

Name of Unit Case: Cantilevered Concave Compression Ramp (3mm)

General Labels

Institution: UNSW Canberra, USQ
Sponsor: Air Force Office of Scientific Research (FA2386-16-1-4024)
Flow Regime: Hypersonic
Compliant model: Concave curved forward cantilever
Principal Physics: Intake compression, SWBLI
FSI or FTSI: FSI



General Details

Model Configuration: Cantilevered forebody, isentropic compression ramp, leading-edge incidence angle = 8.33° , total turning angle = 18.51°
Experiment Description: A compliant intake ramp deforms under the compression load and the resulting flow effects are observed in the isolator
SBLI? Yes
Thermal Effects? No

Sketch/Technical Drawings of Model

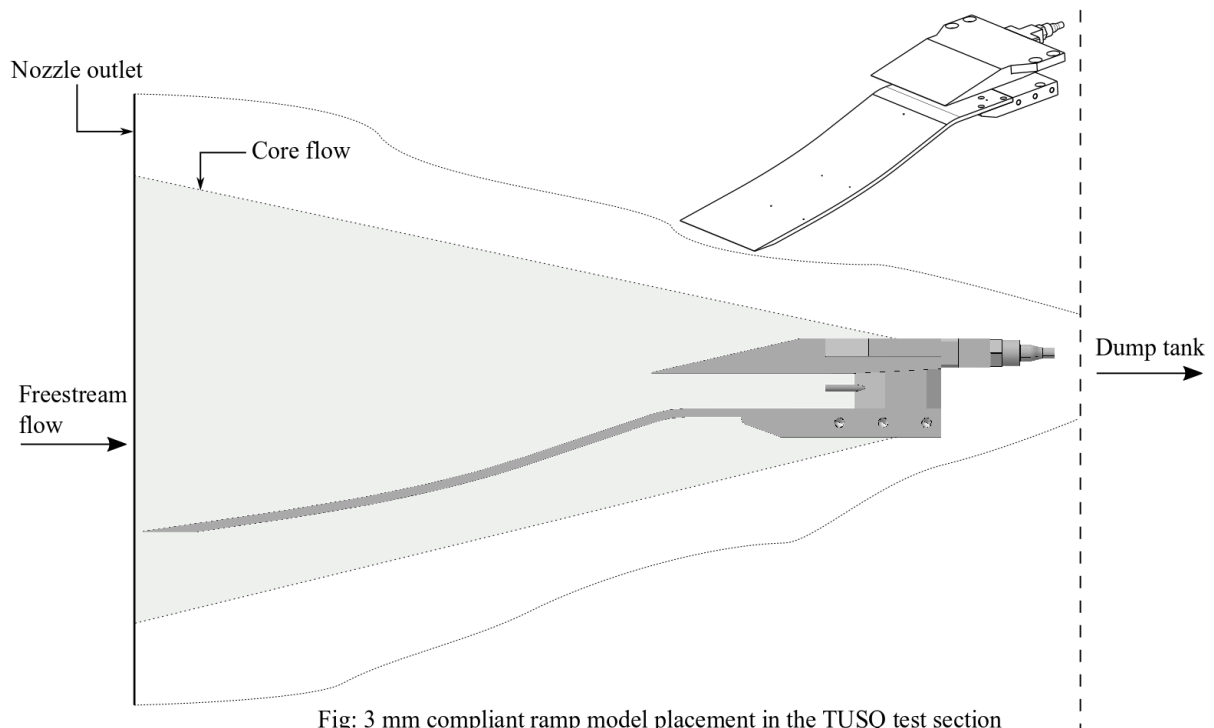


Fig: 3 mm compliant ramp model placement in the TUSQ test section

Experiment Details

Compliant surface material:	Aluminium AL-6061-T6
Other geometric details:	mounted at default configuration, at 0deg AOA
Facility:	TUSQ - compression heated Ludwig tube at the University of Southern Queensland
Mach number:	5.85
Test gas:	Compression heated air
