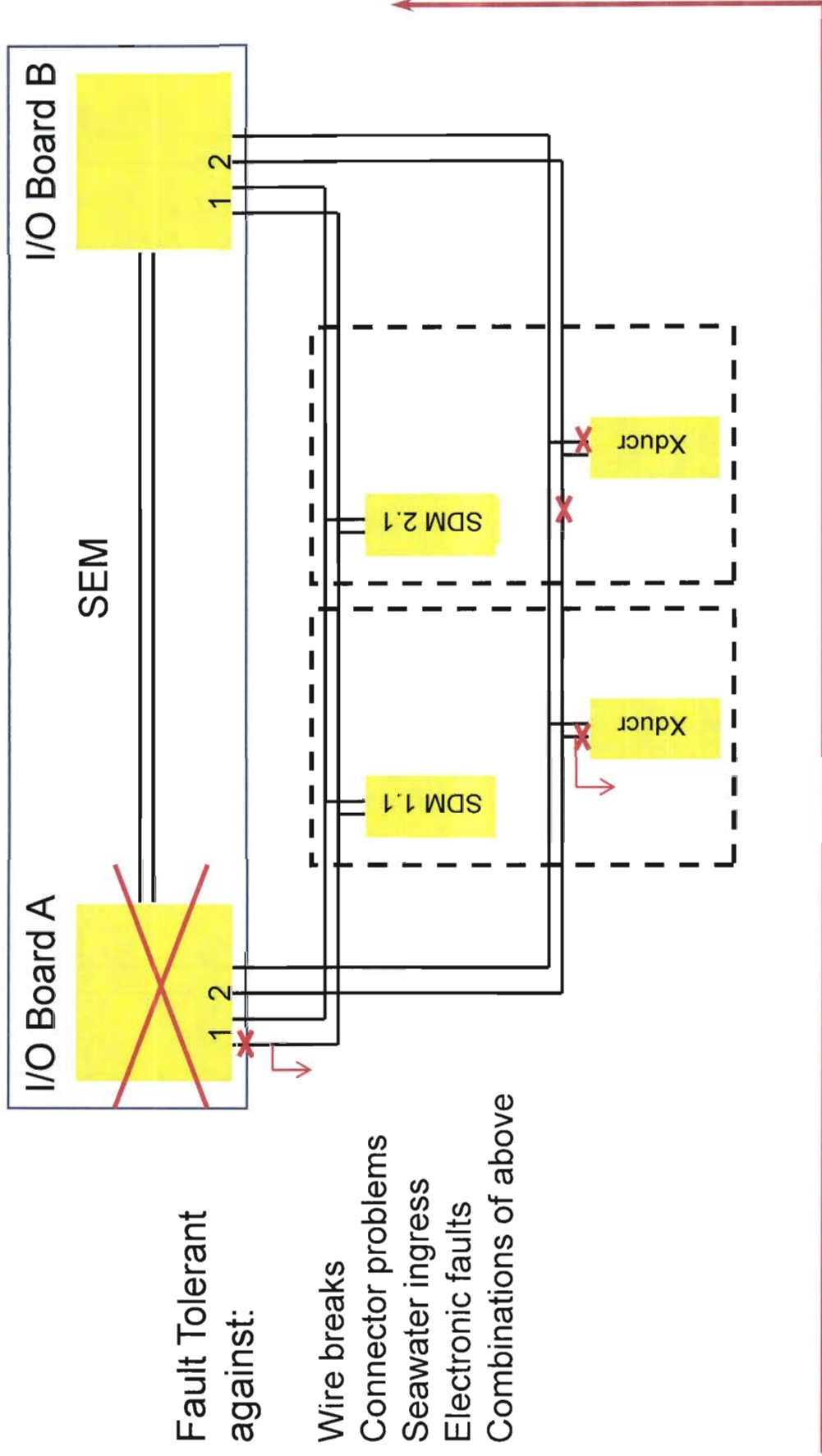


## Why CAN?

- used in the auto industry
- fault tolerant
- wide temperature range
- compact chips available
- cost effective
- low power consumption
- industry standard
- used in the new CamTrol SEM, as well as in the Electric Tree development



