MPP (Multi Phase Pump) Preservation by Subsea Accumulator Modules

Majid Talebi, Senior Engineer & Technical Advisor
Pressure Dynamics

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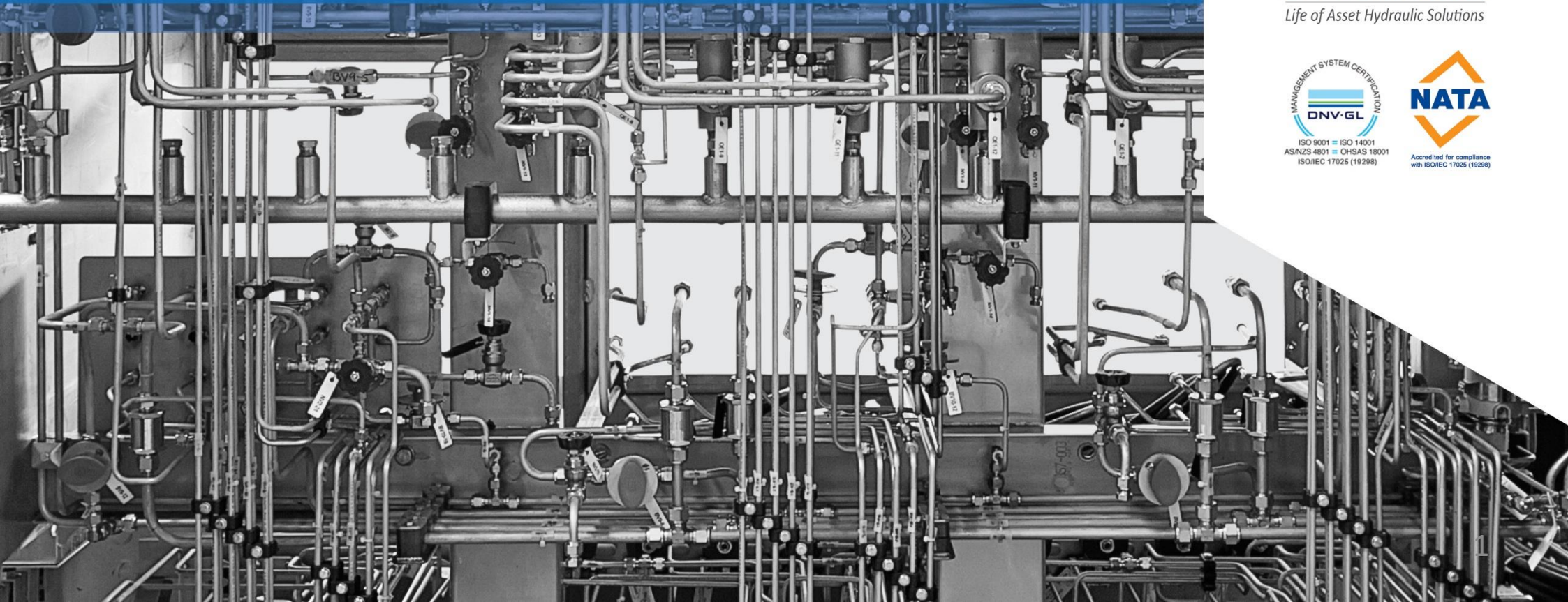
MANAGEMENT SYSTEM CERTIFICATION DNV·GL
ISO 9001 = ISO 14001
AS/NZS 4801 = OHSAS 18001
ISO/IEC 17025 (19298)

NATA
Accredited for compliance with ISO/IEC 17025 (19298)



The Vincent Field

- Is located approximately 40km offshore, north-west of Australia North West Cape.
- 60 % ownership by Woodside and 40% by Mitsui E&P Australia.

