



Titan's unique balanced dynamic hydraulic fixture has enabled it to solve the problem of warpage errors in its helicopter engine components, resulting in an increase in its business.

THE CONTEXT



The diffuser is one of the most critical components of a helicopter engine as it can have a huge impact on the aircraft's movement if it fails. Hence, there are stringent requirements for manufacturing it. The manufacturing phase includes an intermediate heat treatment process to strengthen the component. Titan found that following the heat treatment, the part developed warpage errors across its entire surface, making further machining stages difficult. The component was also unable to achieve the drawing requirement as a result. However, no standard clamping mechanism has been available to hold a component with warpage errors till date. So, Titan designed and developed an innovative clamping fixture to solve the problem.

THE INNOVATION



In general, a clamping fixture will hold a component in accordance with its own shape. But since the diffuser had warpage errors across its entire surface area, by clamping onto the warped surface, a regular fixture tended to multiply these errors. Titan designed a new hydraulic fixture in such a way that it does not hold the component but provides support in accordance with the component's and not its own shape. Hence, when the component is machined in this condition, the surface that is machined is free of errors and can be taken as a reference for further stages of machining.



KEY CHALLENGE



TO CONCEPTUALISE THE HYDRAULIC FIXTURE

This was a major challenge as the fixture had to be dynamic in nature to suit the vertical turning operation -- the fixture has to be fitted on the available space in the machine. Since no one had attempted this before, the team had no ready reference from which it could take cues. After numerous discussions and references, the team finalised the design with multiple internal piping connections for the hydraulic block actuations. The result was a perfectly balanced design.

TO EXECUTE THE FIXTURE AS PER THE DESIGN

The fixture was designed with drills of 5mm diameter and lengths up to 520mm. It was important to balance the fixture after assembly for both safety reasons as well as accuracy in holding the component. The team collaborated with some capable suppliers to manufacture and balance the fixture.

THE IMPACT



Titan has solved the problem of warpage errors in several high-value components by successfully deploying the balanced dynamic hydraulic fixture across the board. The fixture has also reduced its cycle time by 50%. This has resulted in net savings of Rs 2 crore. Moreover, its enhanced capabilities have enabled Titan to win new projects and orders worth Rs 22 crore from SAFRAN, a leading aero engine manufacturer in the world.