Test flow characterisation:	calculated from stagnation pressure history in nozzle reservoir + nozzle area ratio with viscous correction
Total pressure [kPa]:	1000
Total temperature [K]:	584
Freestream pressure [Pa]:	755
Freestream temperature [K]:	75
Model wall temperature [K]:	290
Unit Reynolds number:	7,160,000
Flow duration [s]:	0.2
Test flow (ducted or free jet):	Free jet
Flow starting:	diaphragm burst at nozzle throat to start nozzle
Model insertion:	Model mounted in situ
Data sets:	PSP pressure distribution history DIC aeroelastic oscillation measurement high-speed schlieren video history (flow field structure) high-speed schlieren video history (displacement) Pressure histories from 9 discrete sensors

Example Data

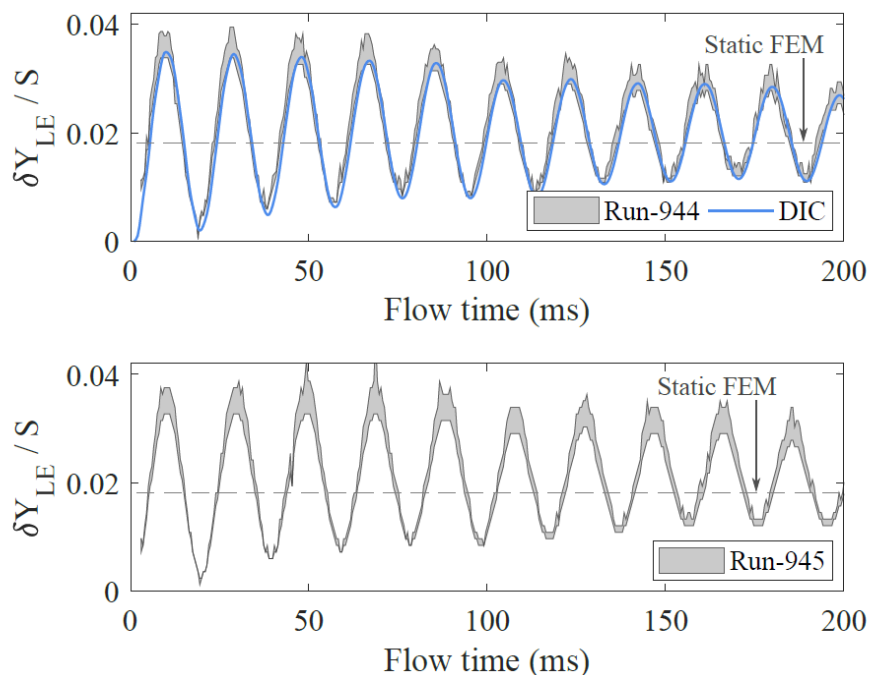


Fig. 23 Transient ramp deformations, measured at the LE, with DIC and schlieren image tracking.

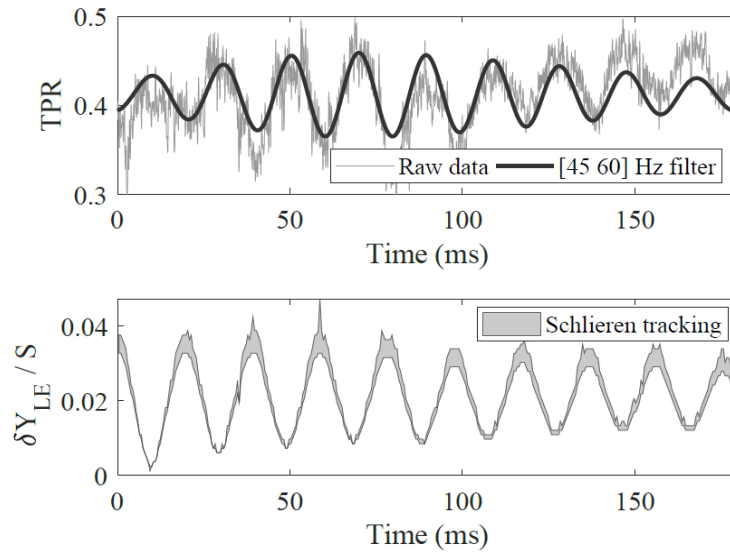


Fig. 28 TPR dynamic fluctuations (Run-945) at the pitot probe location (D7), corresponding to ramp deformation. The occurrences of peak loss directly correlate to peak deformation.