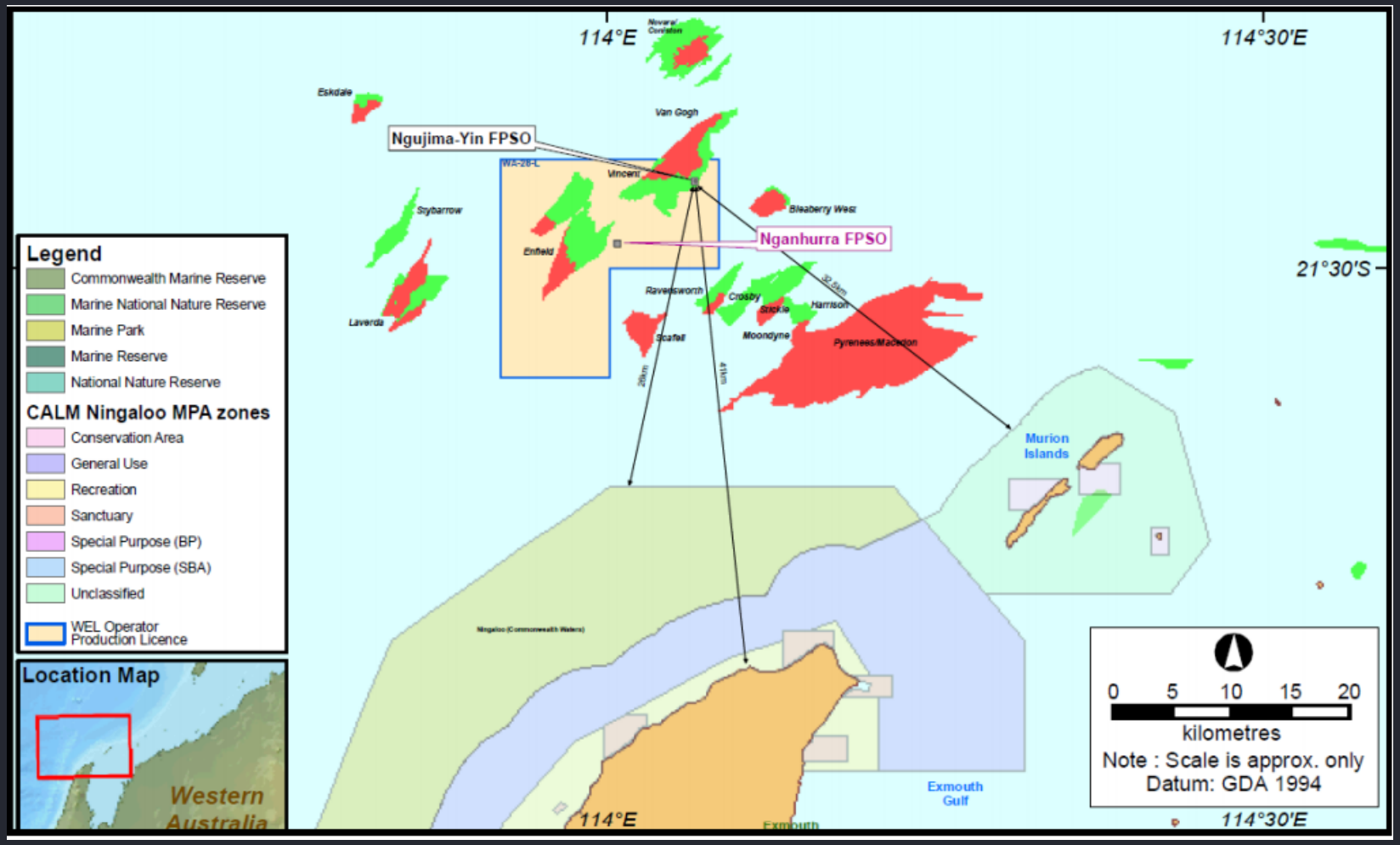


Image: Courtesy of Woodside Energy

And Ngujima-Yin FPSO

- Is a 332 metre double hulled tanker built in 2000 and converted into an offshore production facility to produce oil from the Vincent oil field.
- Is part of Greater Enfield project. Woodside are overhauling Ngujima-Yin FPSO in dry-dock from May 2018.

Have This Subsea Layout.

- 2 Production Manifolds including two Multiphase Pumps.
- 6 wells are connected to production manifold A and the other 6 to production manifold B.

