CASE STUDY:
INDUSTRIAL DRIVESHAFTS FOR A380 FIRE FIGHTING SERVICE

Considering the sheer size of the new Airbus A380, with a take-off weight up to 571,000kg, a wing span of 79.75m and a height of 24.45m, airports around the world needed to review all aspects of airport management to cater for this massive aircraft.

This review included runway strengths, lengths and widths, ground crew numbers, supply vehicle capabilities and gate access. However, the requirements for upgrading the safety equipment and services needed for emergency landings and take-offs, or other aircraft emergencies, were the most important.

Indrotech Pty Ltd were recently consulted by an Airport Aviation Rescue Fire Fighting Team, located at a major Australian Airport, to resolve a major drive transmission challenge on three of their brand new aircraft fire fighting trucks. These trucks are equipped with an extra long extendable ladder to reach the top of the new A380 in case of a cabin fire, and a higher than normal capacity pump to get enough water to this increased aircraft height should a fire occur. The problem at hand was that the offset of the Power Take Off (PTO) driven by, and mounted on, the gearbox, to the main water pump (located along the length of the chassis) was too great for a standard type driveshaft. Indrotech Pty Ltd was given the challenge to find a solution.

A380 Fire Fighting Team Design parameters that needed to be considered by Indrotech in their solution included:

- Working length of driveshaft
- Vertical offset distance
- Horizontal offset distance
- Angle of PTO output shaft
- Angle of water pump output shaft
- Power level transmitted

After researching all the required specifications the Indrotech engineers, using their computer aided design (CAD) package, found the drive shaft universal joints required would exceed the allowable working angle of 12 degrees, the maximum a standard double universal shaft could offer. It was then a matter of sourcing a specially designed double cardan Constant Velocity (CV) unit that would allow Indrotech to achieve these irregular angles and offsets, and to ensure a smooth running reliable unit that could handle torque reversals and long working periods.

A standard double cardan assembly that would be typically found under a Toyota 4WD for example consists of a centre yoke between two universal joints.

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Unfortunately, the angles on this project were too high for a Toyota assembly. This unit would only achieve a working angle of 22 degrees where the required angle was to exceed 25 degrees.

Indrotech's experienced component supply & logistics management department managed to locate and source a specifically designed American made double cardan unit that would satisfy all the requirements of the specified design criteria.

The unit Indrotech sourced was a much more complex design to the standard Toyota CV but works on the same principle. It had been specifically designed for 4WD enthusiasts who raise their vehicles for aesthetic reasons, and then find it difficult to find a shaft that will suitably drive it. Indrotech discovered that this revolutionary designed CV joint would achieve drive angles of up to 30 degrees, more than suitable for this unique application.

After sourcing the specialised components Indrotech designed and manufactured the shaft assembly at their plant in Hallam Victoria.

After manufacture the unit was taken on site where it was to be fitted to the fire fighting vehicle. However, it was found that the hardware used to fasten the shaft on the mating PTO and pump flanges did not allow the shaft to freely rotate. There were too many protrusions from the knuckle casting that were contacting the fastening nuts to the flanges. It was evident that this was a design flaw in the existing CV itself.

The Indrotech team of engineers at the fire station workshop resolved this problem by deciding to physically shift the water pump across the vehicle chassis, directly in line with the PTO unit. This would reduce the excessive driveshaft angles and ensure the hardware would not fail on the casting. After several days of modifications the shaft was refitted, and as planned it was free to rotate as expected. Once the fire truck had been fully modified and the shaft refitted it was test run under full load conditions and performed as designed. The unit ran smoothly without the CV joints jolting, even though the angles were still severe. There were also no vibrations due to the extreme angles thanks to the tight balance grade achieved by Indrotech's Schenck CAB840 balancing machine.

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