# MUX System Architecture



Fault Tolerant  
against:

- Wire breaks
- Connector problems
- Seawater ingress
- Electronic faults
- Combinations of above

## Mod Section





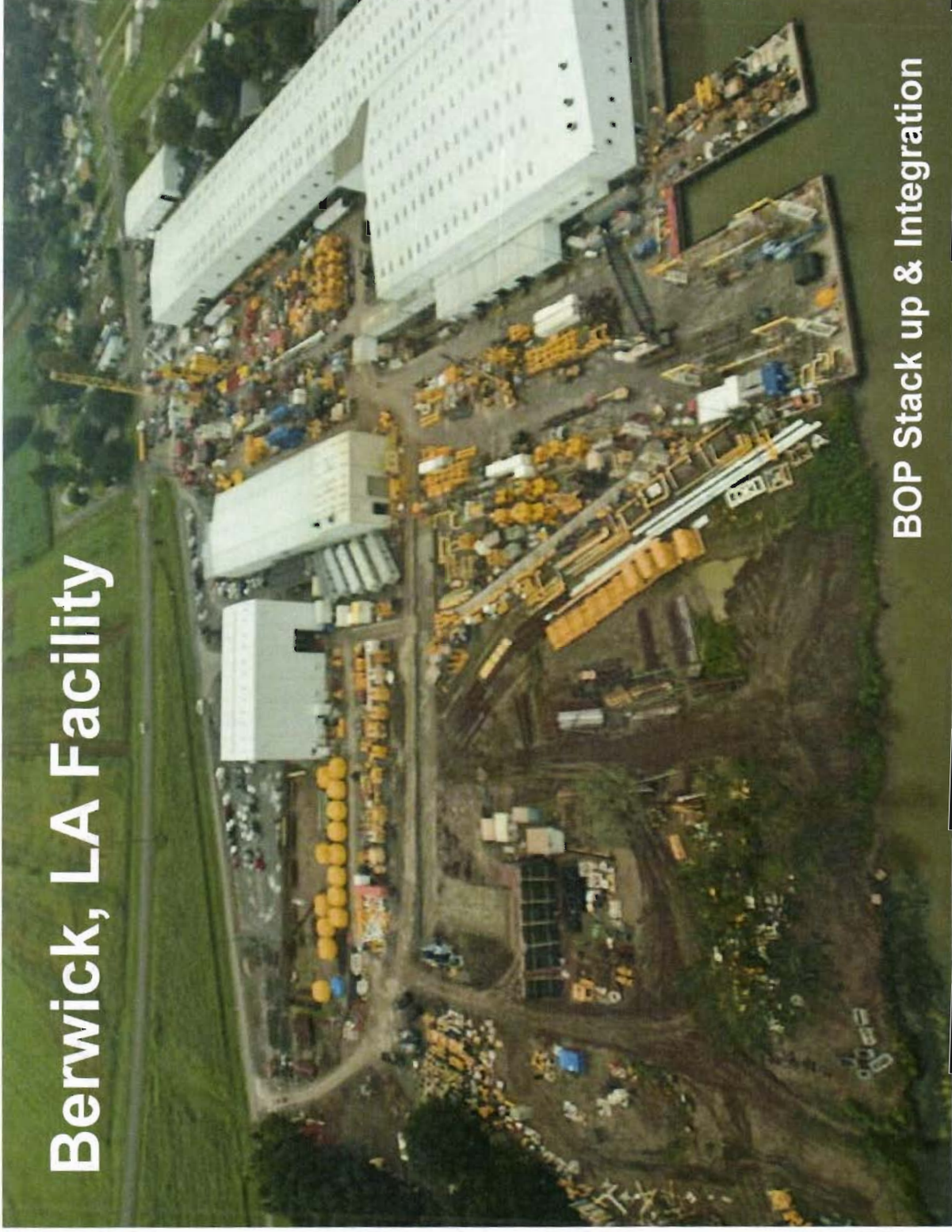
## Mark III MOD Features

- Premium Deepwater Valve and Regulator series