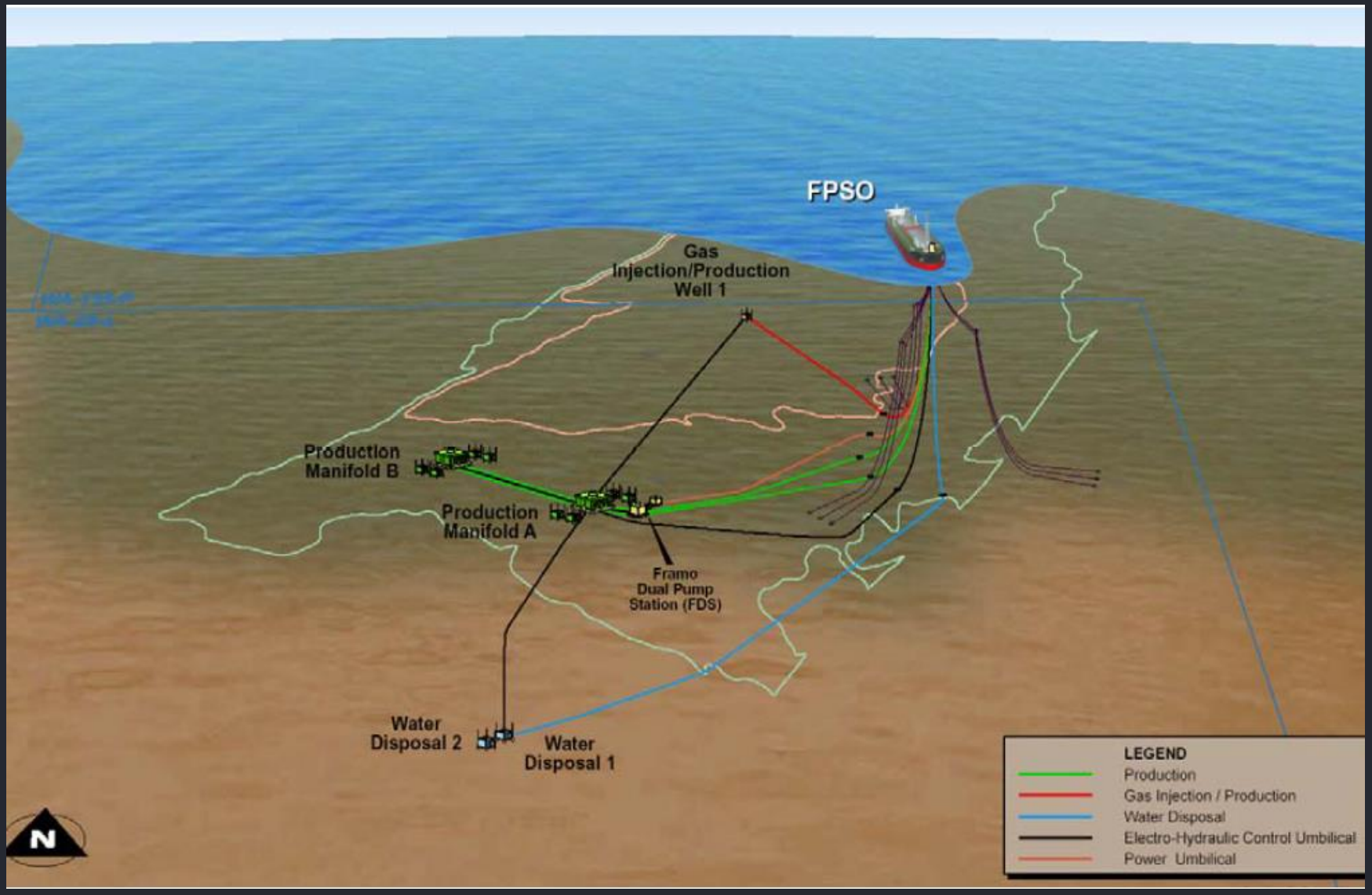


Image: Courtesy of Woodside Energy

The Vincent Multiphase Pumps

- Are Located 375m Below Sea Level

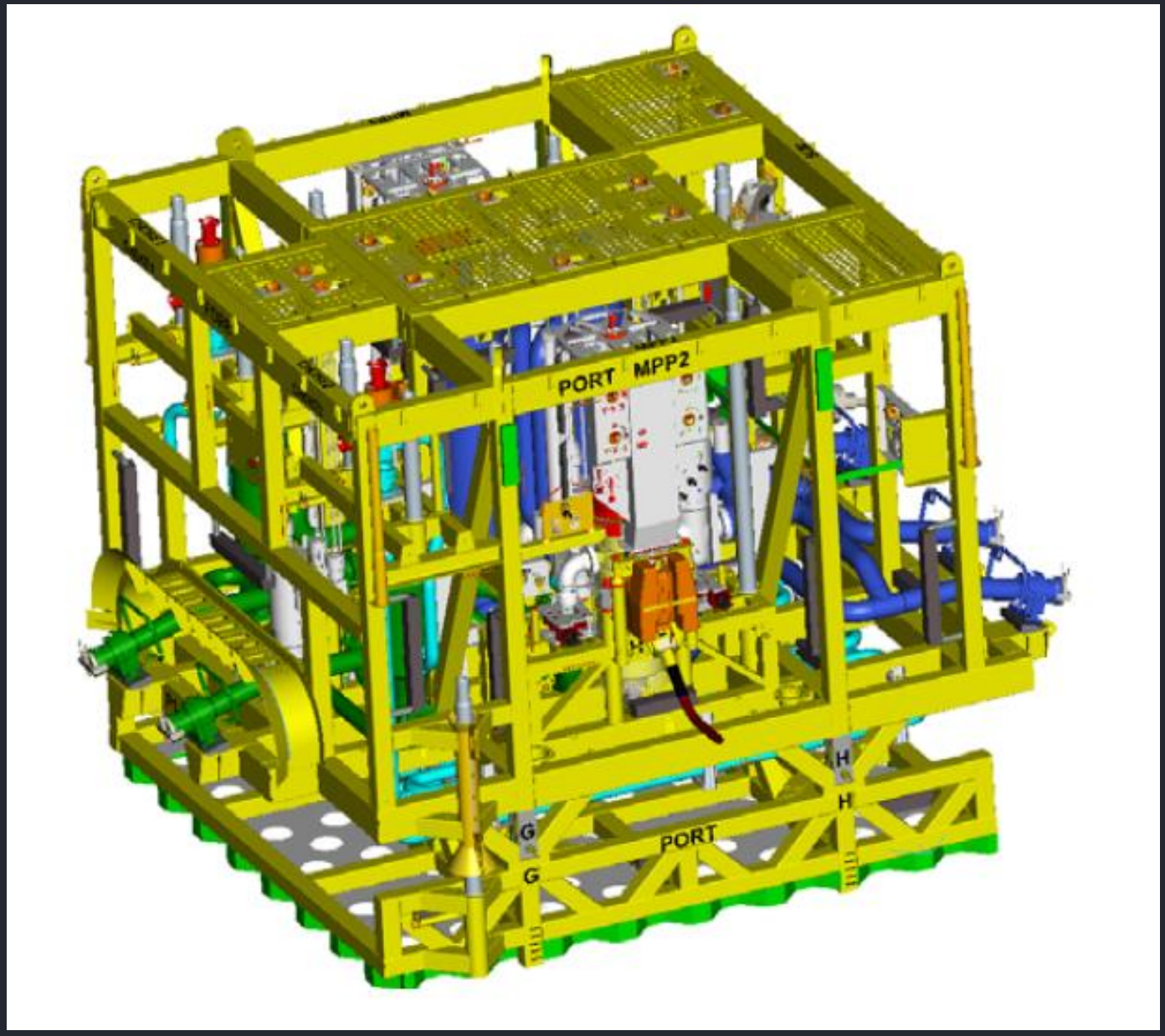


Image: Courtesy of OneSubsea

Are of The Following Type

SUBSEA BOOSTING PUMP TYPES

TABLE 2 – PUMP TYPES & APPLICATIONS

	TYPE	NORMAL CONFIG.	APPLICABILITY FOR SUBSEA BOOSTING
1	CENTRIFUGAL	HORIZONTAL OR VERTICAL	● Highest differential pressure capability among pump types. ● Handles low Gas Volume Fraction (GVF) < 15% at suction conditions.
2	HYBRID (CENTRIFUGAL & HELICO-AXIAL)	VERTICAL	● Combination of helico-axial and centrifugal impeller stages. ● Primary application is for use downstream of separator or in low GOR applications where GVF is consistently < 30% at suction conditions.
3	ESP	HORIZONTAL OR VERTICAL	● Widely deployed technology used for boosting in wells, caissons, flowline risers, and mudline horizontal boosting applications. ● Applicable for GVF < 50%.
4	HELICO-AXIAL	VERTICAL	● Applicable for higher GVF boosting applications – typical range of 30-95% GVF at suction conditions. ● Moderate particulate tolerance.
5	TWIN SCREW	HORIZONTAL OR VERTICAL	● Good for handling high GVF – up to 98% GVF at suction conditions. ● Preferred technology for high viscosity fluids.

