

Darchem Flare



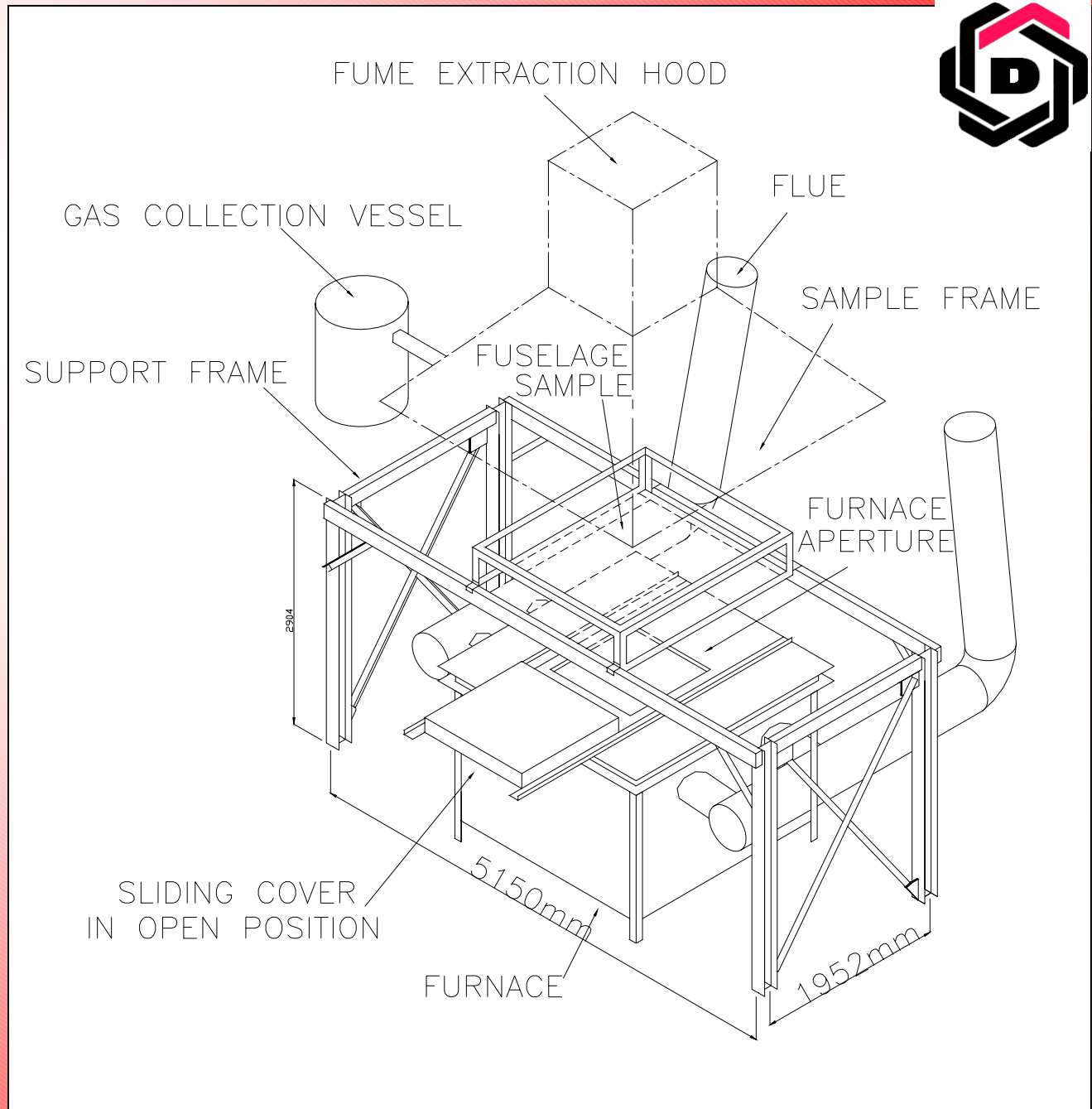
Fuselage Burnthrough Research
Addressing Insulation
Installation Aspects

