CASCADE ENGINEERING

DEPENDABLE ENGINEERING,
CERTIFIED SOLUTIONS

CASE STUDY 04

PILATUS

Client: PILATUS PC-24

ENSURING SUCCESSFUL, PUNCTUAL CERTIFICATION OF NEW, SUPER VERSATILE BUSINESS JET

Developing a new aircraft is always risky. Even more so when your business success depends on both prompt and successful certification. When a European aircraft company was preparing to use a turbofan power plant for the first time, they engaged Cascade Engineering to ensure a successful outcome.

For Swiss aircraft company Pilatus, renowned for their robust, versatile and prestigious aircraft, the development of the all-new PC-24 was critical to their continued reputation and business success. For the first time, Pilatus was looking to develop a prestige business jet aircraft using a turbofan power plant. With a with specific focus on being able to land at both glamorous airports and rough unprepared airstrips, the development of the rear fuselage and vertical tail was key to the project success.

Pilatus was looking for a partner to develop the structural design. In addition, they wanted to work with an experienced team who could help reduce the risk on the project and help with important development decisions.

As a result of our work together, Pilatus avoided costly and timely mistakes, as well as securing a fully certified rear fuselage and vertical tail founded on full structural analysis documentation.

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STRATEGY

This was a challenging project. With our experience from similar projects we were quickly able to understand the design drivers and complex loading for the rear fuselage and vertical tail structures, which meant we could turn an outline design into a well-proportioned arrangement of panels and reinforcement. This could then be optimised to pass all structural calculations at the same time as being efficient with regard to weight. Comprehensive, yet concise documentation was also critical to achieving the prompt certification of the structures.

Project success was also dependent on skilled, capable project management. Like many organisations, resources in Pilatus were stretched. We brought in experienced team members to work alongside the Pilatus team, concentrating on critical programme elements with minimal supervision, while following Pilatus' methods. Working on time and within budget, while meeting quality standards, were naturally all part of the securely delivered brief.

EXPERTISE DELIVERED

With the initial design complete, we were able to optimise the structure against improved load distributions based on further iterations of the FE models and structural design. Weight is key to all aerospace programmes and optimisation of structural requirements against minimal weight was paramount to ensure the airframe remained within the strict limits mandated within EASA CS-23 requirements.

Our delivered design solutions, static analyses, fatigue assessments and finite element modelling were thoroughly controlled and reviewed by our own highly experienced stress signatories, before being formally released to the customer.

After the design was frozen and released to manufacturing, we were then able to concentrate on the certification effort and support Pilatus to deliver structural analysis documentation, not only for the rear fuselage and vertical tail, but also the elevator and associated control system. Knowing that we would reliably deliver a design and certification evidence portfolio as part of the project meant the Pilatus team were free to concentrate on other critical parts of the project.

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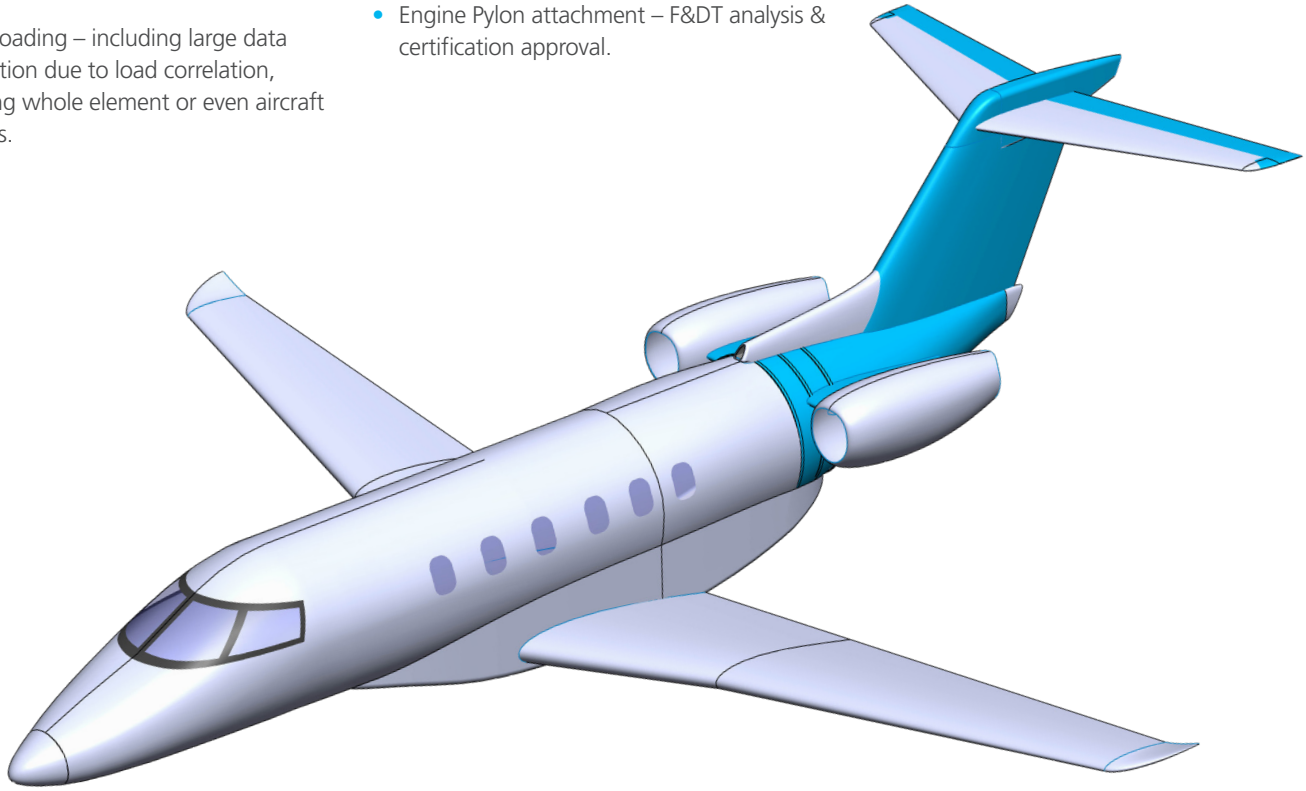
As a result of our robust and timely work to certification, our risk mitigation of potential structural failure issues and our improvements to the design and weight, we were further commissioned by Pilatus to assess the impact of a load increase on the static stress capability of a greater proportion of the rear fuselage and vertical tail. Our familiarity with the Pilatus methods and overall approach meant we were quickly able to identify the critical regions, leaving existing structures to be passed comparatively swiftly with minimal effort and explanation.

