



Introduction of Simulation Software Into Safran Seats GB

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Introduction

Simulation software is used throughout all engineering industries to allow companies to evaluate, compare, and optimise alternative designs, plans, and policies. As the aircraft seat market begins to recover from the devastating impact of Covid-19 (1). Safran Seats GB (SSGB) needs to utilize all tools available on the market to help improve product development times so SSGB can meet the rigorous deadlines set by the airlines as they try to meet the market’s demand

Project Aims

To identify simulation software that can be introduced into SSGB, which designers can use without needing the in-depth analysis required by FEA.

Objectives

- Demonstrate how bringing Computer Aided Engineering (CAE) forward in the product development stage can make it more effective.
- Carry out case studies on existing designs within SSGB to see if they can be improved.
- Validate results from simulation software with the stress department to gain confidence.

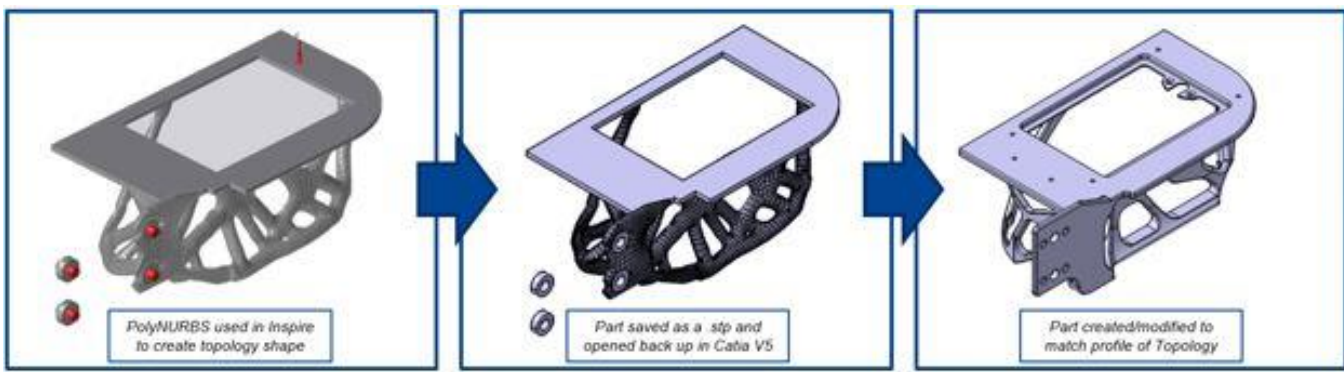
Methodology

After conducting market research to find the most suitable simulation software, it was decided that **Inspire** and **SimSolid** would be tested.

Two current designs being used on the Japanese Airlines (JAL) program were selected for the study to be carried out. The attendant steps were to be re-engineered to create a space boundary to allow for topology optimisation to take place.



Topology results transformed back into a catia model where the analysis could be carried out. Case Study 1



Topology results were used as a guide for design and don’t fully control it. Design and results slight differ in Case Study 2

To conduct the topology, three aspects were defined:

- **Supports** - Attachment points
- **Load** - 1360N downward force distributed
- **Objective** – Minimise Mass