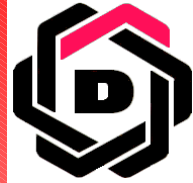
Darren C Dodd/ Ray Cherry

Atlantic City, October 2001

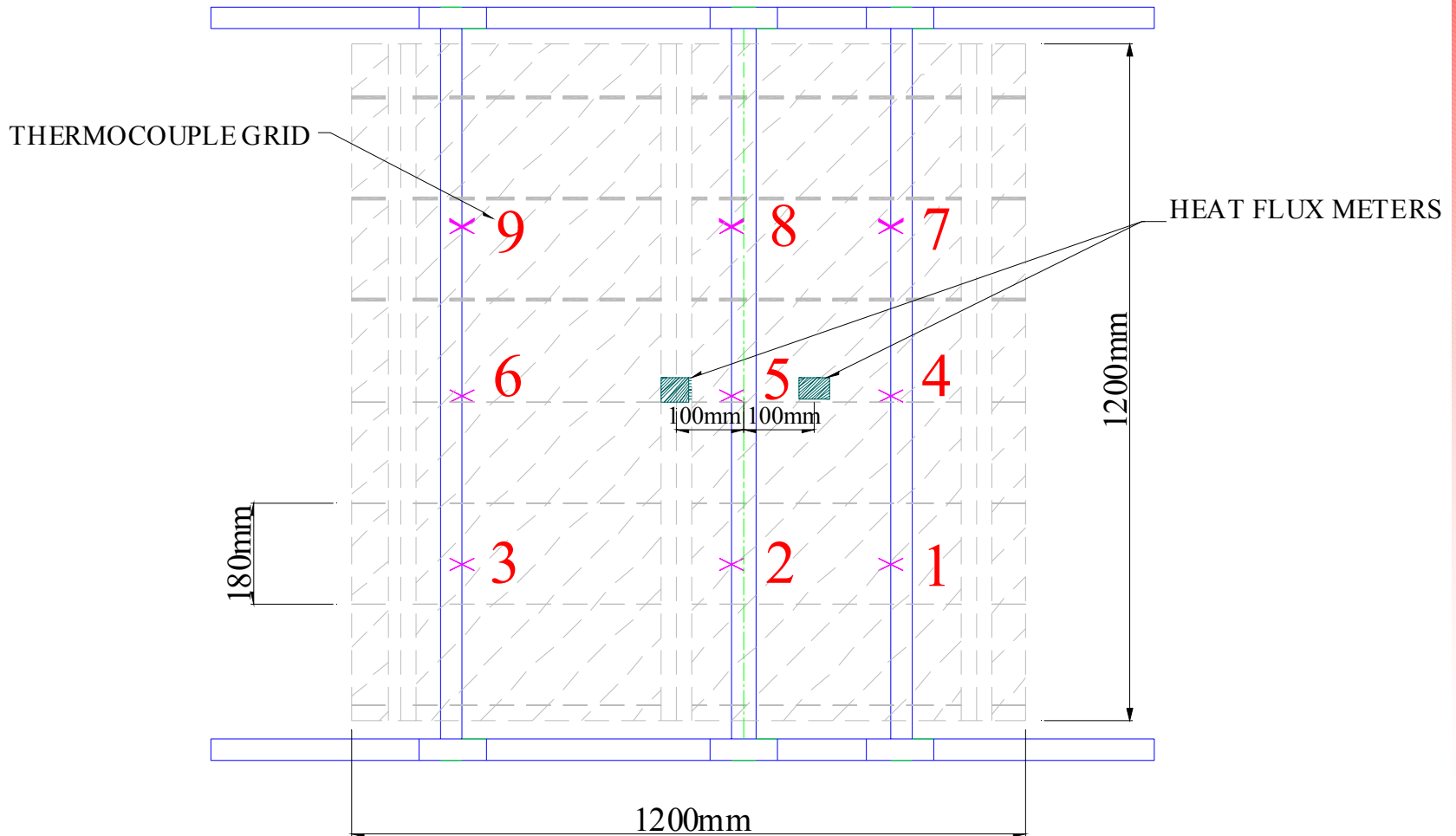
Medium Scale Burnthrough Facility

- Replicates conditions of post crash pool fuel fire
- Temperature 1150°C
- Heat Flux 160kW/m²
 - ◆ Convection 20%
 - ◆ Radiation 80%
- Gas Velocity 2m/s





