



Lightning testing... ...random things

Phil Leichauer



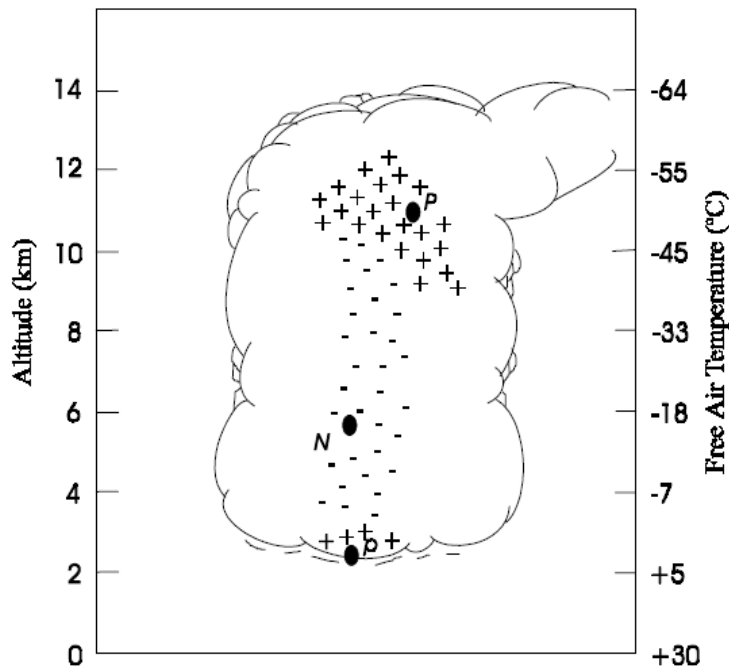
Why lightning test things?

Why protect aircraft?

- Average lightning is around 33kA peak
- On average, each aircraft is struck once per year
- If not protected, lightning could induce:
 - Sparks in the fuel tanks/systems
 - Electrical disturbances
 - Welding of hinges and bearings

How to protect aircraft:

- By understanding the problem
- By following standards that ensure compliance and flightworthiness
- By using protection methods such as:
 - Expanded metal mesh over carbon panels
 - Thorough bonding of conductive parts
 - Ensuring everything can handle the current



Generating lightning

A or D waveform
200 kA / 54 kV
(LCR circuit)

B waveform
4 kA / 14 kV
(LCR circuit)

C waveform
0.4 kA / 3 kV
(CR discharge)

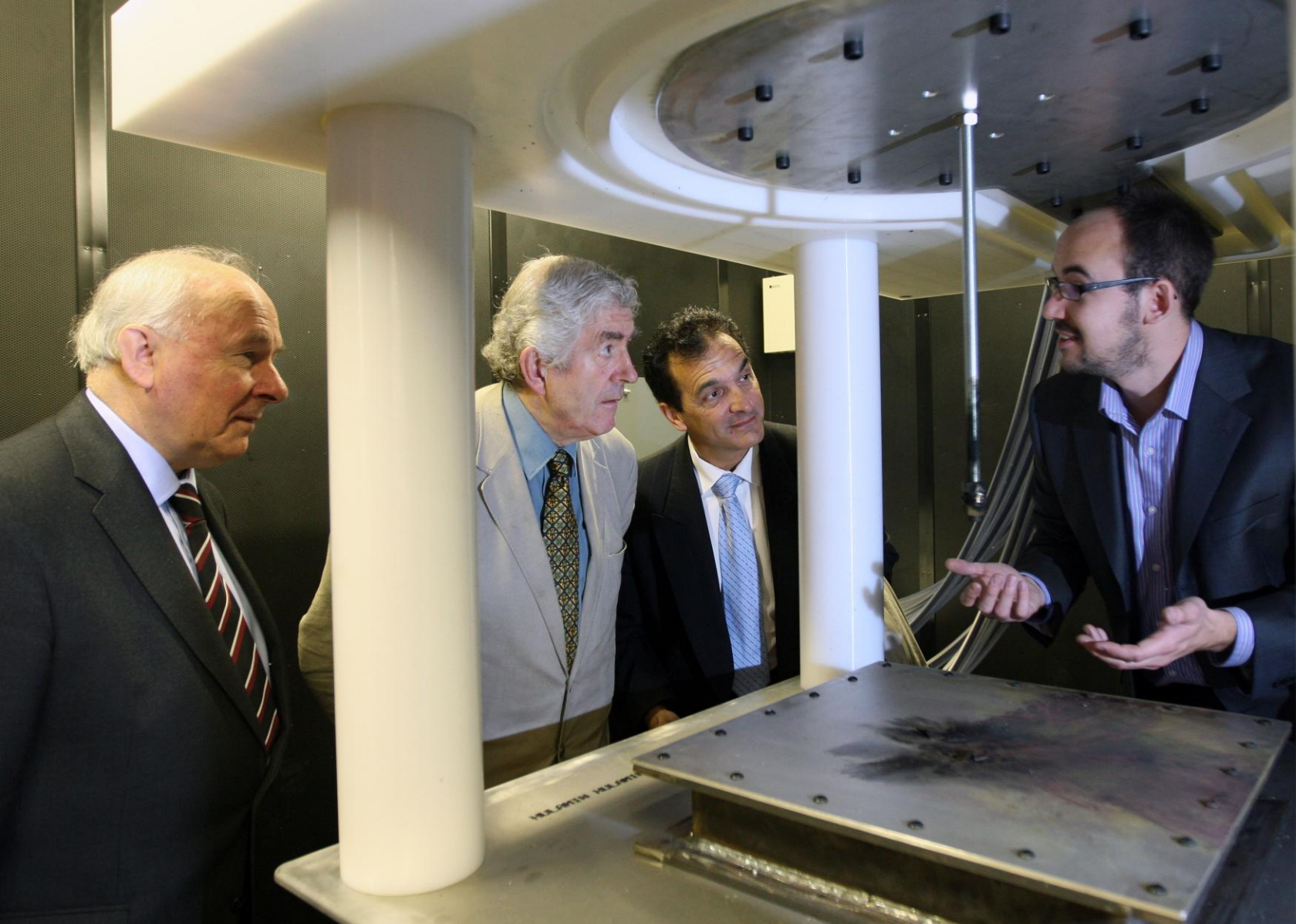
For the A waveform:

$$\begin{aligned} I_0 &= 218,810 \\ \alpha &= 11,354\text{s}^{-1} \\ \beta &= 647,265\text{s}^{-1} \end{aligned}$$



$$\zeta = \frac{R}{2} \sqrt{\frac{C}{L}}$$

$$I(t) = I_0(e^{-\alpha t} - e^{-\beta t}) = A_1 e^{-\omega_0(\zeta + \sqrt{\zeta^2 - 1})t} + A_2 e^{-\omega_0(\zeta - \sqrt{\zeta^2 - 1})t}$$



From left – **Dr David Grant** (*Vice-Chancellor of Cardiff University*),
Rhodri Morgan (*First Minister for Wales when project was kindled*),
John Botti (*EADS CTO*),
Philip Leichauer (*Project manager/engineer for the Morgan-Botti Lightning Laboratory*)