WP8
Cascade rig test campaign

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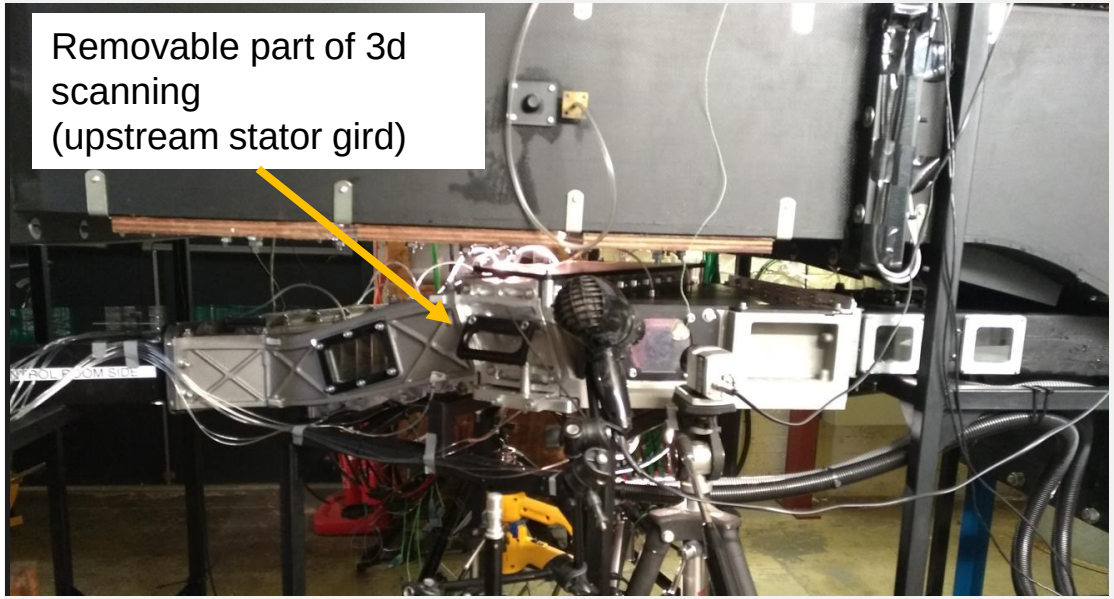
Objectives

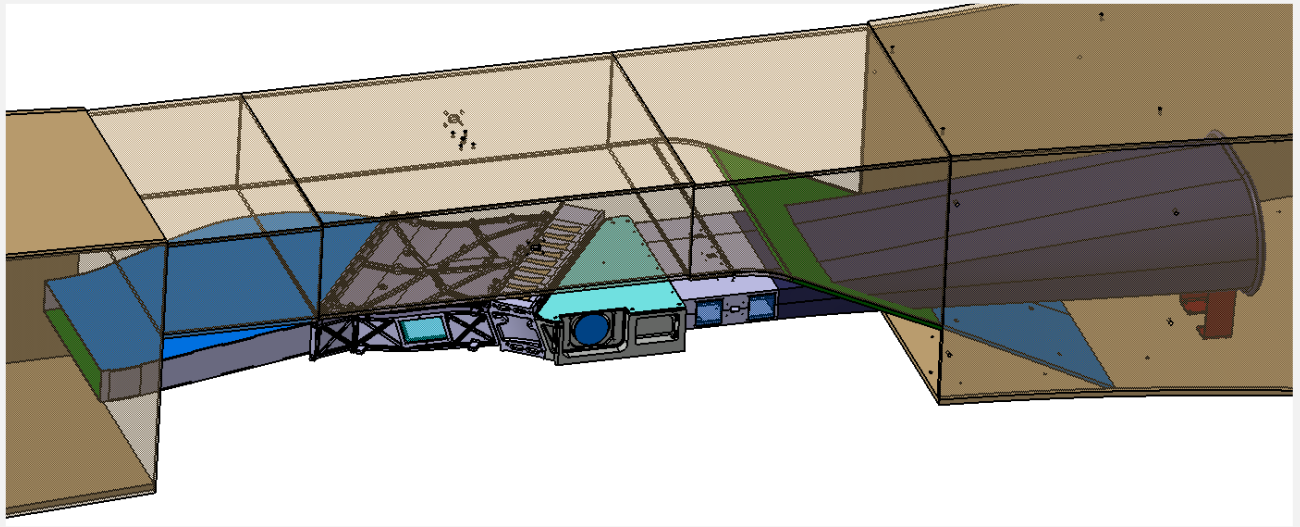
- ICE GENESIS objectives
  - Build an experimental database on ice accretion on 3D engine parts (cold and heated walls)
  - To study the phenomenon of ice accretion in a primary vein representative of the new engine architectures