Thermocouple & Radiometer Grid



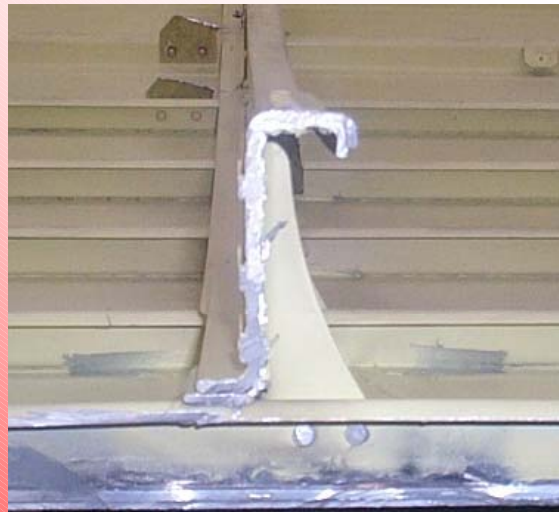


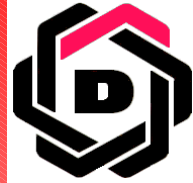
Stylised
Fuselage
Panel



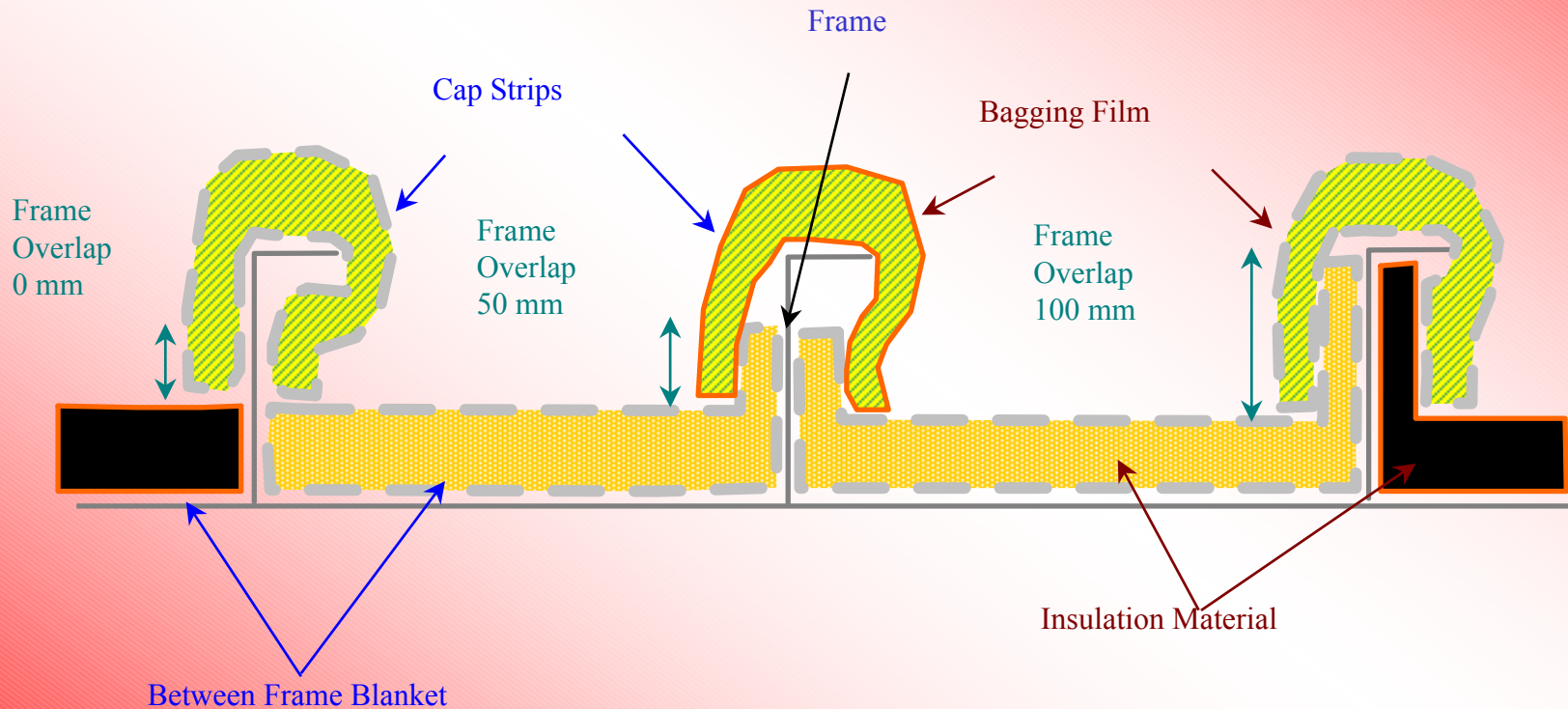


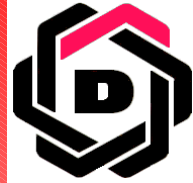
Actual
Fuselage
Panel



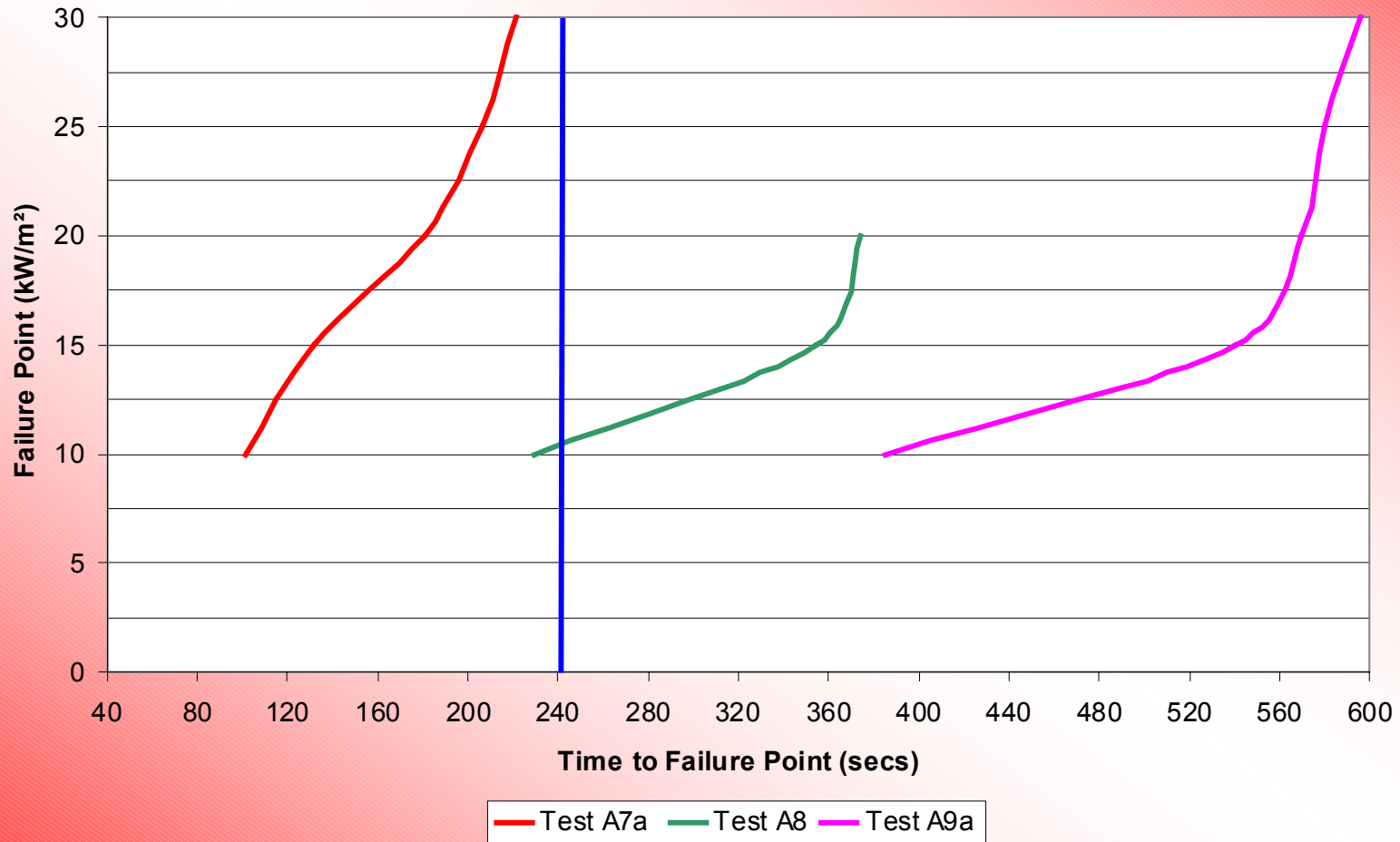


Thermal Acoustic Insulation System Basic Configuration



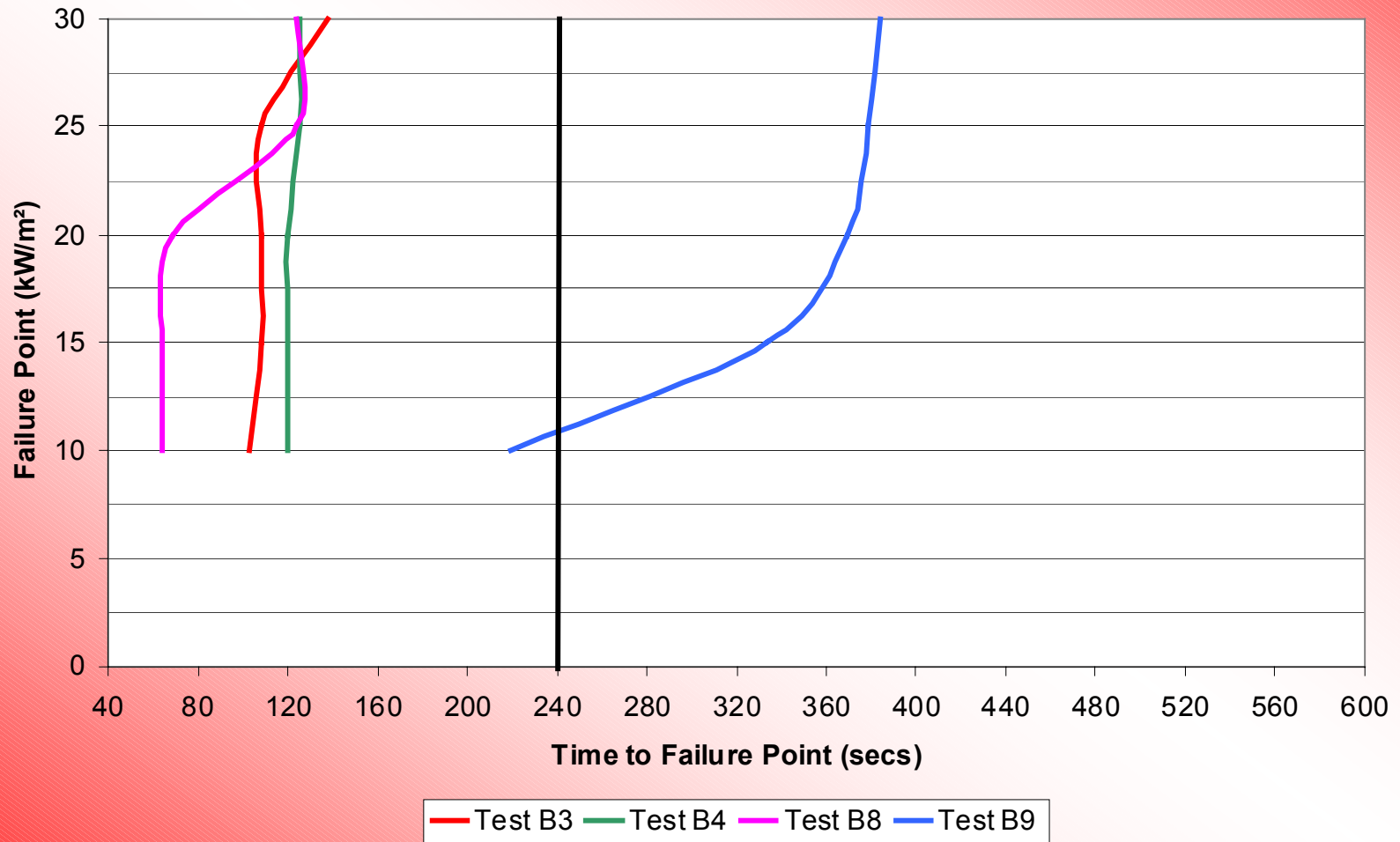