Image & Data: Offshore Magazine Poster No. 022113

Vincent Multiphase Pump Specifications:
Differential Pressure: 28bar, Flow Rate:2,700 M3/Hr
Motor Power: 1.8MW

And The Following Pump Components.

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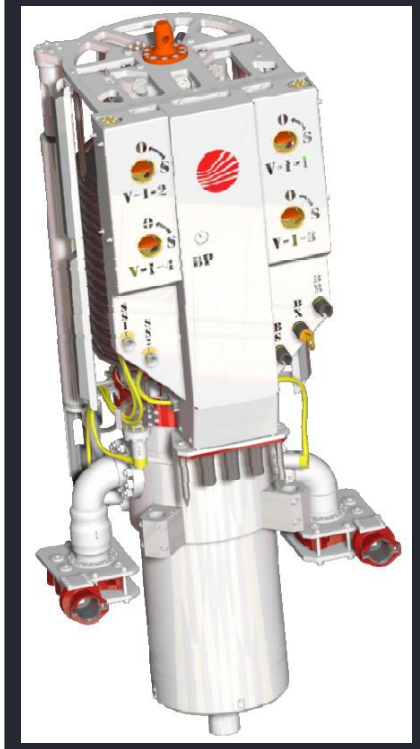
Multiphase Pumps Main Items:

- Electric motor
- Pump impellers and diffusers
- Bearings
- Mechanical seals
- Oil cooling system
- Pump and motor casing
- Electrical connectors
- Hydraulic connectors
- Mechanical clamp connectors
- ROV panel
- Instruments



Images: Courtesy of OneSubsea & Offshore Magazine Poster No. 022113

The Risk of Barrier Fluid Pressure Drop

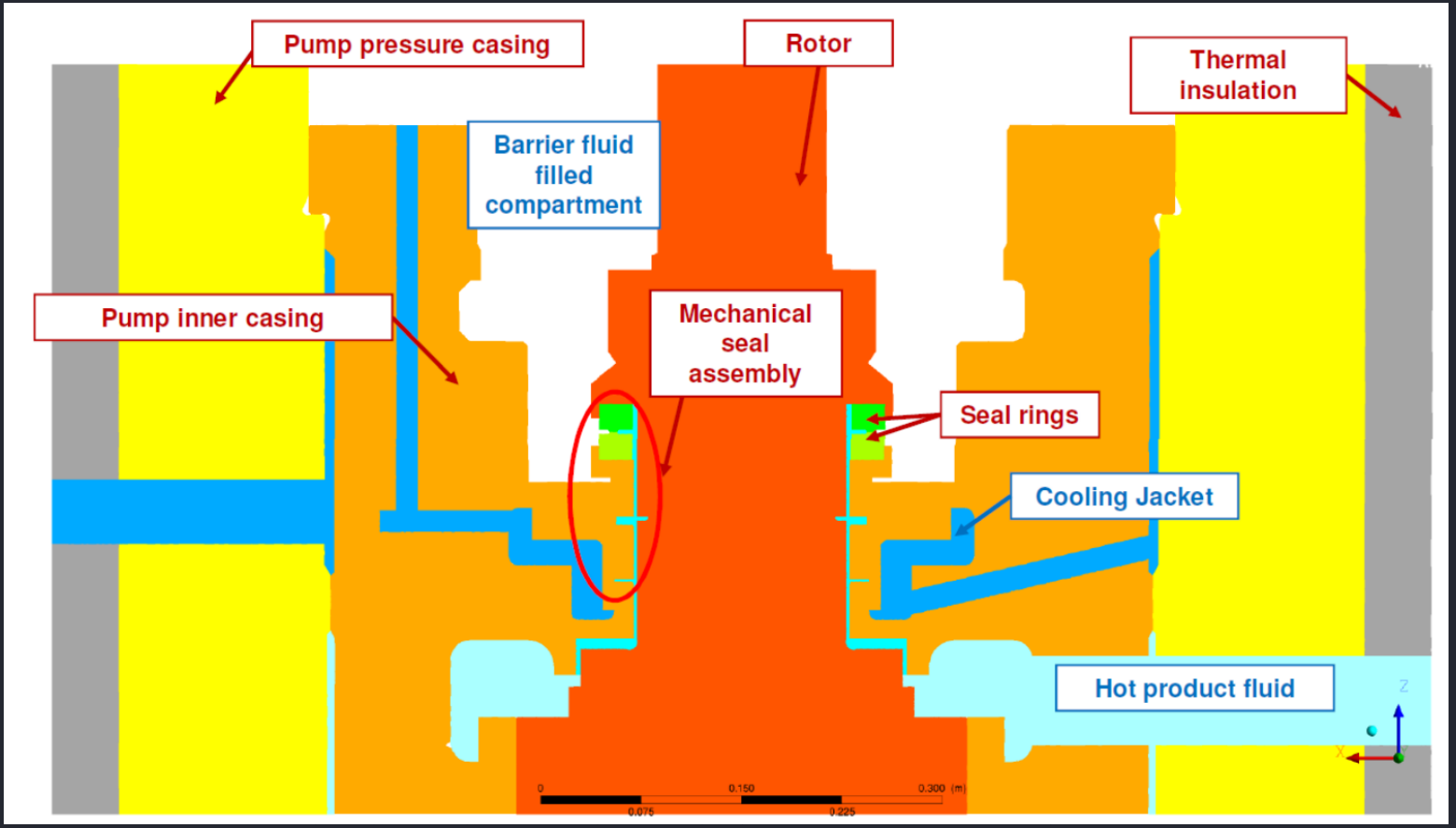
Multiphase pumps' barrier fluid system:

- ✓ **Prevents production fluid & sea water to ingress the electric motor and pump assemblies.**
- ✓ **Assists with motor cooling.**
- ✓ **Lubricates bearings & seals.**

MPP Failures Consequences:

- Around $10Million Per Pump

- 2 Years Reduced Production i.e. Hundreds of Millions As Lost Revenue



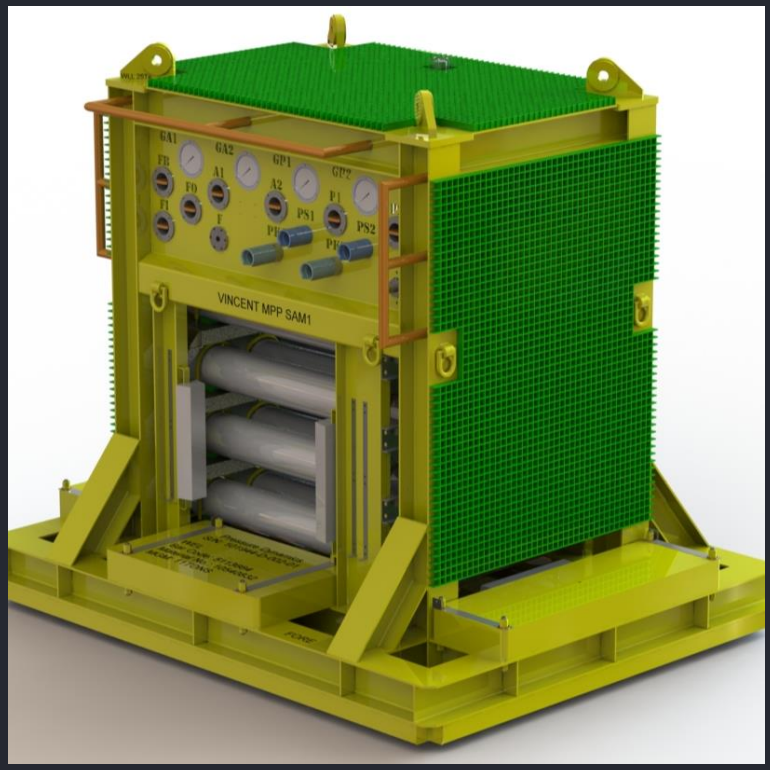
Images: Courtesy of EagleBurgmann - Sulzer

Can Be Managed By Maintaining Differential Pressure.

ROV to Pressurise The Barrier Fluid

- Costly & Unreliable (Over $800k Per Deployment),
- Required To Be Done On A Regular Basis

Pressure Dynamics SAM
(Subsea Accumulator Module)



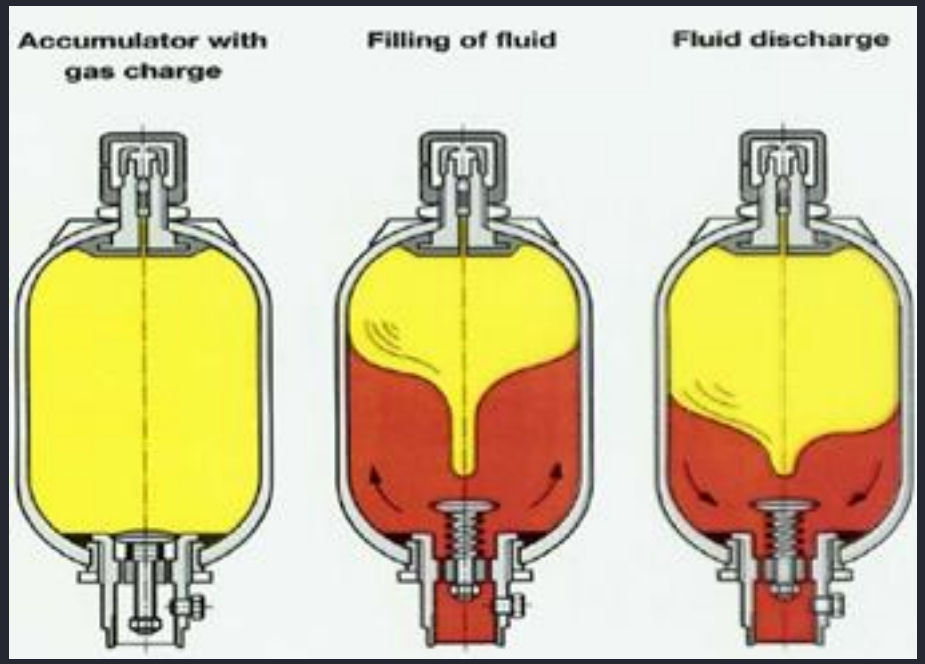
- Cost-Effective & Reliable
- Permanent Source of Pressure As Trickle Charge for MPPs
- Selected by Woodside to Preserve MPPs

Designing PD's SAMs For Vincent

- Series of Bladder Accumulators (Hydraulic Batteries)
- Subsea Hydraulic Connectivity to MPPs
- ROV Operated Control Valves (System Commissioning, De-Commissioning & Redundancy)
- ROV & Wireless Acoustic Communication
- Subsea Hydraulic Re-Charging Capability (Extend life of unit subsea)
- SAM's Output Pressure at Location: 26 Barg
- Ambient Pressure: 39 Bara
- Ambient Temperature: 5-25°C