  - ✓ 1-1/2" and 3/4" Regulators
  - ✓ 1-1/2", 1", 3/4", 1/2", and 1/4" Valves
- Field Proven Pressure Balanced Retractable Stingers



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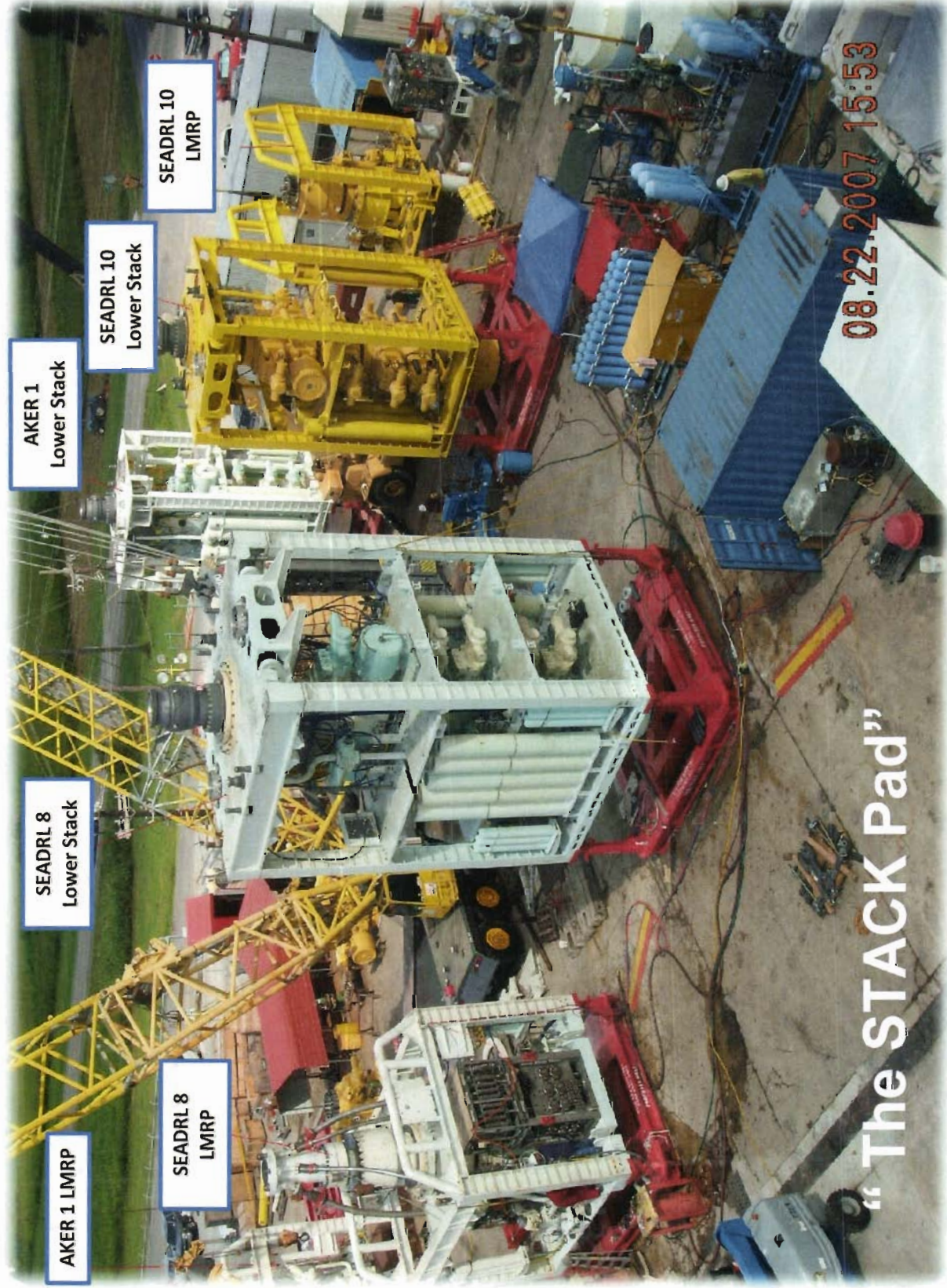
# Berwick, LA Facility



