Background – My Career to Date

• Bristol University Graduate
  • MEng Degree in Aeronautical Engineering
    • Graduated Summer 2002
  • PhD in Experimental Aerodynamics
    • Graduated Summer 2007

• Formula 1 Career
  • Toyota Motorsport – F1 Programme
    • Aerodynamicist (June 2007 – December 2009)
  • Team Lotus F1 Team
    • Senior Trackside Aerodynamicist (Feb 2010 – Nov 2011)
  • Marussia F1 Team
    • Senior Future Concept Aerodynamicist (from March 2012)
What is Formula 1 or F1?

- Motorsport championship governed and sanctioned by the world body of motor racing – Federation Internationale de l’Automobile or FIA.
- Highest class of single seater auto racing within the list of FIA sanctioned events.
- Races are known as Grand Prix and are held all over the world – For 2012, 20 races are planned.
- Two World Championships are at stake each year, the drivers and constructors titles.
- Since 2009, 12 teams, 24 drivers have competed in each Formula One event.
- Figures from Formula One Management claim 527 million people across 187 countries watched Formula One in 2010.
How to demonstrate ‘Inside Track’ of Formula 1 in 25 minutes??

Roles within an F1 team involved when bringing an aerodynamic update to the race car
AERODYNAMICIST

• Scheme ideas/novel concepts to find aerodynamic performance within current regulations – published by FIA

• Utilise scale model wind tunnel testing

• Wind Tunnel Specification – 50m/s maximum, 60% scale model maximum.
AERODYNAMICIST

- Analyse results from wind tunnel testing
- Accurately report the conclusions of wind tunnel tests
  - 1) Recommend part for full scale release
  - 2) Initiate new design loops, either iterative or conceptual
CFD AERODYNAMICIST

- Computational Analysis of F1 Car Aerodynamics
- Working in conjunction with aerodynamicists to investigate new concepts and aid understanding of wind tunnel results
CFD AERODYNAMICIST

- Computational Analysis of F1 Car Aerodynamics
- Post-processing of CFD results can show flow structures, surface pressures, component loads and overall car loads
CFD AERODYNAMICIST

- CFD engineer may be asked to provide specific post-processing to aid the design process.
- Example – Rear brake duct inlet flow seeding
MODEL SCALE CAD DESIGNER

- Work under the direction of the aerodynamicist to produce final design surfaces
- CAD Software used in F1 – CATIA V5 or NX Unigraphics

MODEL SCALE PRODUCTION

- Parts for F1 wind tunnel model are usually made from carbon fibre, aluminium, and using rapid prototyping stereolithography machines.
Pathway to the Track

WIND TUNNEL OPERATOR

• Key person required for wind tunnel programme to function
• Responsible for wind tunnel operation and safety

WIND TUNNEL MODELMAKERS

• Involvement in later stages of model part manufacture
• Check the parts and prefit to check dimensional fit
• Key involvement in the wind tunnel testing, making changes to the model as directed by the aerodynamicist
RECENT WIND TUNNEL TECHNIQUE IMPROVEMENTS

- Increase the scale of your model – Legality limits
- Improve efficiency of your data analysis techniques – Legality is continually monitored
- Introduction of Particle Image Velocimetry (PIV)
AERODYNAMICS DEPARTMENT MANAGEMENT

- **Aerodynamic Group Leaders** will have responsibility for development of a car area and importantly submitting all new improvements for full scale release.

- **Head of Aerodynamics** leads the department with responsibility for all activities, people and budgets associated with the wind tunnel, associated model shop, and CFD group.

