



Case study

Overhead Engine Tooling

RADICAL NEW CONCEPT

All rolls-Royce Trent Engines have traditionally been stripped and built, as part of routine maintenance, on ground based engine build stands. This radical new design for SAESL (a Singapore Airways and Rolls-Royce joint venture) has the engines mounted overhead and uses no ground based tooling. It is very similar in practice to a car production line, but in reverse. The engine is stripped into its modules and either stored via overhead 'sidings' or sent for deep strip. The factory has two lines, one strip and one build.

FLEXIBLE DESIGN

The engine modules had not been designed for this type of tooling, with the exception of the connections to the wing pylon. The design therefore required considerable innovation in providing an efficient solution. The Frazer Nash solution was to design two manipulators (yellow) which can be used for the whole range of Trent engines. These manipulators had four degrees of freedom (two translation and two rotation) enabling the extraction and insertion of all engine modules. Interface elements (green) have been designed to connect to the various engine modules. This means when a new engine is developed only the minimum amount of new tooling is required. The new design has saved the use of over 200 tooling fixtures.

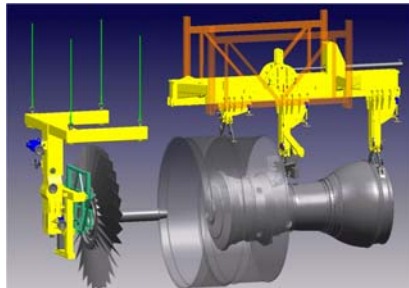
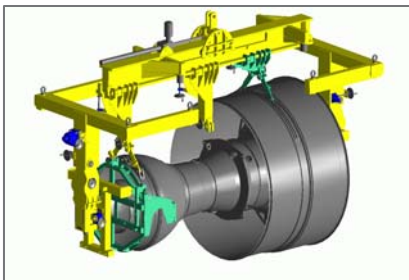
ASSURED OPERATION

Like all lifting equipment for Rolls-Royce, this tooling had to be designed and stressed to exacting standards. Much of the stress analysis was conducted with hand calculations with a limited amount of finite element analysis where necessary. The carriers and interface tooling were all subject to individual strength tests.

Frazer-Nash also provided on-site support during installation, training and commissioning. To date, tooling has been supplied for three engine variants.

KEY BENEFITS

The target for the over-head strip concept was that it would double productivity compared to a ground based system. In fact, this bench mark has been shattered with a productivity gain of four. This is directly attributable to the quality of the design.



Client
SAESL

Business need
Design a new engine strip mount to increase efficiency and productivity that was flexible enough for multiple different engines

Why Frazer-Nash?
Frazer-Nash has a great expertise in mechanical and structural design using CAD tools and innovative design concept.

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