



**TTI is the Worlds leading authority on the design of synthetic net systems to be used for riser and under rig protection. Our engineers are experienced in every aspect of the net design, from analysis of wave, vessel and debris impact and fatigue response to the design, specification, documentation (design brief, design report), procurement and installation of net components and complete net systems to offer a fully comprehensive turnkey solution.**

In 1990/91 TTI undertook the failure analysis of a Riser Protection Net [RPN] system that had been designed and supplied by a third party for use on Conoco's Hutton field. This study concluded that the polyester fibre ropes had functioned as designed and indeed still retained very high residual strength [98%] after 6 years service, however failures in the mechanical terminations and tensioning system led to tension being lost which in turn had caused fatigue induced failure in the system.

The findings of this study proved invaluable to TTI and led to the development of a

number key design principles which have been applied to all RPN systems designed and supplied by TTI since. These have allowed TTI to design greatly improved protection systems, including novel tensioning and installation procedures with optimisation of material and rope constructions.



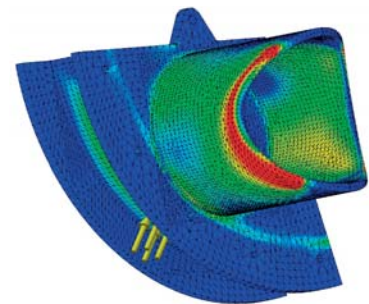
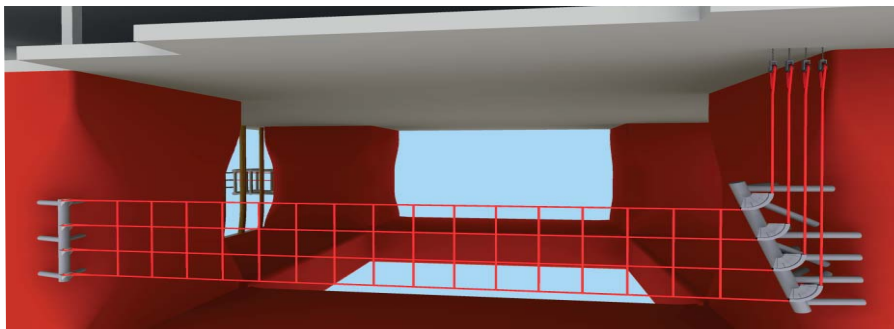
In 1991 TTI secured its first contract for the design engineering of a complete RPN system to be used on the Shell Auger field. This was followed in 1992 with a contract on behalf of Conoco Norway to design a RPN system for the Heidrun TLP. These and other projects since have led to the development of a suite of in-house computer design programs to design and evaluate the response analysis and fatigue life of RPN systems.

TTI's involvement in these projects has ranged from individual component design through to the design of complete systems which can be suitable for both steel and concrete platforms (TLP's, semi-submersibles, jackets etc).

Typical RPN will arrest a 7500 tonne deadweight supply vessel travelling at 2m/s that creates up to 22MJ energy. Polyester ropes with breaking loads up to 600 tonnes and with length of 130m are traditionally used. These long lengths combined with a large net deflection reduces the forces imposed on the platform structure or deck.

Up until 2015, the record for the largest net designed by TTI was produced for Statoil's Asgard B platform. This RPN used 600 tonne break load horizontal ropes, covered a span of around 80m and was 10m high and weighed around 10 tonnes.

This record has now been surpassed with a RPN system that will be installed mid to late 2016. TTI designed and has overseen successful production of the complete net system. As well as being the largest net



manufactured to date, this will also use for the first time a high modulus polyester fibre called PEN. The horizontal ropes on this net have break loads of 870 tonnes, span approximately 80 metres and the net has a height of just over 6 metres.

The successful design and installation of each of these RPN's has been the result of the unique combination of skills and expertise that TTI can offer. TTI's

independent technical expertise in synthetic fibre ropes, their design and construction, performance, and the selection and design of terminations ensures the best available installed life coupled with lower through life costs.

TTI has also developed an in-house computer model 'NET' to determine net deflection, tensions, energy and wave drag forces for calculation of fatigue life.

Extensive verification of this model has been carried out. TTI also has an in-house computer model 'FIBRE ROPE MODELLER' that determines the load/ torque/ twist and fatigue response of synthetic fibre ropes. In-house design of terminations, bend shoes and tensioning systems are verified through FEA, 3D modelling and other engineering tools to ensure ultimate compatibility, safety and service life.

Offshore Facility / Operator	Installed	Material	Main Span Rope MBL tonnes
Auger TLP (Shell)	1993	Polyester	360
Heidrun TLP (Conoco)	1995	Polyester	400
Asgard B FPS (Statoil)	2000	Polyester	600
Modec Prince Mini TLP	2001	HMPE	218
Modec Marco Polo Mini TLP	2002	HMPE	240
AIOC PDQ Jacket Caspian Sea - BP Amoco	2004/10	High Modulus Twaron	425
NADL - Floating Ice Protection Net	2014	Polyester	11.2
Total Moho Nord TLP	2015	Polyester	37
Ichthys FPS - INPEX	2016/17 ongoing	High Modulus Polyester PEN	870

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Consultancy, Design and Engineering Services in Ropes, Textiles and Marine Systems