- Further responsibilities lie outside the department including,
  - Release of new surfaces to full scale design office
  - Release of aerodynamic data and simulation results to race team
  - Feedback of senior management decisions
FULL SCALE DESIGN OFFICE

- Stress Engineer
  - Design to ensure structural integrity using Finite Element Analysis
  - Ensure FIA Legality standards

- Composite Design Engineer
  - Design tooling/moulds/jigs and fixtures required for assembly
  - Complete design documentation, both inhouse and FIA
FULL SCALE PRODUCTION

• CNC Operators/Composite Laminators
  • In-house or external manufacture in line with composite design
• Design Verification Process
  • Proof and/or fatigue tests and legality checks
  • Some new concepts may require destructive testing
• Paint Shop and Stickering
  • Paint/foil used depending on weight and finish
RACE TEAM

LOGISTICS - PEOPLE

- Race Team Management
  - Race Team Travel
  - Hotels/Flights/Cars/Movement Schedules
  - Driver Schedules

LOGISTICS - INFRASTRUCTURE

- Four/Five Trucks bring Cars/Equipment/Spares/Office Space
- Team motorhome houses marketing, catering, and guests!
Pathway to the Track

RACE TEAM - MECHANICS

• Factory based car build
• Trackside Car Build and Setup
• Race Pitstops

RACE TEAM – ENGINEERS WITH RESPONSIBILITIES

• Tyre Engineer - Pirelli
• Engine Engineers
• Gearbox Engineer
• Electrical and Hydraulic Systems Engineers
Pathway to the Track

RACE TEAM – RACE ENGINEER
- Responsible for the planning and execution of car running
- Detailed interaction with driver before, during and after outings

RACE TEAM – PERFORMANCE ENGINEER
- Monitors live data streams coming from the car
- Data analysis as requested by race engineer in line with test programme
- Discussion with trackside aerodynamicist
Pathway to the Track

TRACKSIDE AERODYNAMIC ENGINEER

- Important role inside/outside the Aerodynamics Department due to responsibility for providing aerodynamic data from the wind tunnel/specific information to the rest of the team.
- Race catalogues detail aerodynamic characteristics of car, alongside all new and existing setup options.

- Full scale aerodynamic testing
  - Four (9 hour) days per year
  - Straight line or constant radius corner testing
  - Most commonly conducted on runways
Pathway to the Track

SENIOR TEAM MANAGEMENT

- Chief Engineer
- Sporting Director
- Technical Director
  - Adrian Newey, Paddy Lowe, Pat Fry
- Team Principal
  - Christian Horner, Martin Whitmarsh, Stefano Domenicali
Pathway to the Track

MOST IMPORTANT PERSON – DRIVER

• Provides hands on feedback regarding performance of the car and new upgrades/setup changes.
• Driver feedback is critical for successful development of an F1 car both on track and back in the factory

THE KEY TO SUCCESS - TEAMWORK

• Leading F1 teams consist of up to 650 people who must all work together efficiently
• All have the same rules and the same aim
  • To Win Grand Prix
Starting a Career in F1
Pathway to an F1 Career

University of Bristol F1 Alumni

- Chris Herbert (MEng Aero Eng 1995-1999)
  - Head of Aerodynamics – Toyota Motorsport
  - F1 experience with Toyota Motorsport, Red Bull Racing and Reynard

- James Rodgers (MEng/PhD Aerodynamics 1998-2006)
  - Aerodynamics Group Leader – McLaren Racing

- Rhodri Moseley (MEng Aero Eng 1989-1992)
  - Aerodynamics Project Leader – Ferrari
  - Previously Aerodynamicist at McLaren

- And a significant number of others!!
Advertisement of F1 Vacancies

- Print/online media
  - Autosport

- Marussia F1 Team
  - For further information about the team
    - www.MarussiaF1Team.com
  - All current vacancies are found at:
    - http://MonsterCoolJobs.com/MarussiaF1Team
  - Email address for speculative enquiries
    - jobs@marussiaf1team.com

- Other online resources
  - LinkedIn, F1 Team websites – Recurring Internships
Pathway to an F1 Career

F1 Interview Preparation

• Current Affairs
  • Internet Press, TV Coverage, Blogs, Forums, Twitter feeds

• Technical Blogs
  • James Allen, Craig Scarborough

• Books
  • Race Car Aerodynamics – Joseph Katz
  • Haynes – F1 Car Manual
  • Piola Annuals
Any Questions?