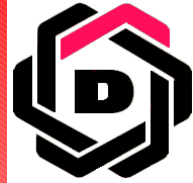
Burnthrough Criteria





Burnthrough Criteria

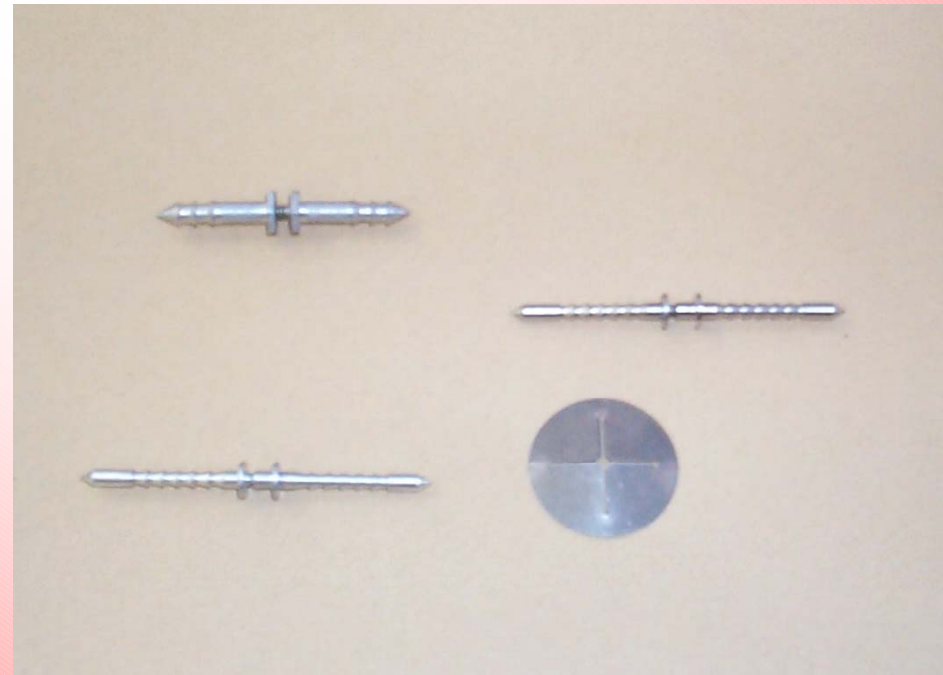




Fixing Methods

- To represent the configurations present in an actual aircraft a number of standard fixing components were used.
- These were of three main types:
 - Through Frame Fixing Pins (Plastic & Metallic)
 - Over Frame Clips (Plastic & Metallic)
 - Stringer Fixings (Plastic & Metallic)