Image : Courtesy of Pressure Dynamics

Principles of Bladder Accumulators



SAM Pressure Needs To Be Monitored After Deployment

Monitoring SAMs Pressure

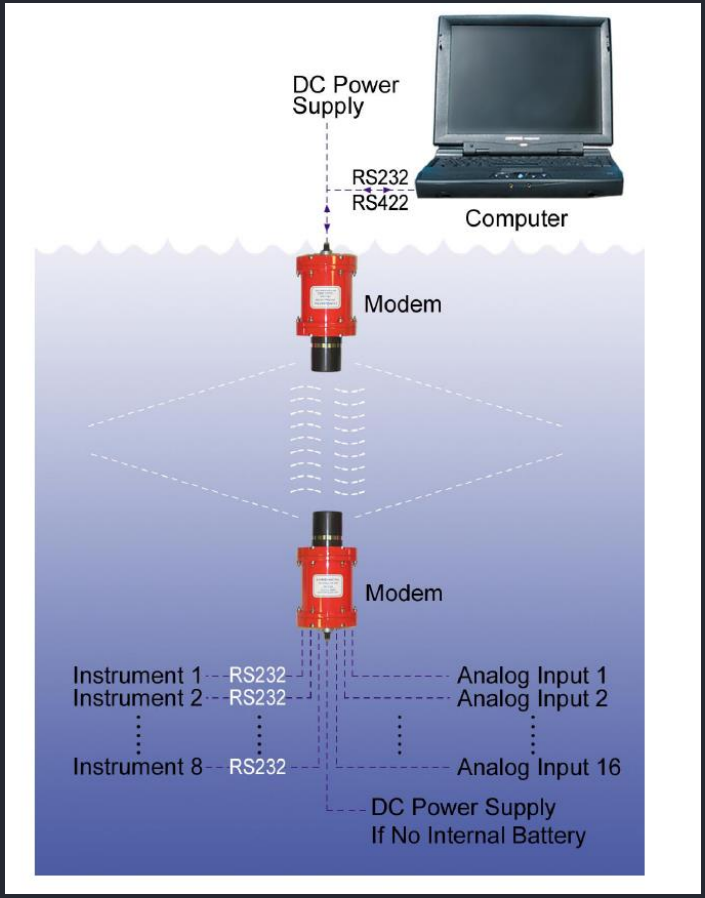


Image: Courtesy of Link-Quest

Acoustic Monitoring - Preferred

Image: Courtesy of Pressure Dynamics

Pressure Gauges Via ROV

Image: Courtesy of Siemens

Direct Connection to Tronic Connector Utilising ROV

And This is How All Methods Can Be Used.