- Course of the campaign
  - Test campaign is performed by Cranfield University
  - 1st part of the campaign : from 18/07/2022 to 29/07/2022
    - Anti-icing tests de-icing test
    - Thermal measurement with thermocouple and infrared camera.
  - 2nd part of the campaign : from 30/08/2022 to 06/09/2022
    - Accretion tests with 3D scan of the ice of upstream stator grid.
    - 3D scanning operation is performed by Austrian Institute for Icing Sciences (AIIS)

- The test mock-up was manufactured by Danielson.

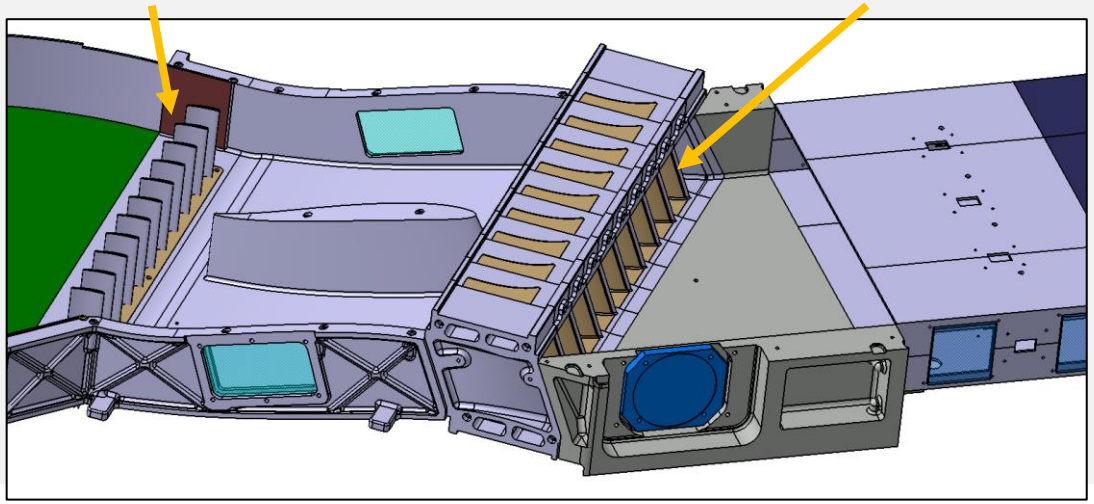
Mock-up presentation





Downstream stator gird

Upstream stator gird



Test article designers:
Safran Aircraft Engines
Danielson

Test article manufacturer:
Danielson

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Test matrix

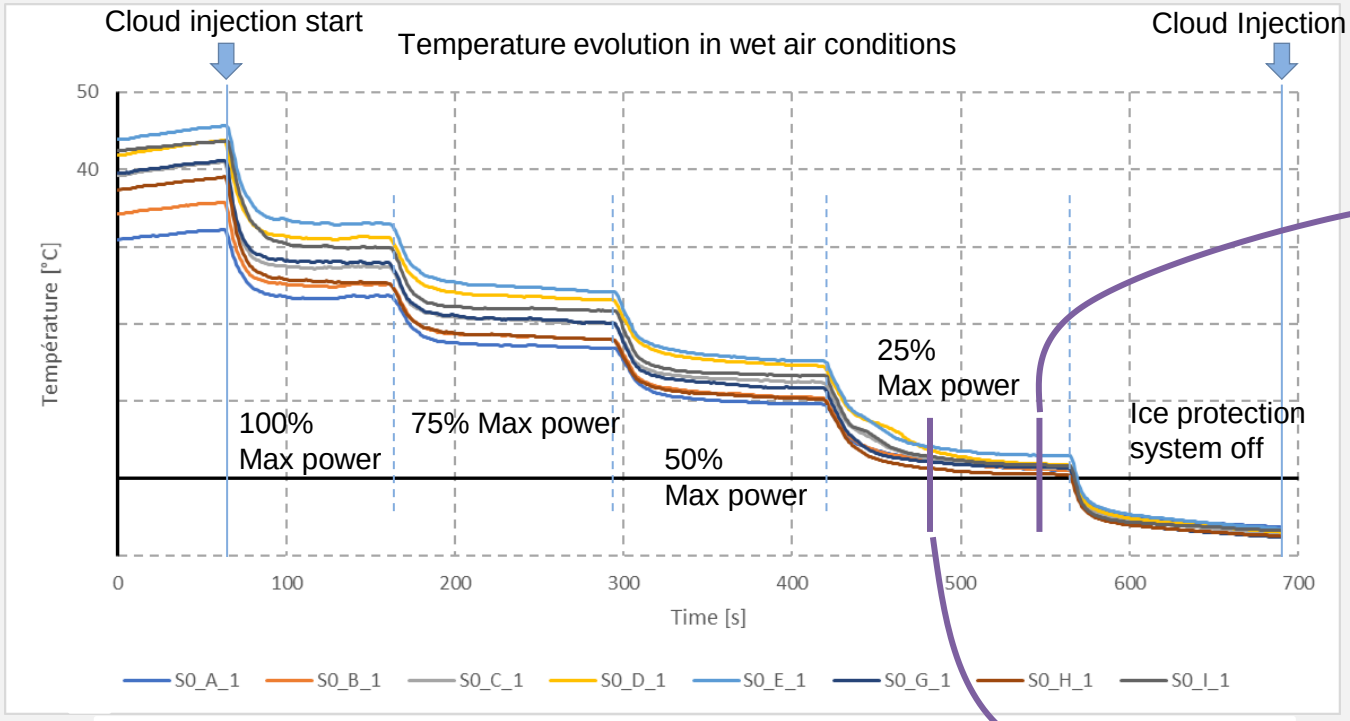
Anti-icing tests

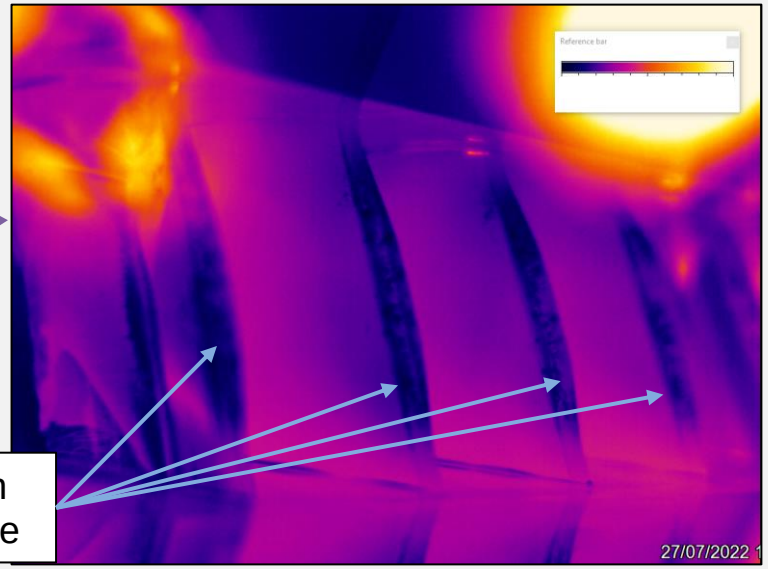
- 31 different tests are realized
- Parameter range :
  - Air speed in the main stream : from 40 m/s to 80 m/s
  - Air temperature: from -20°C to -5°C
  - LWC: from 0.4 g/m3 to 1.0 g/m3
  - IGV Pitch from 0° to 35° (with the main air flow direction)
- Test sequence
  - Stabilization of aerodynamic in dry condition
  - Activation of the heaters
  - Activation of the cloud
  - Heaters power decrease step by step until shut down
  - cloud stops, air speed decrease to 40m/s then activation of the heaters at full power