Through Frame Fixing Pins



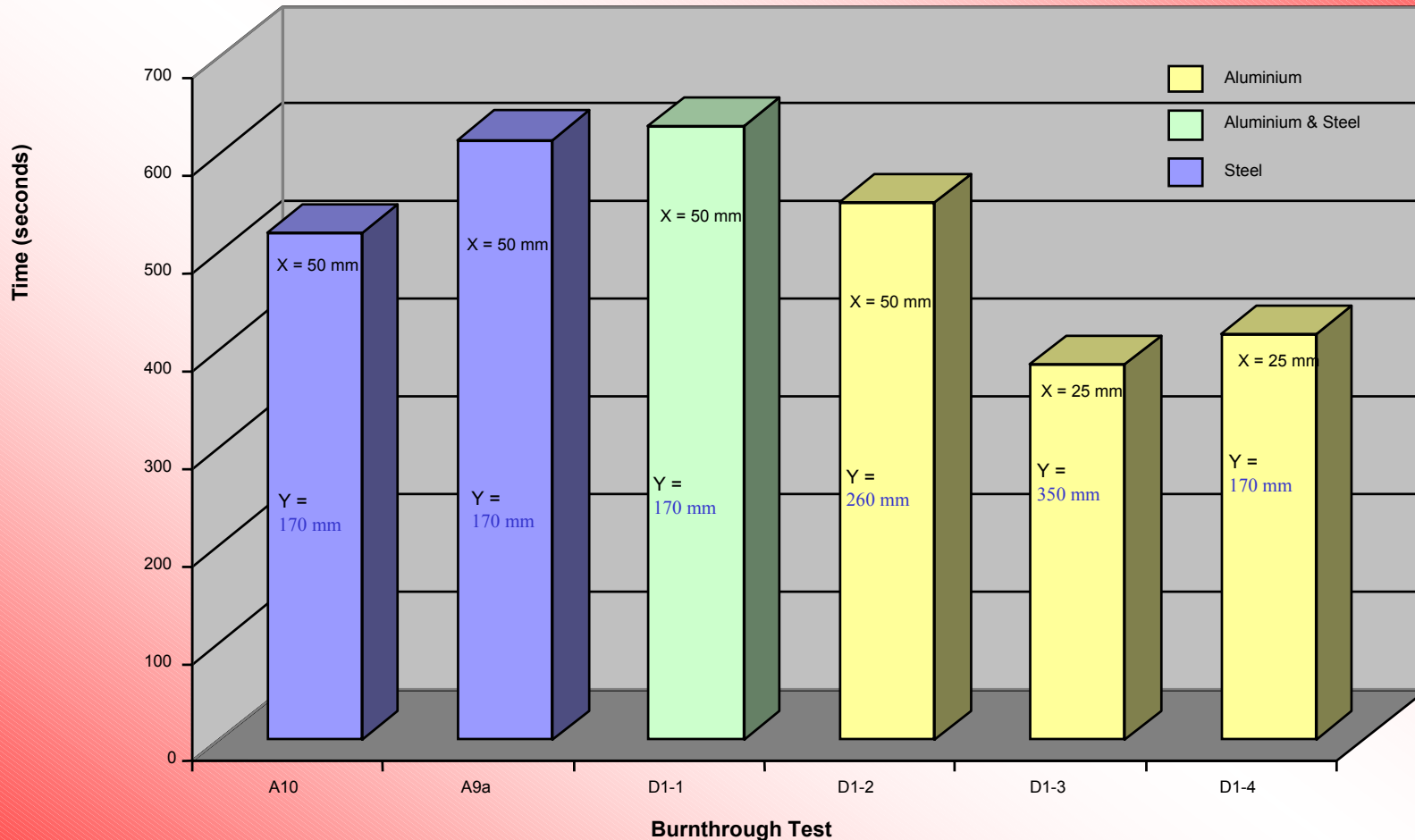


Through Frame Fixings





Through Frame Fixings



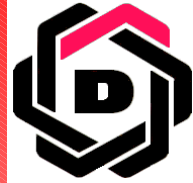
Time to Reach Failure Point of 20 kW/m^2 for Tests using Through Frame Fixing Pins & Washers
NB: Y = Pitch of through frame fixing along the frame
X = Vertical location of through frame fixing in relation to the skin of the panel