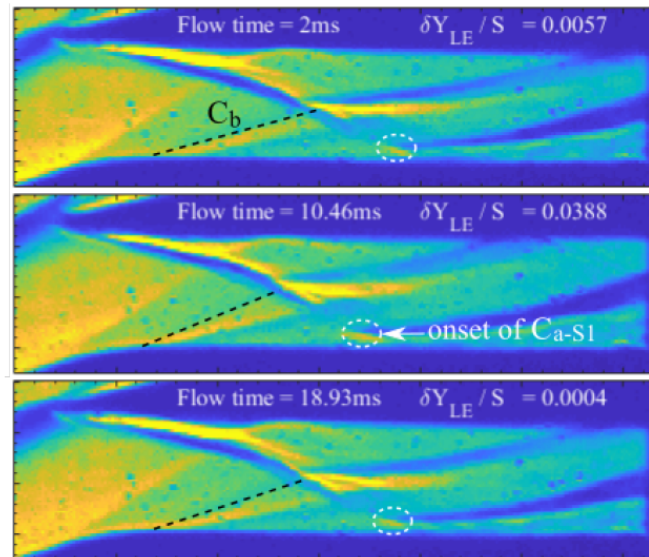


Fig. 34 Translation of SWBLI features across a single ramp oscillation cycle.

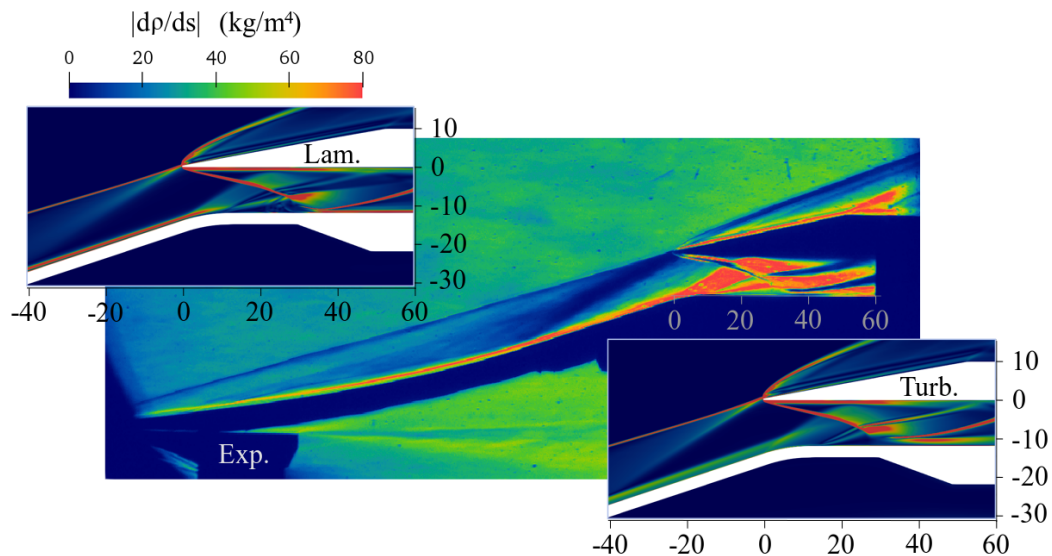


Figure 1 Comparison of flowfields from experimental schlieren (Exp.) and CFD (Lam. = laminar simulation, Turb. = turbulent simulation). The scaled colorbar applied only to the CFD results.

Publications and contact info

Publications:	Bhattraï S, McQuellin LP, Currao GMD, Neely AJ, Buttsworth DR (2020) Experimental Study of the Aeroelastic Response and Performance of a Hypersonic Intake, AIAA-2020-2449, 23rd AIAA International Space Planes and Hypersonic Systems and Technologies Conference, DOI: 10.2514/6.2020-2449
Date Experiment performed	2019
Date Entered:	April 2020
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Other notes:	