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
### Table 2 – Pump Types & Applications

<table>
<thead>
<tr>
<th>Type</th>
<th>Normal Config.</th>
<th>Applicability for Subsea Boosting</th>
</tr>
</thead>
</table>
| 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. |

### Vincent Multiphase Pump Specifications:
- Differential Pressure: 28bar
- Flow Rate: 2,700 M3/Hr
- Motor Power: 1.8MW
And The Following Pump Components.

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 $10 Million 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.

- 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

Direct Connection to Tronic Connector Utilising ROV

Image: Courtesy of Siemens
And This is How All Methods Can Be Used.

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

- Built and Delivered on Schedule

Image: Courtesy of Pressure Dynamics
Shipped from Pressure Dynamics Facility

Image: Courtesy of Pressure Dynamics
Successfully Deployed & Operational

Image: Courtesy of Woodside
Successfully Deployed & Operational

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

Image: Courtesy of Woodside
Thank You!

Questions?