LOLA GROUP

Lightweight structures and aerodynamic technologies

MG-Lola B0540

Winner LMP2

Le Mans 24 hrs
2005 & 2006

Technology Transfer

- Lola Group provides access to motorsport technologies
- F1 teams keep their technology secret.
- Lola has exploited both carbon fibre composites and wind tunnel model testing for over 20 years.
- Much published in magazines about composites and aero but little understood

Carbon fibre composites

- Engineering with carbon fibre is not a black art.
- 60% of a typical racecar is composite
- For potential new users properties not widely understood in the same way as traditional materials and processes.
- More awareness due to Airbus A380 and Boeing 787
- Increase in global supply
- 20 years of experience in application- design and manufacture

Extremely versatile and strong

- Construction is based on moulding of panels- free shape
- Strength/ weight ratio
- Fatigue resistance
- Energy absorption
- Complex shapes
- No rivets! Adhesive bonding only
- Apply loads through solid inserts- steel, aluminium, titanium
- Almost zero thermal expansion
- Service temperature up to 180 ºC or even 250 ºC

Applications

- Car body panels- carbon or glass fibre reinforcement
- Class A surface finish
- Panels can be painted directly
- Resin Transfer Moulding
- Lola Composites manufactures 12,000 class A car body panels per year

Applications

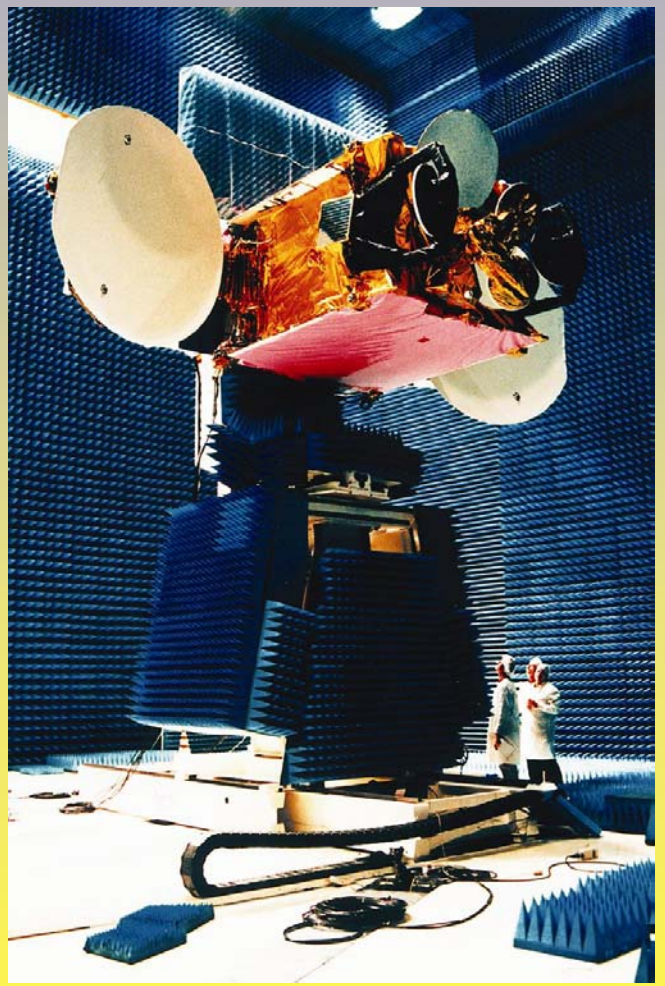
- Road car chassis
- Best results obtained if designed for CFRP

Easy design for manufacture

- Inexpensive tooling compared to pressed steel, good for low volumes
- More versatile shapes than extruded aluminium
- Stronger and lighter than castings
- Very accurate shapes. Manufacturing tolerances < 0.3 mm

