

3D reconstruction using photogrammetry

Automated tools that use advanced image analysis help engineers at engine repair centres (MRO facilities) quickly spot damage on engine blades. These tools accurately pinpoint problem areas, making it easier to decide whether a part needs repairing or replacing. Since one side of a blade is often out of sight, blades are disassembled and photographed from multiple angles using a technique called 'photogrammetry'. This technique creates a highly detailed 3D digital replica of the blade—a 'digital twin'—which is both faster and just as precise as older methods.

The digital twin can then be used to simulate how the blade would perform inside a working engine, showing how air flows over it and how it responds to heat and pressure. To speed up this process even further, advanced deep learning algorithms, which use neural networks, are employed to instantly predict these airflow patterns. This allows engineers to evaluate the blade's performance without the need for lengthy, time-consuming computer simulations.

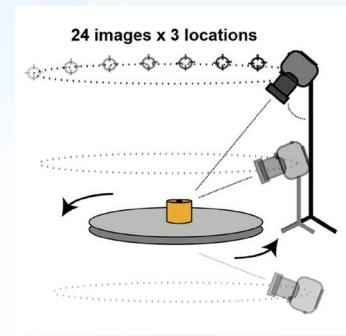


Image adapted from Thibaud Poigt (2018)

(a)



(b)

Figure 2. (a) Use of photogrammetry to reconstruct a CAD model of the HPT turbine from 72 images, which are taken at 15° intervals from three different locations. (b) The resulting CAD model.

Rapid prediction of the flow at turbine cross-section

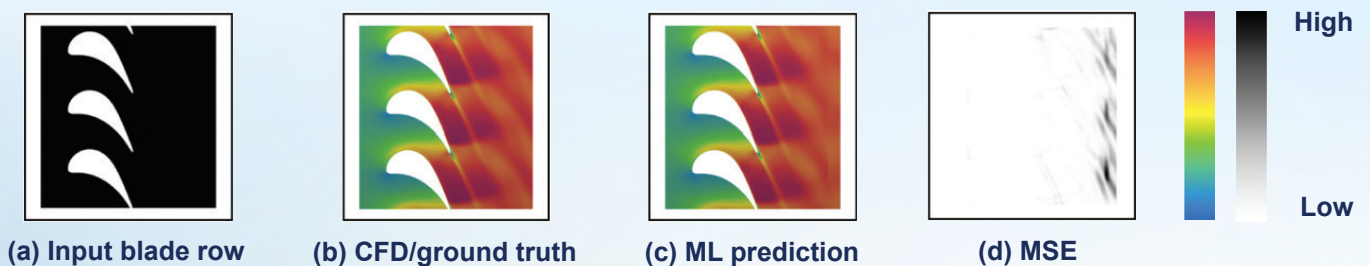


Figure 3 demonstrates how AI predicts airflow around damaged engine blades. The AI predictions (c) closely match the actual airflow patterns (b), with minor differences shown in (d). This comparison helps engineers quickly assess the impact of the damage and make more informed maintenance decisions, leading to safer and more efficient flights.