Accretion ice tests & 3D scan

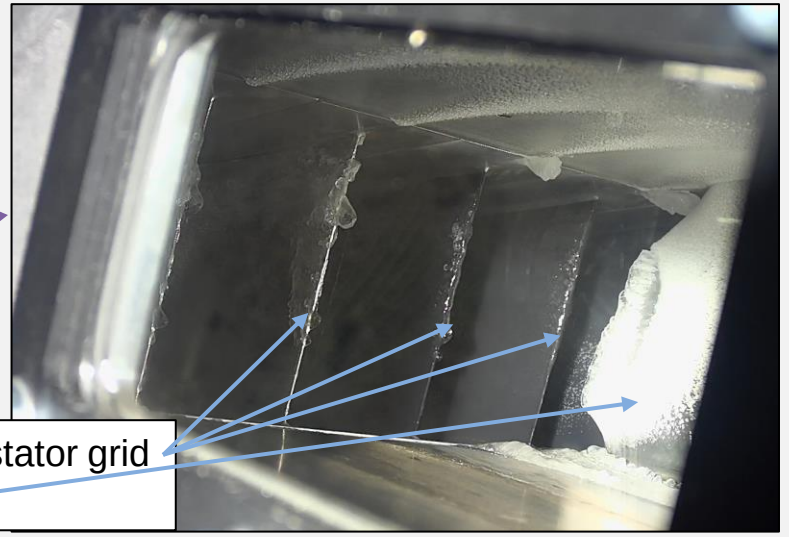
- 17 different tests are realized
- Parameter range :
  - Air speed in the main stream : from 40 m/s to 80 m/s
  - Air temperature: from -20°C to -5°C
  - LWC: from 0.4 g/m3 to 1.0 g/m3
  - IGV Pitch at 0°
- Test sequence:
  - Stabilization of aerodynamic in dry condition
  - Activation of the cloud during the specified time
  - Stop of the cloud
  - Extraction of upstream grid to scan the 3 center blades.
- For few test cases, density of ice accreted on the leading edge is estimated.
  - After 3D scan, the ice is removed for weighing. Then the blade is scanned a second time (without ice on LE).
  - The volume of the weighed ice will be get by the difference of the two 3D scans.