COMPREHENSIVE EXPERIENCE

- Involved at the heart of development programmes.
- Provide integration between OEM, its suppliers, our RSP customer and its suppliers.
- Bring a ceaseless drive to streamline analysis approaches, utilising technology and data handling techniques to improve robustness and expedite any analysis to allow decision making.
- Optimise against multiple drivers.
- Ensure teams work with the best current data.
- Develop loading – including large data manipulation due to load correlation, developing whole element or even aircraft FE models.
- Safety assessment, including PRA events – bird strike, hail strike, wheel & tyre failure, fuel egress, lightning strike, etc.
- Development of Means of Compliance strategies and evidence requirements.
- Development of test plans, review of testing arrangements, test witnessing, results review, correlation of data and models.
- Fixed Trailing Edge – Spoiler, Flap, Aileron support & actuation, hydraulic, electrical support integration.
- Leading Edge – Nose Ribs, Intercostals, Skins & Wing Tip.
- Engine Pylon attachment – F&DT analysis & certification approval.
- Stores pylon – design & development, plus enhanced store carriage and release clearances.
- Wing/Fuselage discrete attachment assessment and life enhancement.
- Cabin & Cargo floor assessments, Stow-bin design & development.
- Cockpit equipment & console support.
- Introduction of equipment bay into Forward Fuselage, plus Radar attachment.
- Dynamic response assessments in forced vibration environments.



Cascade Engineering Involvement

CASCADE APPROACH

- Start with concept solutions – brainstorming, getting something on the blank sheet.
- Move to concept development – moving initial ideas into viable schemes for selection.
- Assess manufacturing capabilities, production rate issues, installation and assembly limitations.
- Preliminary & Critical Design Review preparation, presentation to OEM, managing actions to progress beyond review.
- Decide on clear route forward.

CASCADE ENGINEERING HALLMARKS

- Analysis of metallic semi-monocoque aluminium structure under current CS-23 requirements.
- Analysis of complete structural elements, such as the Rear Fuselage, Vertical Tail and Elevator.
- Analysis of specific fuselage elements, such as fuselage frames, skins and vertical tail discrete attachment fittings.
- Analysis of mechanical systems, such as the Elevator Control System.
- Large data manipulation for results taken from Finite Element models, to allow multiple load cases and structures to be analysed in an efficient, logical and repeatable manner.
- Development of design, optimisation and certification analysis and compilation of reports, presentations and certification stress reports.
- Experience of delegated signatories and compliance verification engineers (CVE) to ensure Stress justification satisfying FAR or EASA regulations.
- Ability to apply OEM stress methods, partially automate them and understand where initial problematic issues can be mitigated and improved to acceptable levels.
- Ability to assess all types of structural analysis method and determine suitability or even develop methods to suit the circumstances, all in collaboration with the OEM.
- Ability to apply this efficiently when revisiting stress calculations performed by others, for new variants of an aircraft.

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