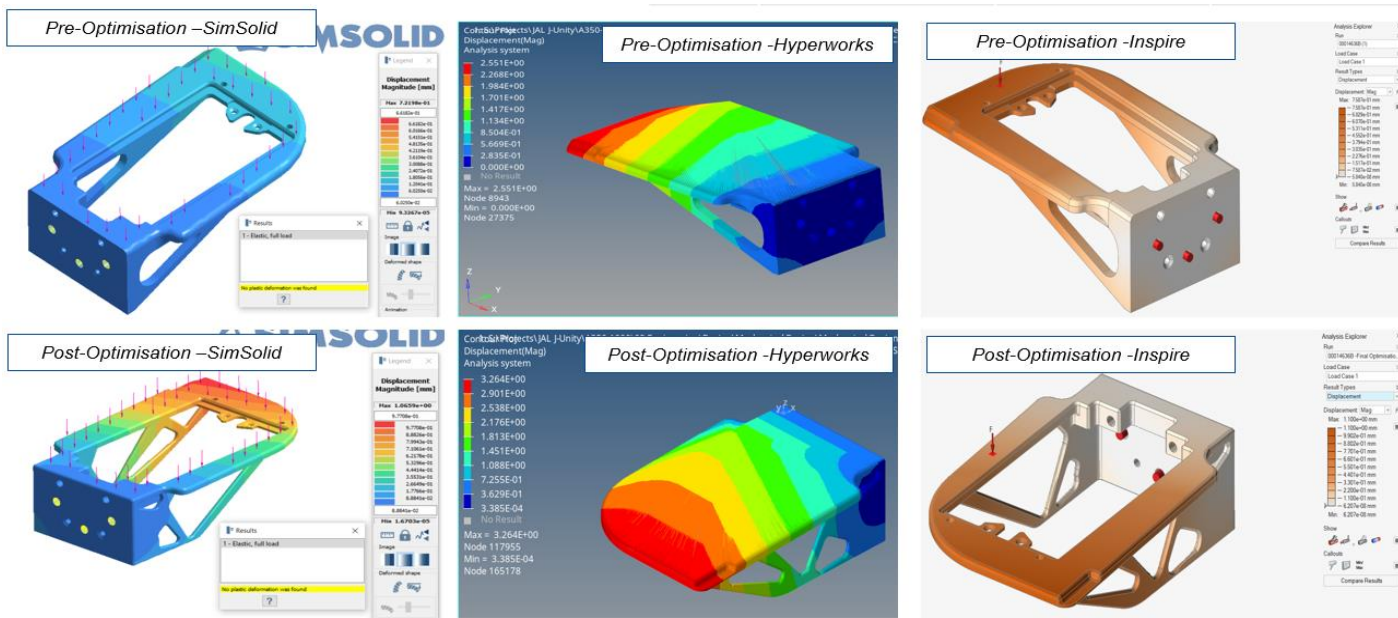
Designs were developed with DFM processes in consideration.

Results

Once the designs were completed, they were run through Apriori, a tool used within SSGB to estimate the costs of machined components.

Table below shows Apriori results for case study 1, Pre & Post Optimisation

	Pre-Optimisation	Post-Optimisation
Weight	0.21Kg	0.15Kg
Cost	\$66.68 (£53.36)	\$82.05 (£65.65)
Stress Analysis (Von Mises)	4.3752e+02 MPa	5.2440+02 MPa
Labour Time (S)	4,193.65	4,176.48
Cycle Time (S)	4,161.60	4,147.00
Batch Setup Time (Hr)	8.24	14.57