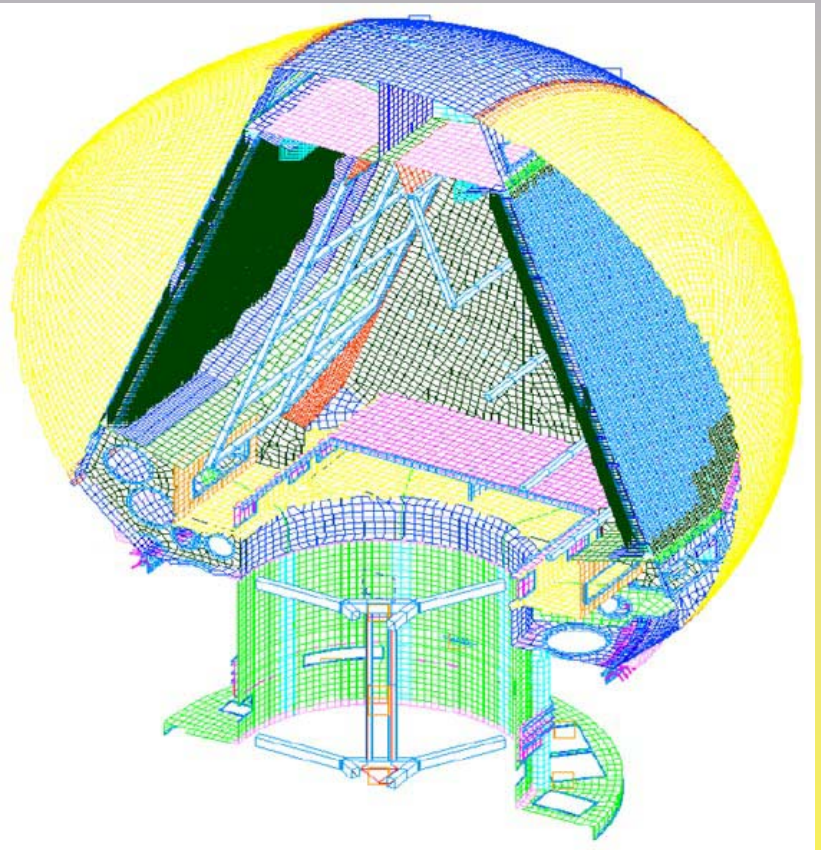
Integrated shape and structure

- Lightweight structures
- Improved packaging space
- Multiple functions from single component:
  - Load bearing structure
  - Enclosure from environment (bodywork)
  - Impact protection and absorption



Stress analysis

- FE linear analysis well established.
  - MSC Laminate Modeller
  - Altair Hyperworks
- For aero structures, surface pressures can be imported from CFD



Impact absorbing structures

- Non-linear (crash) in infancy
- To date empirical formulae have proven accurate for energy absorption
- Always needs to be validated with testing

Damage and repairs

- In field damage detection and repairs are essential for defence applications
- Portable Ultrasonic NDT equipment
- Composite structures can be repaired both temporarily and permanently.
- Normally adds weight and stiffness.

Aircraft Quality Standard

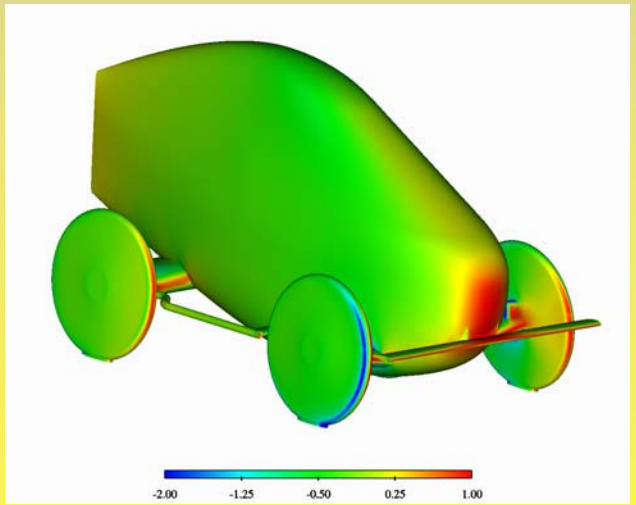
- Lola Group is approved to quality standard AS9100 for design and manufacture of composite tooling and components for aircraft.