BOP Stack up & Integration

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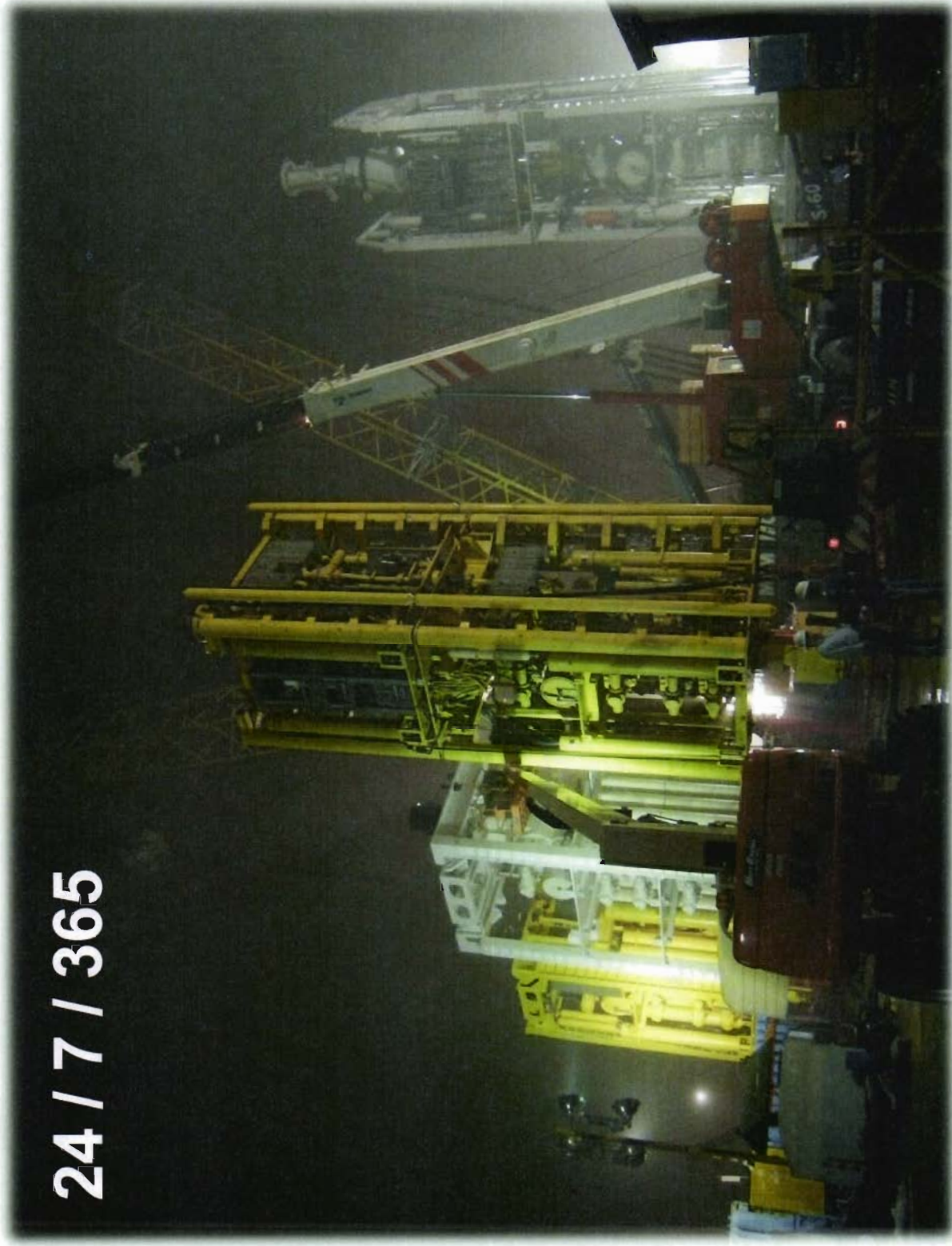