Over Frame Fixing Clips

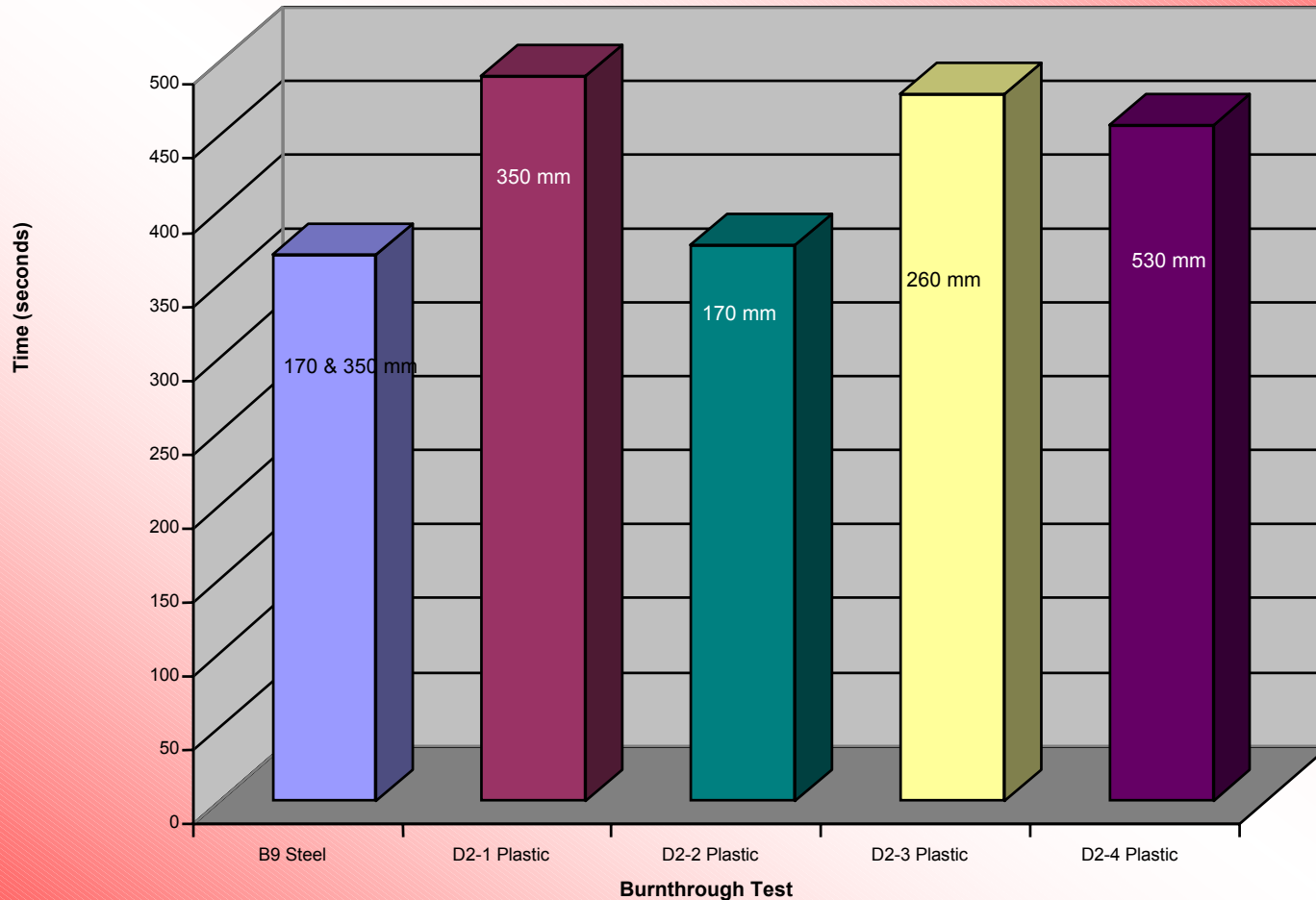


Over Frame Fixings





Over Frame Fixings

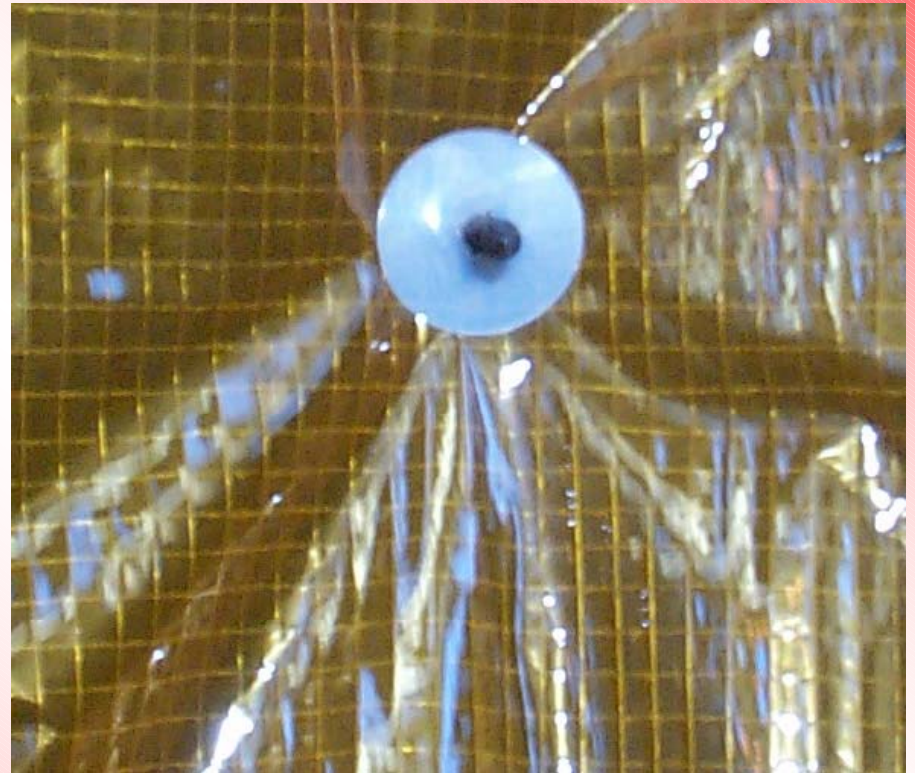


Time to Reach Failure Point of 20 kW/m^2 for tests involving over frame clips

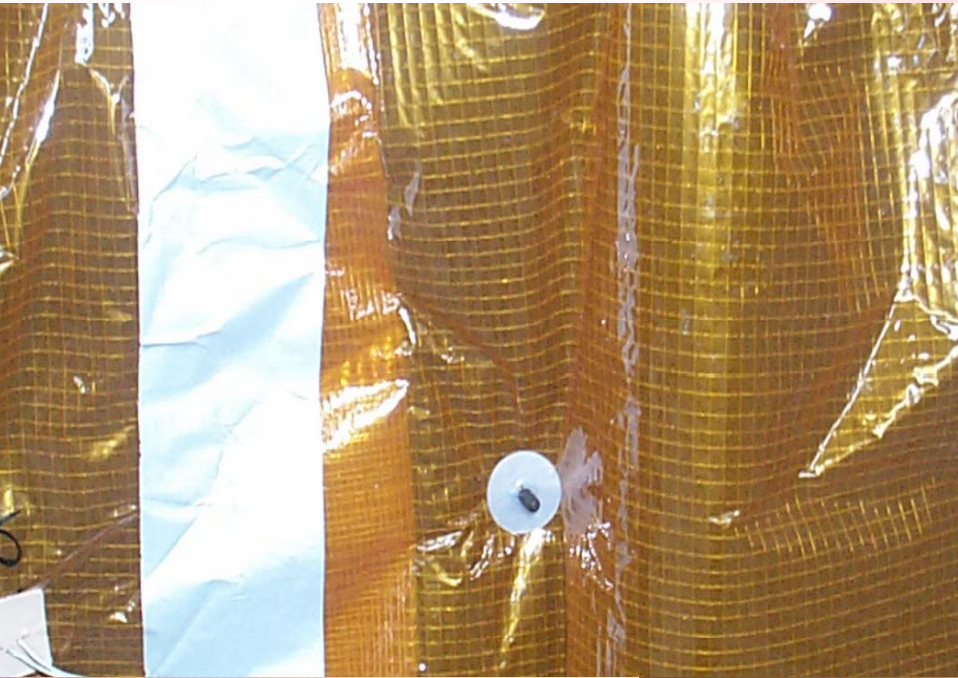
NB: The values at the top of each column indicate the pitch of the fixings along the frame