Aerodynamic technology

- In depth understanding and experience of ground vehicle aerodynamics
- 20 years of wind tunnel model testing

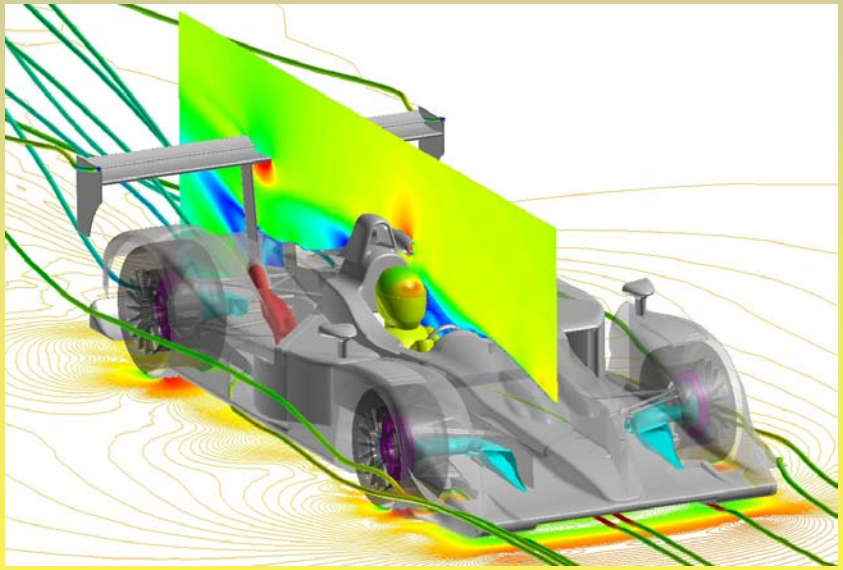
Applications

- Application to any structure subject to wind or fluid flows
  - Vehicles
  - Buildings
  - Bridges
  - Masts
  - Boat hulls