Test sequence presentation with the ice protection system on





Ice accretion on the leading edge



Training edge of the upstream stator grid
Leading edge of the strut

Leading edge of the downstream stator grid

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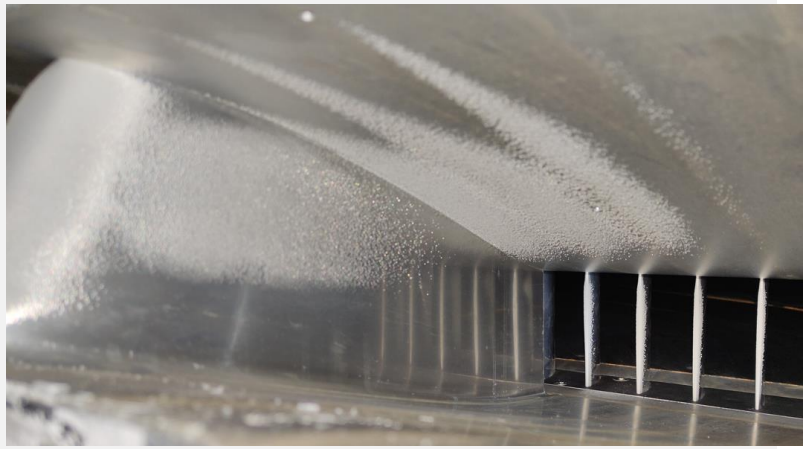
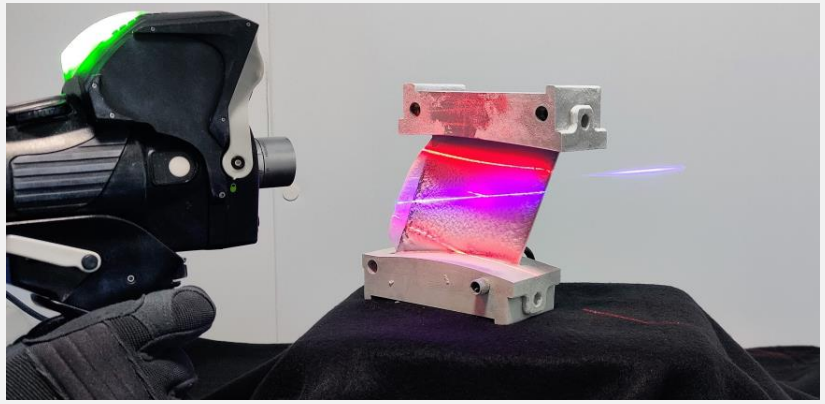
Ice accretion test sequence presentation

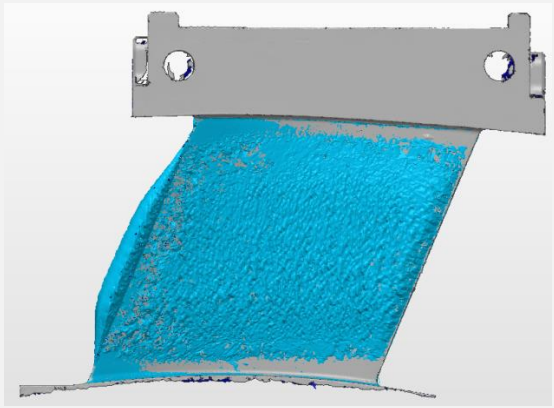
Upstream Grid

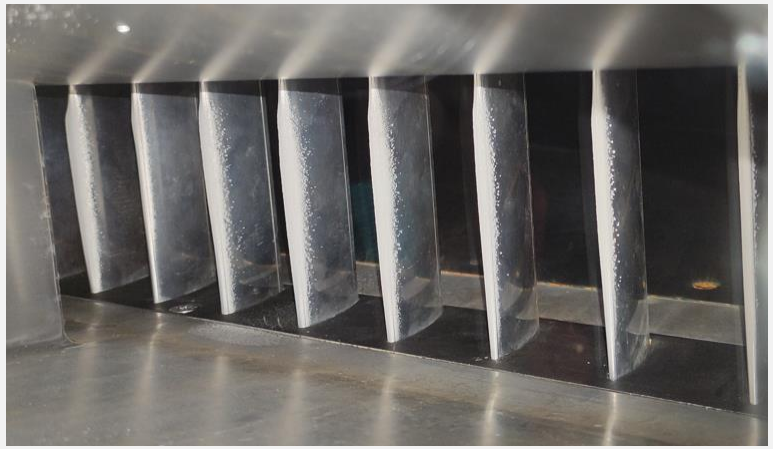
Downstream Grid



3D scan operation performed by AIIS







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THANK YOU

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