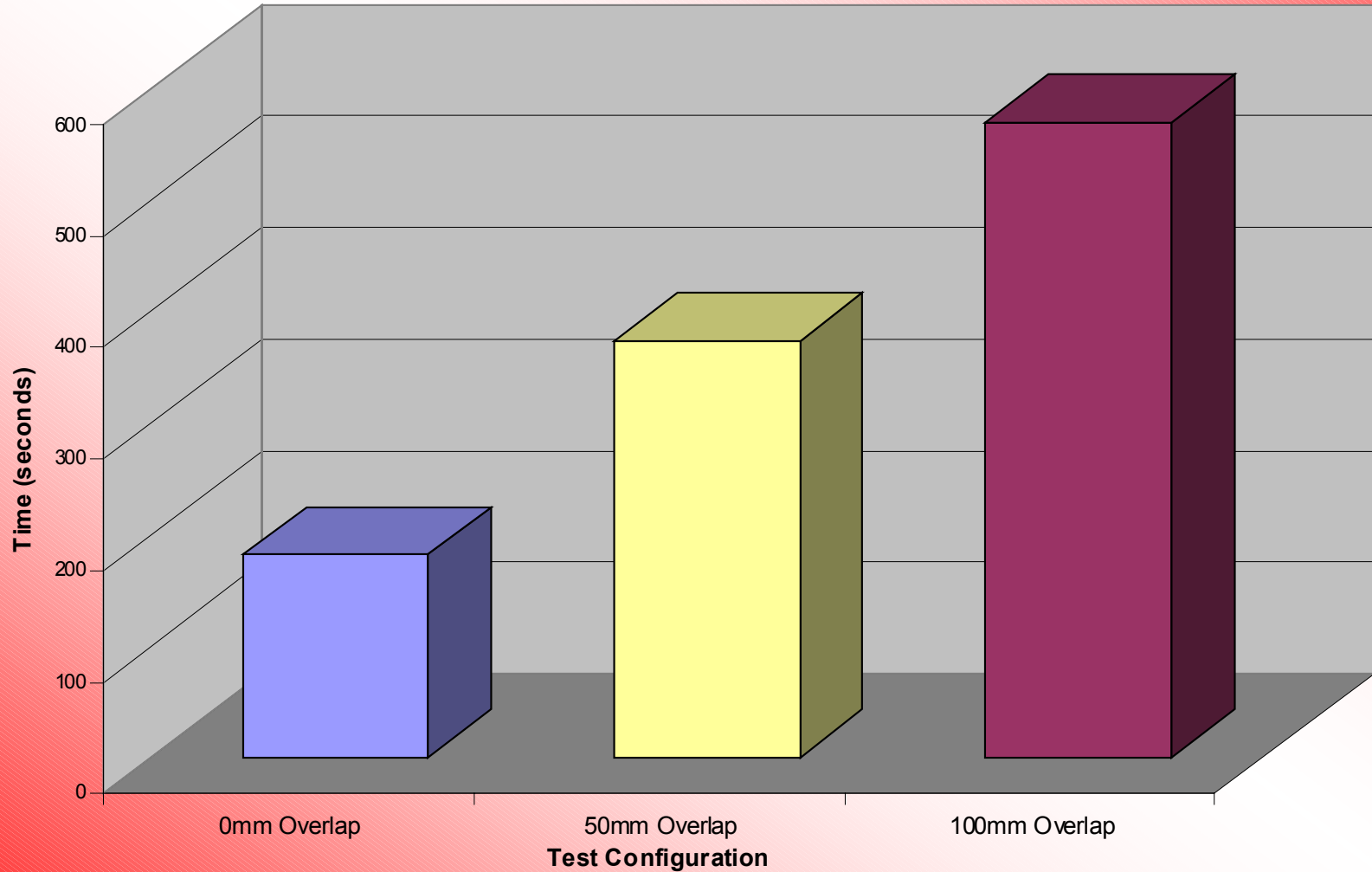
Stringer Fixings



Stringer Fixings



Overlap at Frames



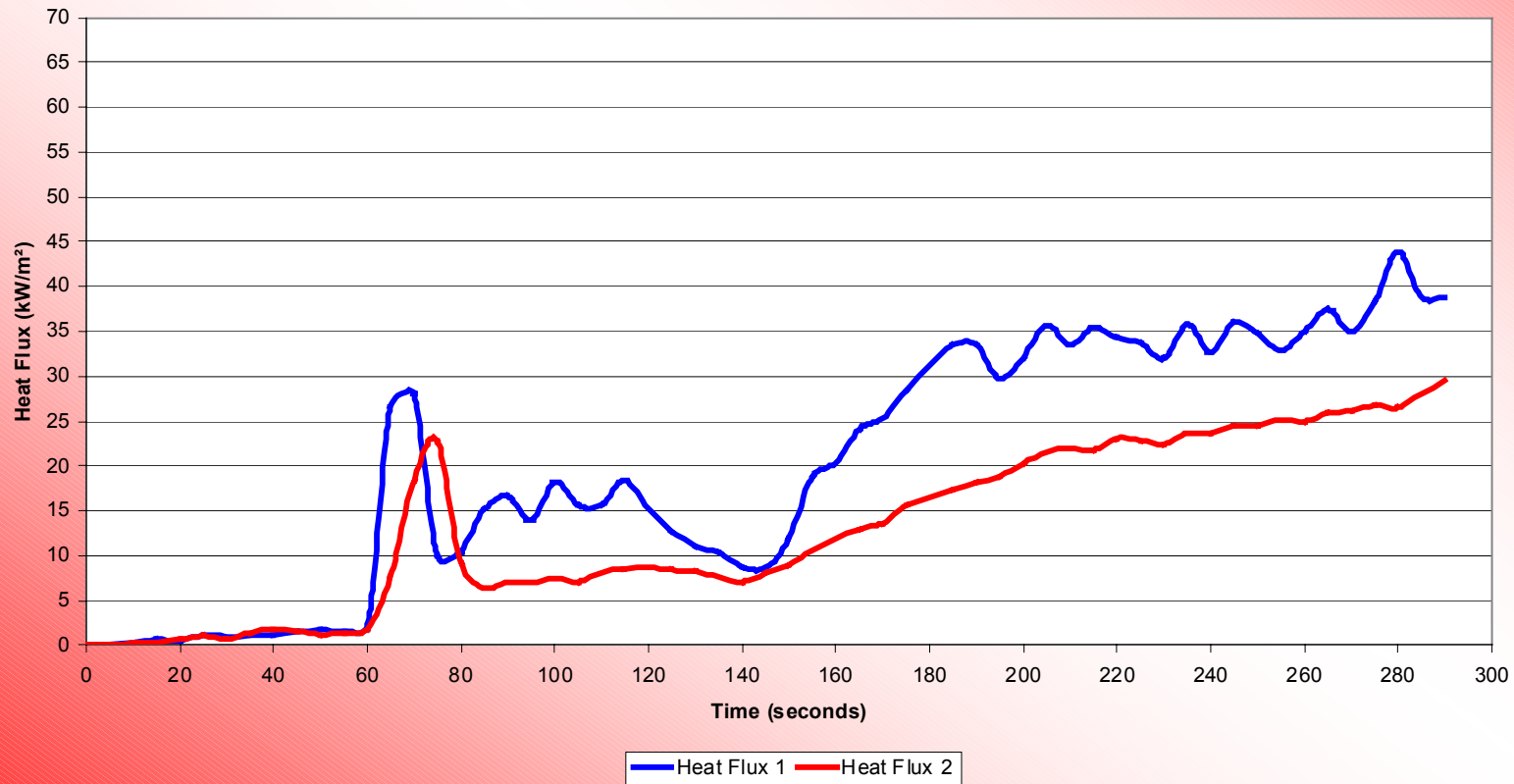
Overlapping of Insulation Bags



Frame Covering/Capping Strips



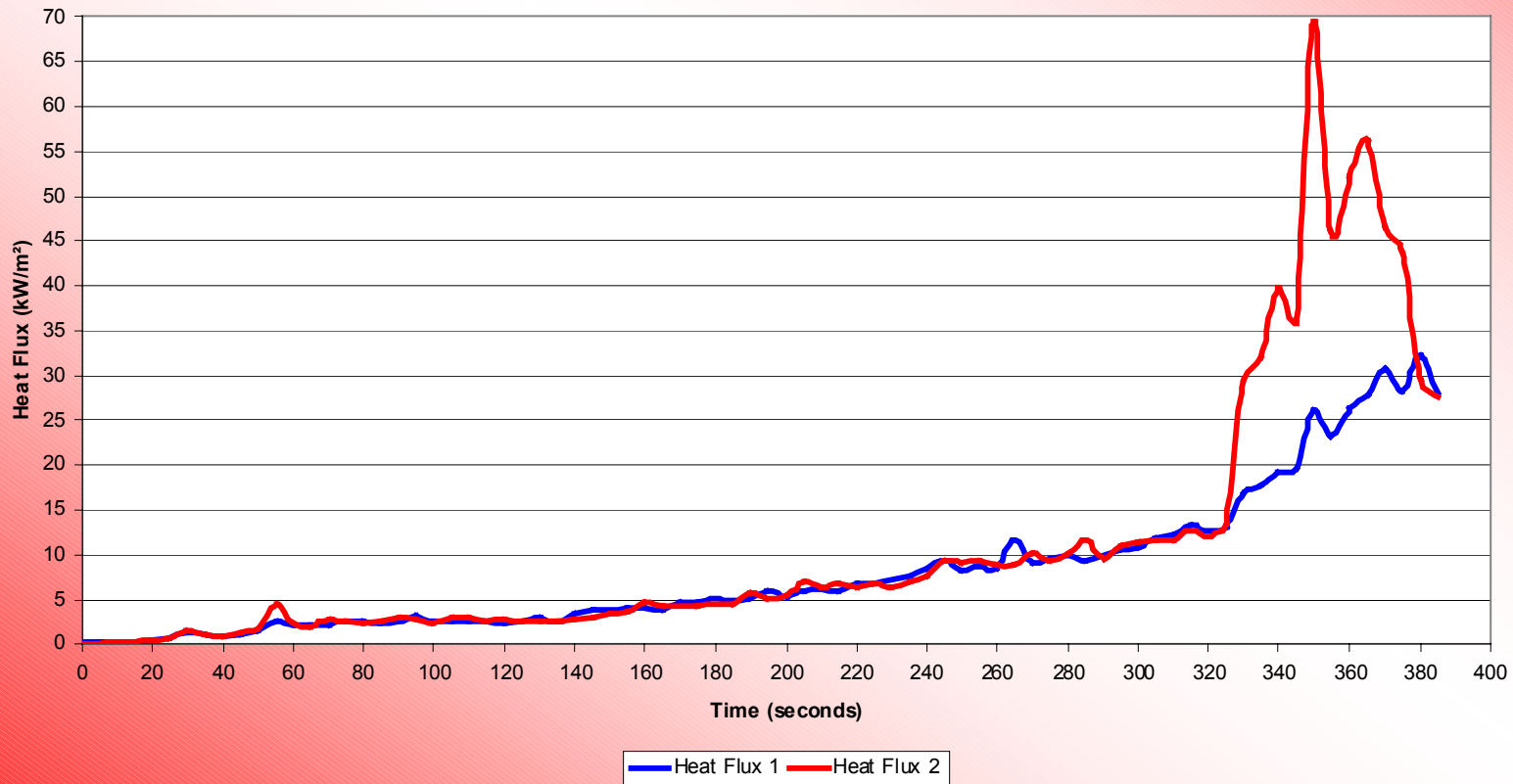
- A test was conducted on an insulation system with no capping strip present to determine the necessity for this aspect of the installation. The results of the test are shown below.