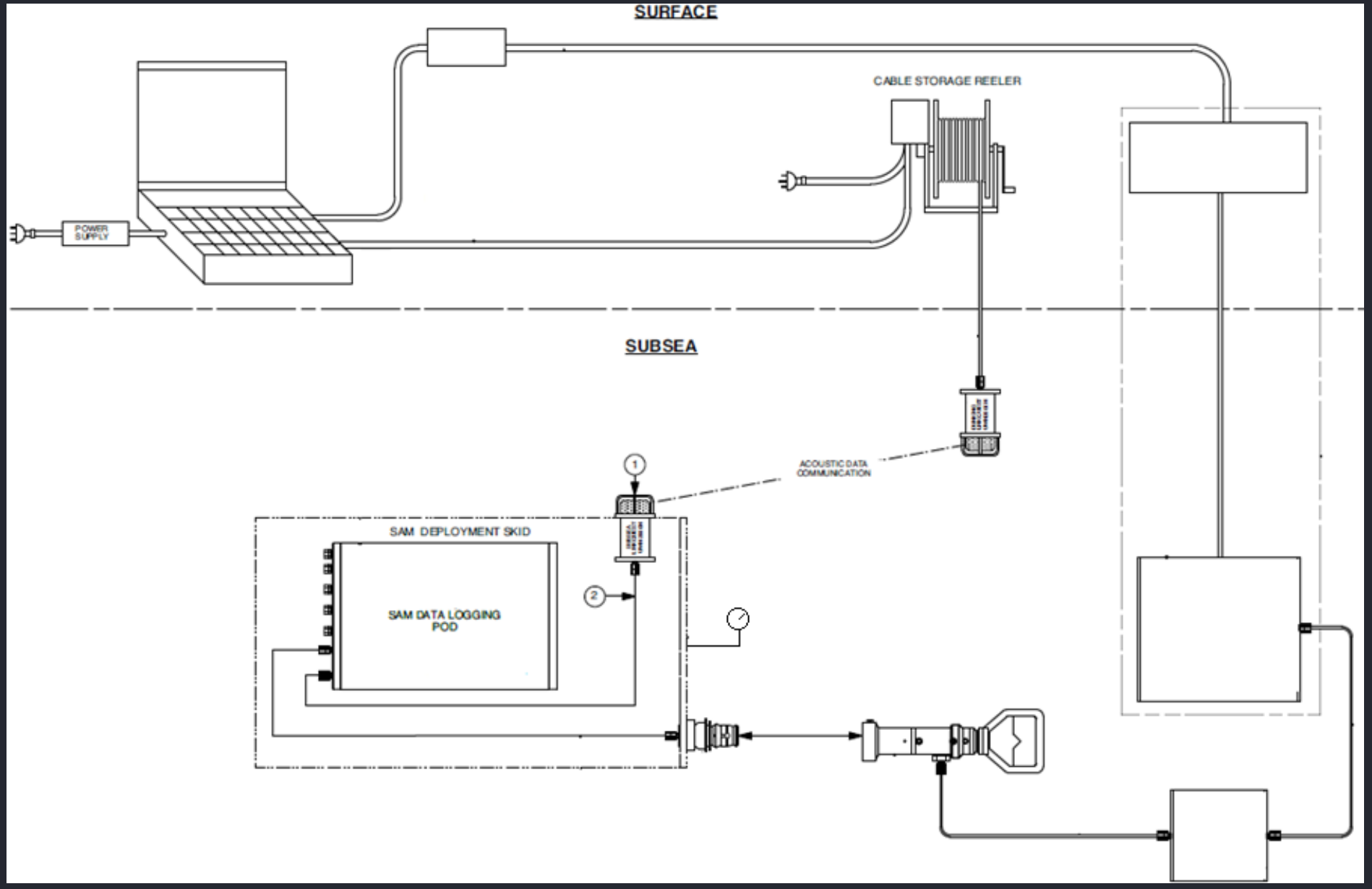


Image: Courtesy of Pressure Dynamics

Design

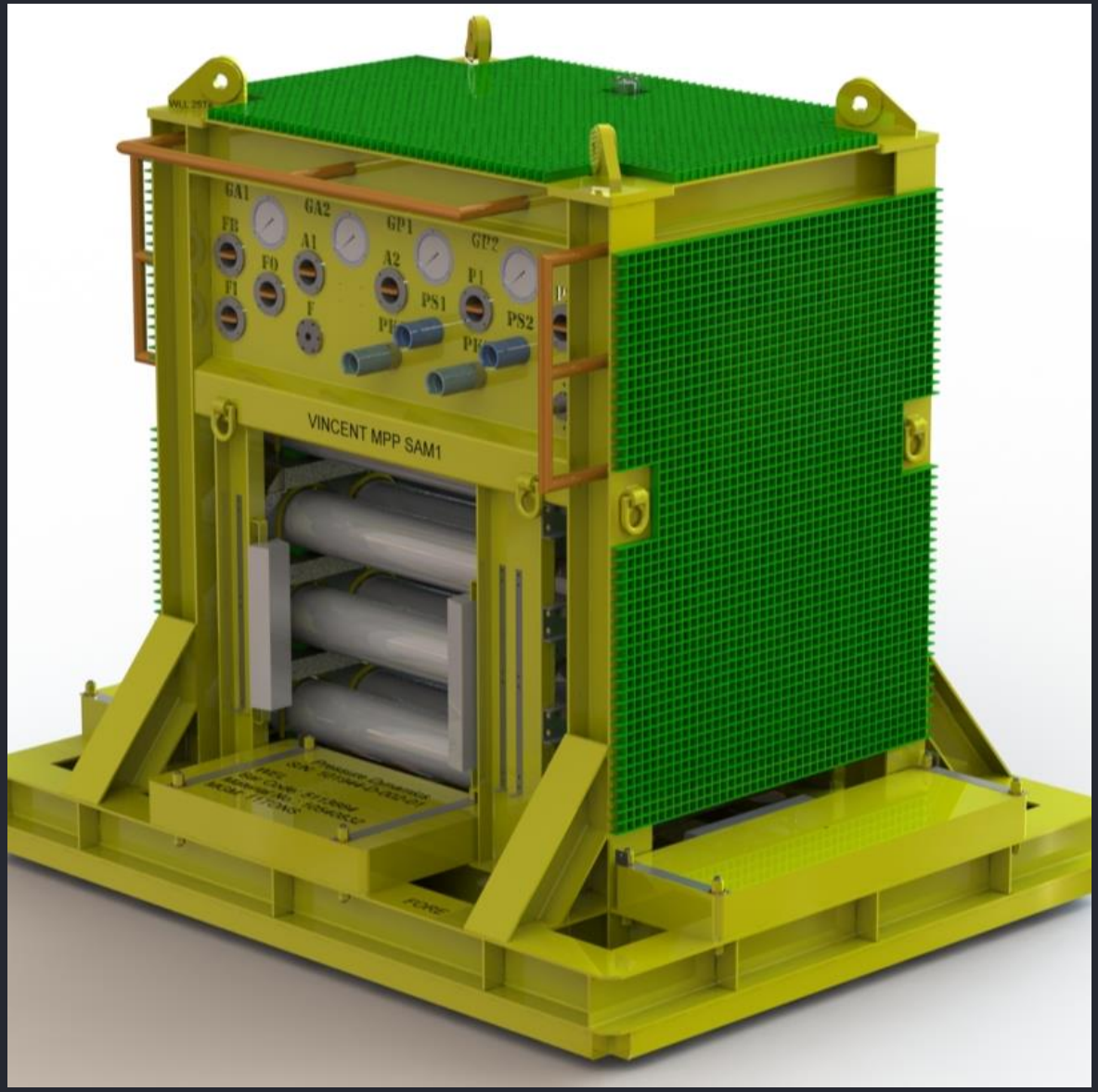


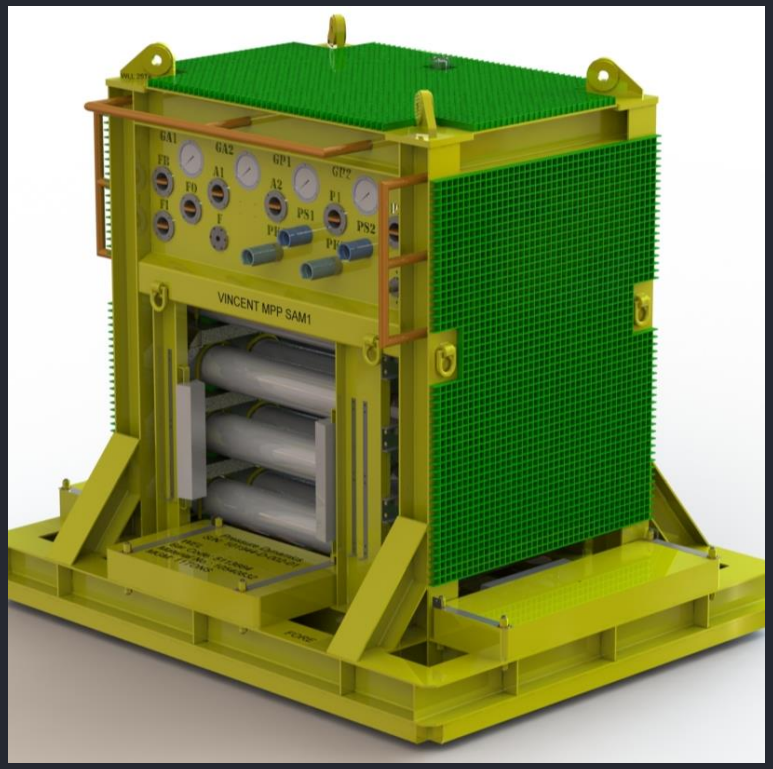
Image: Courtesy of Pressure Dynamics

- ✓ Hydraulic System designed by Pressure Dynamics
- ✓ Close collaboration with Woodside on frame and mud matt design
- ✓ Team effort by all stakeholders to achieve a long term cost effective solution
- ✓ Designed and Built in Pressure Dynamic Workshop in Perth
- ✓ Local Service & Support by Pressure Dynamics