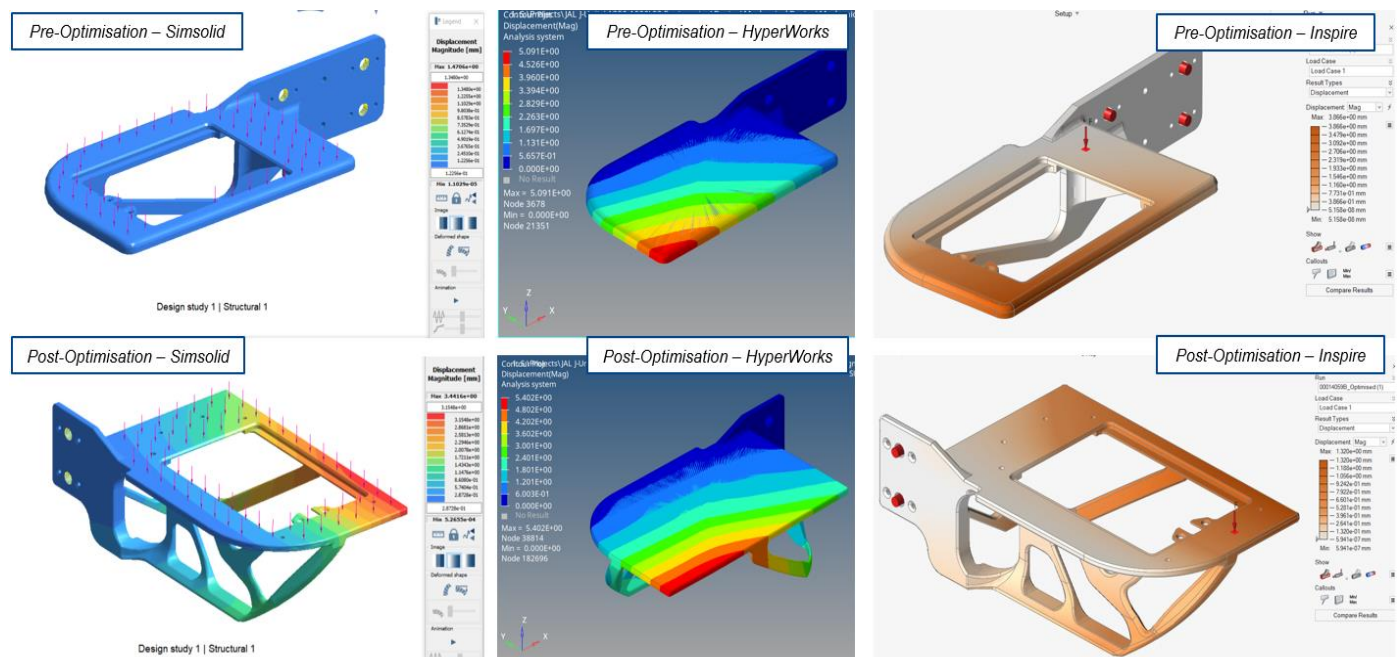


Images above show the displacement Pre & Post Optimisation from three software’s used; SimSolid, Hyperworks & Inspire respectively

The aim was to reduce the weight of the components as airlines are now looking to mitigate their carbon footprint as the world works to becoming carbon neutral.

Taxes imposed by governments will put extra financial burdens on airlines (2). Reducing the weight of designs in SSGB will make it a more attractive proposition than it’s competitors when it comes to winning contracts.

	Pre-Optimisation	Post-Optimisation
Weight	0.24Kg	0.2Kg
Cost	\$81.46 (£64.57)	\$104.15 (£82.55)
Stress Analysis (Von Mises)	3.002 e+02	5.610 e+02
Labour Time (S)	1,439.38	2,470.16
Cycle Time (S)	1,416.47	2,446.41
Batch Setup Time (Hr)	4.55	10.72



Weight savings from each design were used to calculate the potential savings in terms of fuel cost and C02 savings. Figures taken from Aerospace Technology Institution (3)

	Case Study 1	Case Study 2	Potential Savings
Weight Saving/PAX	0.06Kg	0.04Kg	
\$ Value/AC/Year	\$252	\$156	\$408
\$ Value/AC/Lifetime of Suite	\$2,520	\$1,560	\$4,080
\$ Value/Fleet/Lifetime of Suite	\$32,760	\$20,280	\$53,040
CO² Saving/AC/Year	873.6 Kg.CO²	540.8 Kg.CO²	1,414.4 Kg.CO²
CO² Saving/AC/Lifetime of Suite	8,736 Kg.CO²	5,408 Kg.CO²	14,144 Kg.CO²
CO² Saving/Fleet/Lifetime of Suite	113,568 Kg.CO²	70,304 Kg.CO²	183,872 Kg.CO²
CO² Tax Saving/AC/Year	\$20.62	\$12.76	\$33.38
CO² Tax Saving/AC/ Lifetime of Suite	\$206.17	\$127.63	\$333.8
CO² Tax Saving/Fleet/ Lifetime of Suite	\$2680.20	\$1659.17	\$4,339.37

Conclusions

- The project demonstrated how simulation software could improve designs while reducing iterations.
- Improved the weight of the parts but increased cost and manufacturing time.
- Validated results through correlation with proven software.
- **2.72 kg** of weight saving per aircraft leads to the airlines saving **\$53,040** over a ten-year period while producing **183,872 kg** less carbon dioxide.

Future work

- Look into additive manufacturing to reduce costs and remove design constraints.
- Carry out case studies on larger modules.

References

[1] Bouwer, J., 2022. Taking stock of the pandemic’s impact on global aviation. *Mckinsey & Company* .

[2] Obayashi, Y., 2022. Japan's carbon pricing scheme being launched in April. [Online] <https://www.reuters.com/markets/carbon>

[3] Aerospace Technology Institution, 2023. ATI FIXED TRADE CALCULATOR. [Online] <https://portal.ati.org.uk/fixed-trade-calc>