Frame Covering/Capping Strips



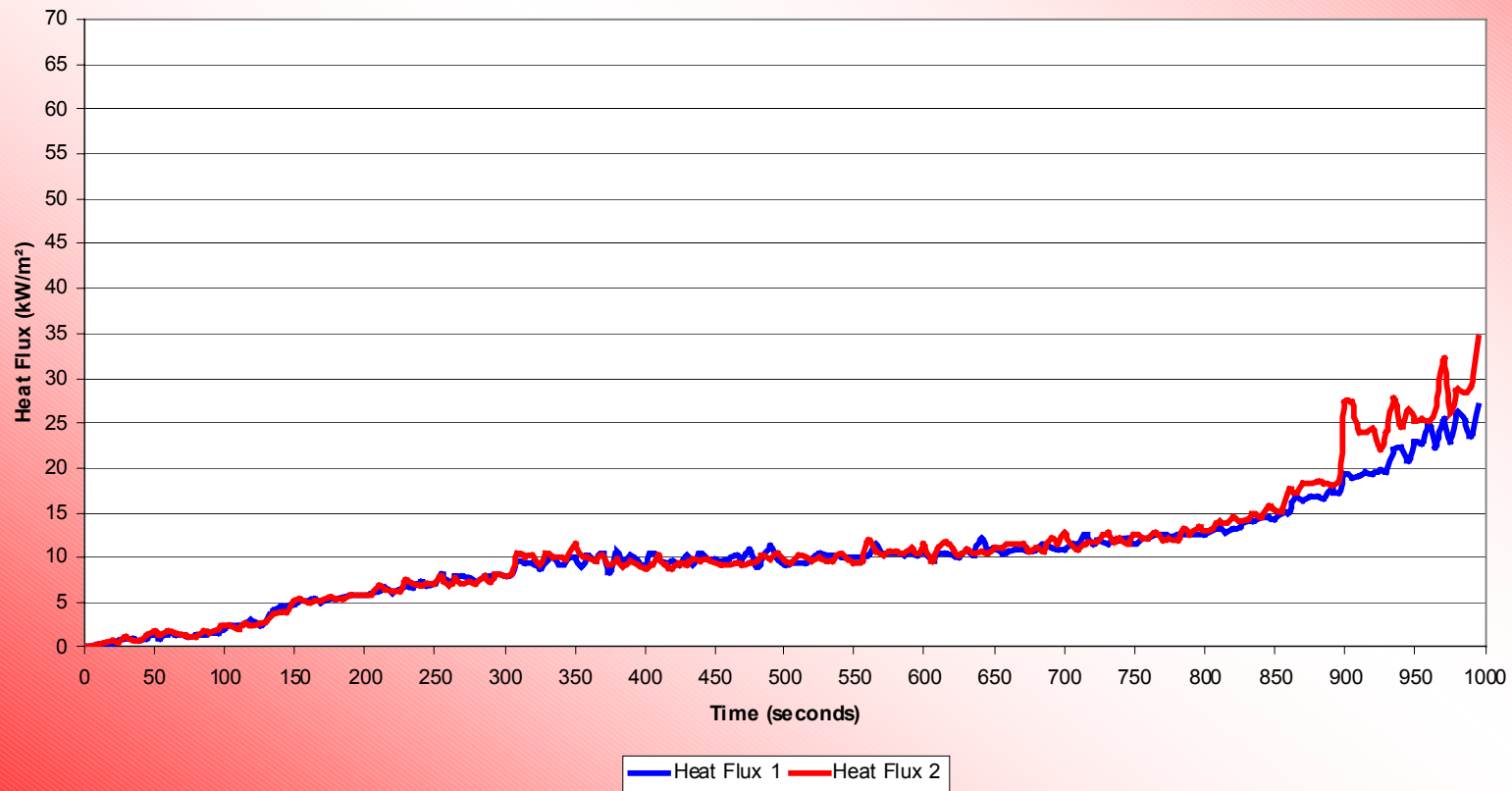
- A similarly configured test was then carried out with the addition of cap strips. The cap strips were made of fibreglass batting encapsulated in a PVF based bagging film.

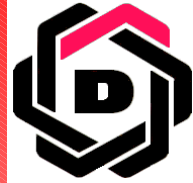


Frame Covering/Capping Strips



- An additional test was then carried out changing the cap strip material. The cap strips were made of Orcobloc batting encapsulated in a Orcofilm KN-80 bagging film.





Summary of Conclusions

- The body of testing has shown consistently that any gaps in the insulation material, close to the fuselage skin, will result in rapid flame penetration into the cabin.
- It is therefore essential that the thermal acoustic liner installation is such that it restricts the passage of gases and subsequent flame penetration through to the cold side of the insulation bag.
- The presence of protective coatings and corrosion inhibitors on the aircraft structure appears to have an adverse effect on the capability of an installation to achieve the levels of protection suggested by the testing carried out on stylised panels.



Summary of Conclusions

- The areas of the installation that seem to be particularly vulnerable are at the insulation bag overlap.
- Testing has shown that it is possible to achieve satisfactory levels of protection with bag overlaps of 150mm provided the overlap is secured with suitable tape and fixings.
- In final conclusion the extensive testing carried out under this research programme has shown that extended periods of protection (up to 900 seconds) may be achieved when burnthrough resistant materials are installed.



Insulation Materials & Bagging Film

| Microlite AA | |
|---------------------|--|
| Description | Microlite AA is a fibreglass material, which is currently used on the majority of transport category aircraft. |
| Typical Densities | 6.7 kg/m ³ for between frame blankets 9.6 kg/m ³ for the cap strips |
| Nominal Thickness | 50.8 mm for between frame blankets 25.4 mm for cap strips |
| Orcobloc | |
| Description | Orcobloc is an Orcon product designation for insulation batting made using Curlon fibres. Curlon is comprised of heat-treated oxidised polyacrylonitrile fibre and is similar in appearance to fibreglass but black in colour. |
| Typical Densities | 6.7 kg/m ³ for between frame blankets 9.6 kg/m ³ for the cap strips |
| Nominal Thickness | 50.8 mm for between frame blankets 25.4 mm for cap strips |

| Bagging Film | |
|---------------------|--|
| Orcofilm AN-18R | A metallized polyvinyl fluoride based film, reinforced on one side with polyester yarns. |
| Orcofilm KN-80 | A polyimide based film, reinforced on one side with nylon yarns. |
| Insulfab 330 | A metallized polyvinyl fluoride based film manufactured using a proprietary adhesive bonding fabric. |