DRILLING & PRODUCTION SYSTEMS

24 / 7 / 365

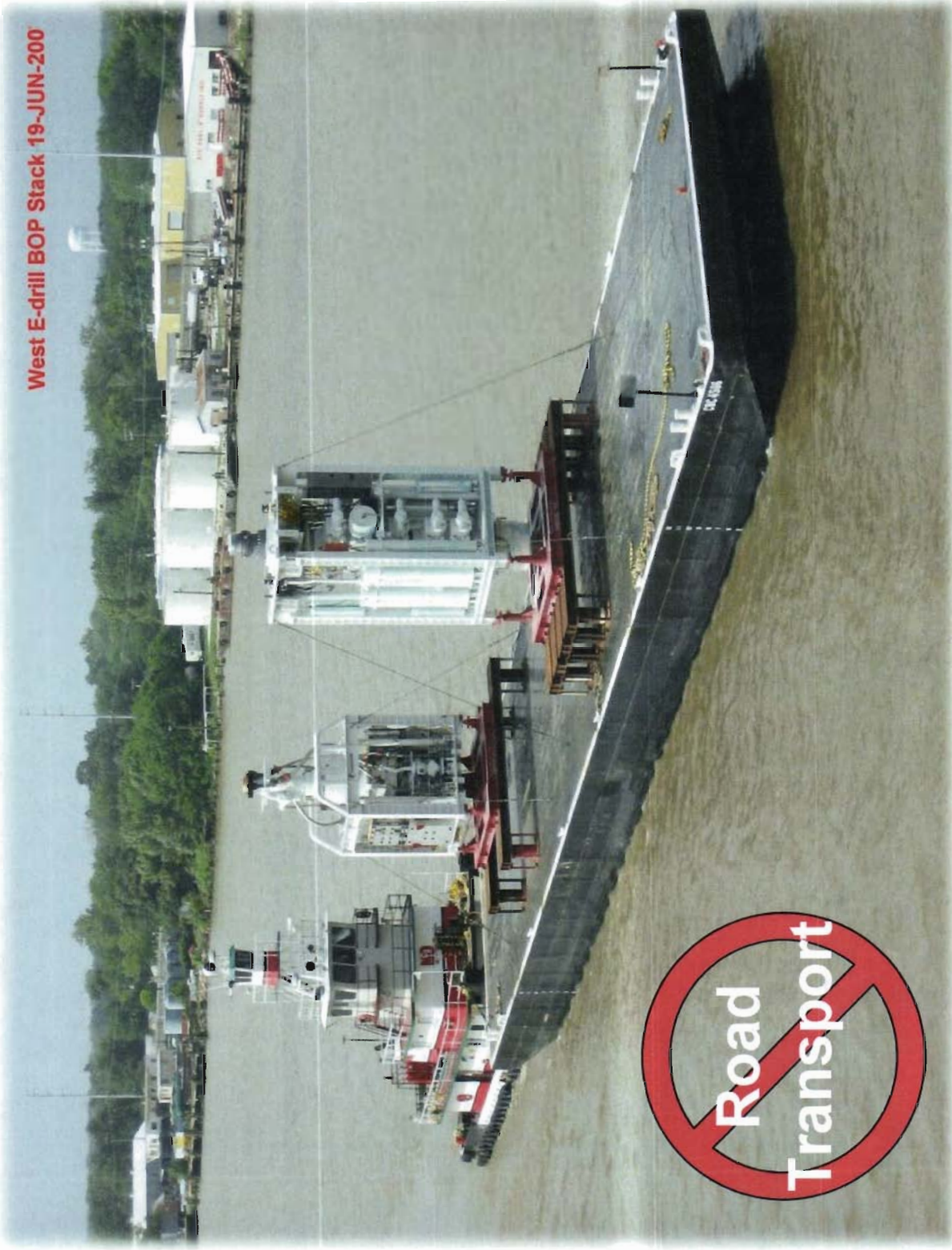


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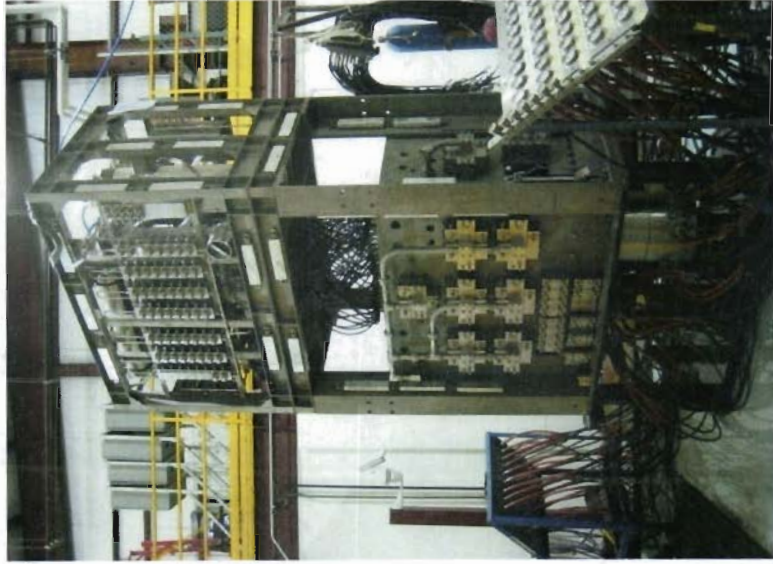


DRILLING & PRODUCTION SYSTEMS



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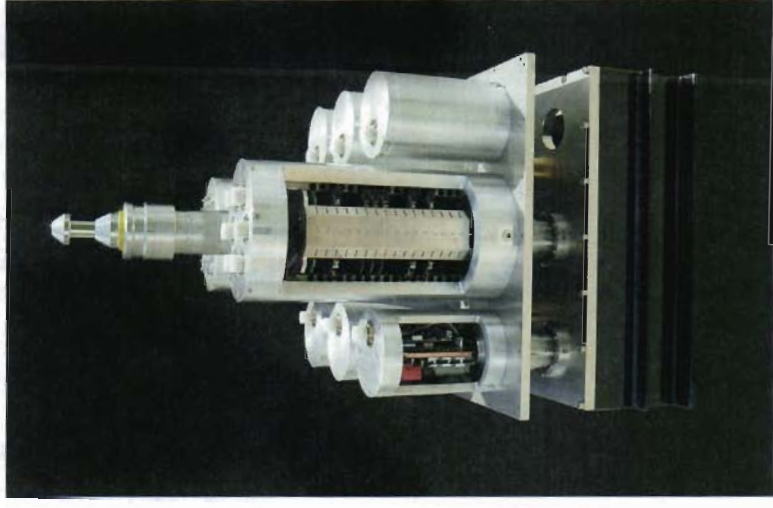
# Why Cameron Mark III?



MUX Drilling Systems



Camtrol SCM



Camtrol DC SCM





## DRILLING & PRODUCTION SYSTEMS



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DRILLING & PRODUCTION SYSTEMS



the Industry Leader in  
MUX Control Systems

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