

## INFRARED THERMOGRAPHY (IRT) IN F1

### IRT objectives

Infrared Thermography allows the measurement of the model surface temperature. This is generally used to locate the boundary layer transition thanks to the associated large change in heat flux when the flow becomes turbulent.

### IRT application

F1 is equipped with a 640x512 pixels CCD infrared camera, sensitive to radiation in the range 1-5  $\mu\text{m}$  and 3 infrared lenses of 13, 25 and 50 mm focal length. 2 specific IRT windows of 130 mm diameter are available and can be positioned at multiple locations in the test section.

For specific needs, additional cameras can be borrowed from other Onera departments.

### Preparation

Specific model preparation is required for IRT measurements. On metallic model, coating with high-emissivity paint is required with a thickness of at least 60 microns. Alternatively, part of the model can be manufactured with thermal insulating materials, or fitted with insulating inserts of about 1 mm thickness. Markers are also painted on the model to resect images onto the model surface if required.

IR cameras are either compatible with the F1 pressure or either kept at atmospheric pressure in a dedicated housing during pressurized test.

Final camera adjustment requires 0.5 working days inside the test section.

### Testing

Images are acquired by putting the model under thermal imbalance, by turning on or off the wind tunnel cooling system. This causes quick changes in airflow temperature, thus evidencing the magnitude of the surface heat flux. Acquisition is therefore performed in pitch pause mode and takes about 1 minute.

### Results

The IR system has its own independent data acquisition system. IR videos are immediately available for qualitative analysis. Resection on the model surface mesh takes about 1 hour.

### Accuracy

Thermal resolution is about 0.1°C. Absolute accuracy depends upon the model emissivity characteristics.

### Extra cost to the customer

Preparation for first configuration: 14.2 k€

Preparation per new configuration: 7.1 k€

Test performance: 1.69 k€ per day

### Limitations

IR observation is only suitable for surfaces having angle between the normal to the surface and the viewing axis below 60°.