Built

Image: Courtesy of Pressure Dynamics

- Built and Delivered on Schedule



Shipped from Pressure Dynamics Facility

Image: Courtesy of Pressure Dynamics

Successfully Deployed & Operational

Image: Courtesy of Woodside

Successfully Deployed & Operational

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Design, Build, FAT & Delivery In 6 Months by Pressure Dynamics in Perth

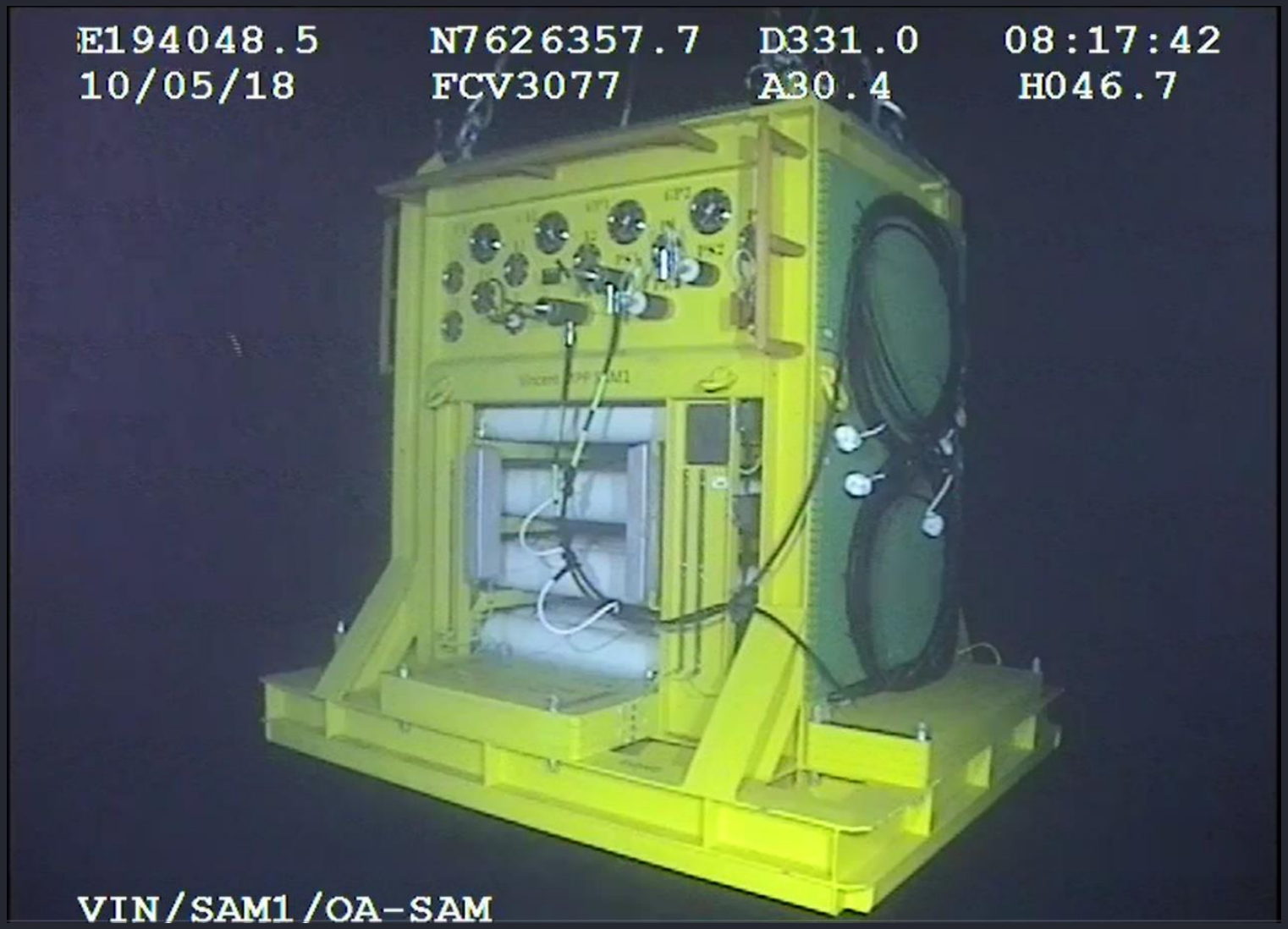

Image: Courtesy of Woodside

Thank You!

Questions?