HYDRAULIC WORK OVER
SAFETY THROUGH INNOVATIVE DESIGN
Introduction

• Following several successful land-based operations CCI were awarded a scope of work to develop an offshore compliant hydraulic work over unit for a local WA operator

• CCI completed a BOD with innovative safety design features at the forefront of the design criteria

• These designs and engineered solutions eliminate many risks present with Hydraulic work over operations and ensure the safety and wellbeing of the operating crew
Safety in Design

The “Safety in Design” principle ensures that hazards arising from equipment design are assessed and mitigated during the design phase. The process commences early in the design where the opportunity to achieve step change improvement in safety outcomes is the greatest.

Ref: W1000SF5568513 Rev 1 Engineering Standard Safety in Design

- Hazards are identified, analysed and understood;
- The design complies with relevant regulations codes and standards;
- Risks are tolerable and it can be demonstrated, in the early phases of a project, that the decisions made will help on the path to achieving a design where the risk is ALARP;
- Safety design measures that are provided to protect personnel are suitable for the hazardous events which they are designed to manage.
## MAE & Fatality Risks (DESIGN PERSPECTIVE)

<table>
<thead>
<tr>
<th>MAE / Fatality Risk</th>
<th>Causes</th>
<th>Preventing controls (Design)</th>
<th>Mitigating Controls (Design)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural collapse of HWU</td>
<td>Extreme Weather Event, Mechanical Overload, Incorrect Installation</td>
<td>• API 4F Design – 100yr Storm Case for region</td>
<td>• Multiple escape routes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Grillage support beams</td>
<td>• Digital wind speed monitor &amp; alarm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dynamic loads independent of frame</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Modular components designed to install in specific configuration</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Struck by rotating Equipment (Hydraulic Tong)</td>
<td>• Back up failure / not engaged, Operator in Line of Fire, Safety line not installed, Snub point not rated, Handrails not sufficient / in place</td>
<td>• Remote Control Panel removes operator from red zone</td>
<td>• Permanent handrails designed to AS code</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dual rated snub point (5T) allows both make and break side to be permanently installed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical failure of equipment / components during high over-pull / jarring</td>
<td>• Parted work string, Sudden release of energy, Struck by equipment</td>
<td>• Remote control removing personnel from work basket / red zone</td>
<td>• Beveled edges on work window</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pressure control admin switch limiting overpull</td>
<td>• Dead man switch on jack &amp; Slips</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Design features attributed to a safer operation - HWU

- Design Standards – API4F
- Remove personnel from line of fire
- Fail safes (deadman switch)
- Large Work Area (Rig Floor)
- Hose Management (Reduction & Routing)
- Access / Egress
- Component Interface / Equipment selection
- Minimise working at heights
Design & Build Standard

Designed and built-in accordance with API 4F and Australian relevant standards. The unit can safely operate in wind speeds of 40 knots and can remain rigged up during wind speeds of 110.8 knots (Cat-4 Cyclone).
• HWU is operated via an ATEX rated RF remote control panel that syncs directly with the HPU
• During normal operating conditions housed in a semi fixed control panel on the rig floor
• During high-risk activities or when the operator needs to move to a position for better visibility the unit can be removed and is operational up to 250m from the Unit
• Remote control unit has successfully been operated to remotely Jar on a stuck string, perform high over-pulls and remove a coil tubing hanger without a single person on the unit
• HPU pressure limited with coded admin control to prevent excessive overpulls
Winch & Slip system

- Dual winch System hydraulically restricted to not exceed SWL
- Spool mode feature to allow pay out of winch line under low load condition
- Fail-safe engineered weak point on winch line to avoid excessive load being transmitted through tower
- Safety deadman switch on pipe slips to avoid inadvertent setting or opening
- Safety deadman switch on Jack to prevent inadvertent movement
Tubular Make / Break

- traditionally considered a high-risk activity on HWOU due to limited space
- Incident occurred in WA Offshore in 2020 leading to LTI
- Following investigation, it was ascertained that:
  - Safety Line not installed,
  - Integral Back up not engaged,
  - Tong operated in high gear during initial bite
- IP subsequently struck by tong sustaining lacerations and bruising
Conventional HWOU Tong arrangement

Tong Operator in red zone and line of fire

Single Safety Line
Tong Operator removed from red zone via remote Panel

Dual Safety Line permanently installed on Tong

Remote controlled hydraulic tong jib to reduce manual handling
Ladders & Handrails

- All Ladders and Handrails are designed in accordance with AS1657 and AS1892
- Tower section of the unit designed to minimize fall distance by alternating ladder position between sections
- Ladders access all the way to the work floor with self closing spring-loaded gates removing the need of a “trap-door”
- Handrails always remain in place and in accordance with the standard including around the pipe-slide access point
Compliant ladders for Gin Pole access

Double retention on tong safety line

Remote Tong Panel

Kick Plates to prevent drops

FRP non-Slip grating

Funnel Guides to prevent hands on loads

Fixed cartridge retention pins prevent drops

Large, clear work floors

Multiple access & Egress Points with Self closing gates

Handrails & Ladders in accordance with AS Standards

Beveled edges on jack & work window

Fixed cartridge retention pins prevent drops

Large, clear work floors

Multiple access & Egress Points with Self closing gates

Handrails & Ladders in accordance with AS Standards

Beveled edges on jack & work window
16kms Tubing Tripped
8420 Man Hours Worked
844 Remote Connections
13 Rig Up / Down Events
4 Remote High Risk Activities
2 Offshore Facilities
Thank you for your time