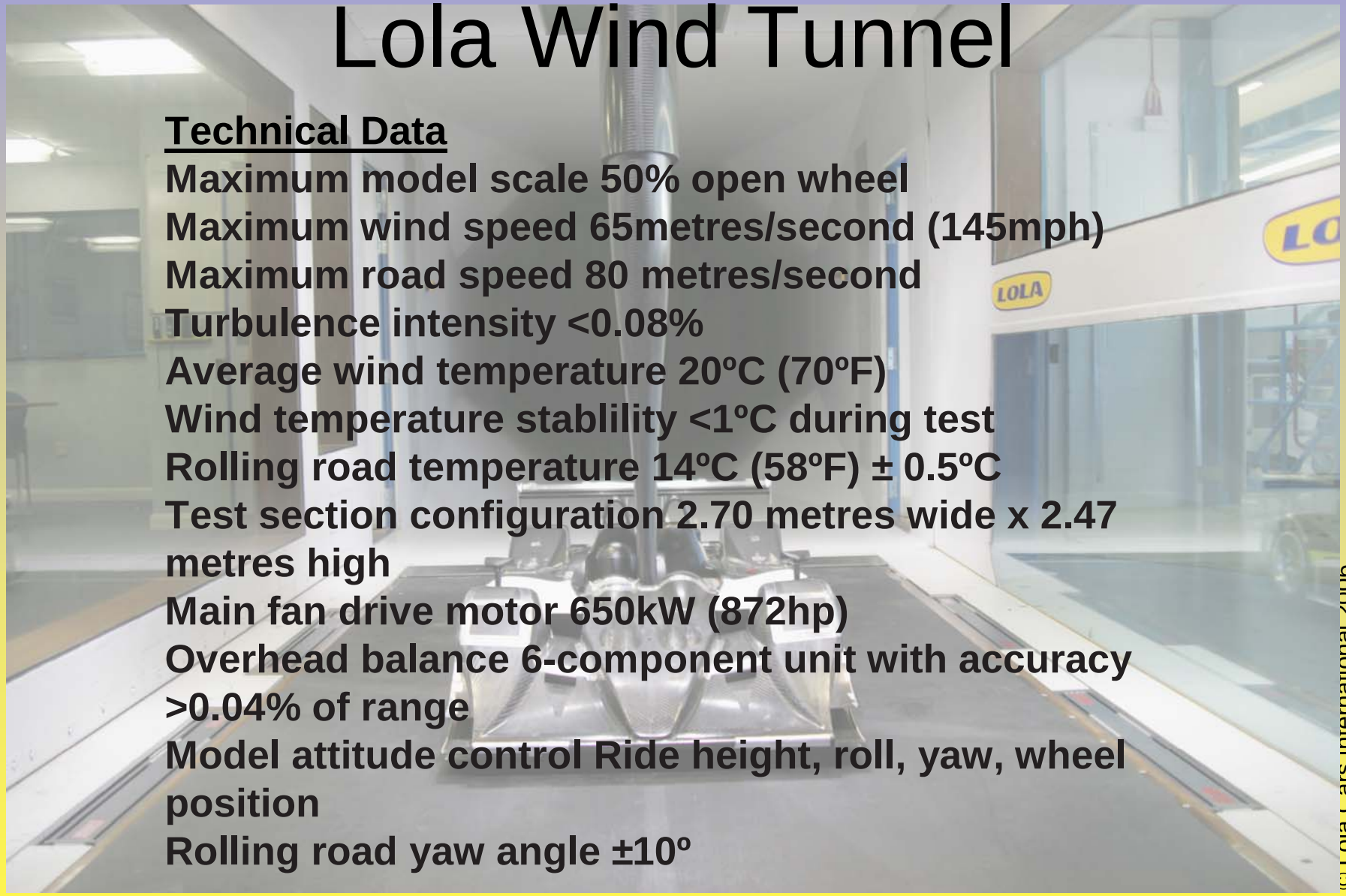


Experience plus state of the art tools

- Very experimental but experience can narrow the search field
- Tools:
  - Wind tunnel testing
  - CFD
  - Coastdown



Lola Wind Tunnel



Technical Data

Maximum model scale 50% open wheel
Maximum wind speed 65metres/second (145mph)
Maximum road speed 80 metres/second
Turbulence intensity <0.08%
Average wind temperature 20ºC (70ºF)
Wind temperature stablility <1ºC during test
Rolling road temperature 14ºC (58ºF) ± 0.5ºC
Test section configuration 2.70 metres wide x 2.47 metres high
Main fan drive motor 650kW (872hp)
Overhead balance 6-component unit with accuracy >0.04% of range
Model attitude control Ride height, roll, yaw, wheel position
Rolling road yaw angle ±10º

Testing technology

- Wind tunnel technologies:
  - Fan blade design and manufacture
  - Model positioning actuators
  - Model design and manufacture

Computational Fluid Dynamics

- Fluent CFD
- Full car simulation
- Visualise flow structures
- Look for pressure loss, turbulence, vorticity
- Identify areas for investigation
- Forces predicted within 10%

Transient CFD analysis

- Rotating or moving bodies can be simulated
- Rotating wheels and moving ground considered “steady state” as solution is not position sensitive
- Varying incidence of assymmetric body such as rotating antenna housing requires transient solution
- Aero pressures can be exported to FEA as structural design load case

Coastdown testing

- Full size validation and testing
- Does not require a model
- Limited productivity
- Accurate results providing atmospheric correction factors applied

…and we also build racing cars