BLOODHOUND SSC

Inspiring the next generation of scientists and engineers?

NAAIDT Annual Conference 2010

Topics covered

- What is the BLOODHOUND SSC Project
- What makes BLOODHOUND SSC unique
- Why do we need such a project
- Target groups and delivery strategy
- Examples of curriculum support materials
- Feature some of the team involved
- First year audit results

October 2008 – launch video

BLOODHOUND SSC Project aims

1. To inspire the next generation

2. To bring coherence to the promotion of STEM

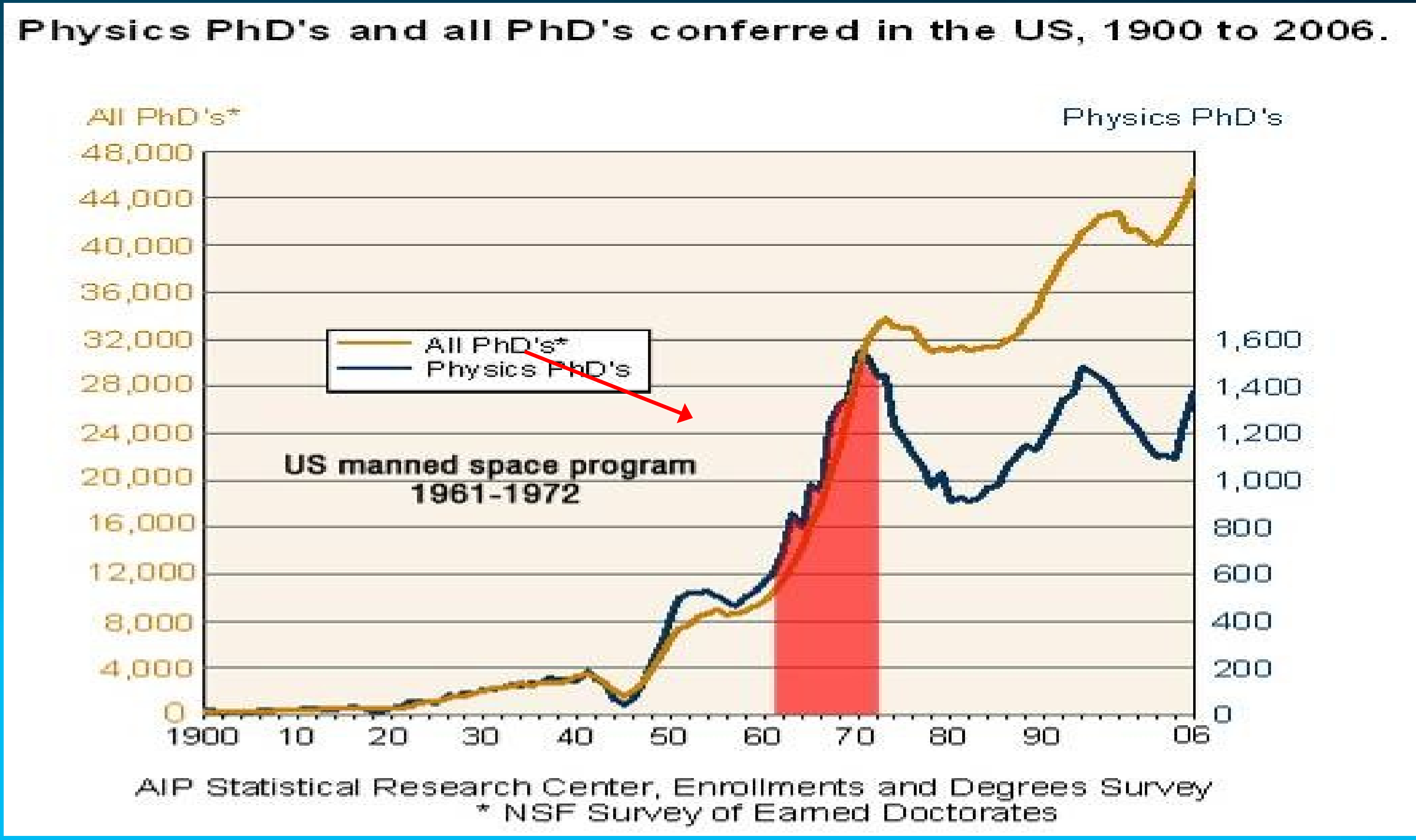
3. To push the boundaries of engineering

4. To break the World Land Speed Record

The BLOODHOUND SSC team will share all the research, design, manufacture, testing and challenges with schools, colleges and universities throughout the UK and the World.

We are looking to emulate the Apollo effect of the 1960 -70's.

'Apollo Effect' 1961-72



Concorde 1969 - 2004

UK inspiration?

Thrust SSC model goes supersonic

The World Land Speed Record Rules

Governed by FIA – encourages innovation

1. Car must have minimum of four wheels, all in contact with surface
2. Two runs in opposite directions within one hour
3. Driver?

Driver

Robot?

No! Andy Green
… the world's fastest mathematician

Faster than the speed of sound

1997 ThrustSSC

Black Rock Desert shock wave

BLOODHOUND SSC

Target groups

- Primary schools
- Secondary schools
- Special schools
- FE colleges
- Universities
- Families
- Youth organisations
- Underrepresented communities
- Girls

BLOODHOUND SSC basic facts

- 6,500 kgs fuelled weight – 6.5 tonnes
- 12.8 m long (42 feet)
- 2.8 m high (9’- 2”)
- 1.8 m wide at rear wheels (5’- 10”)
- 212 kN - 47,500 lb thrust = 135,000 eHP equivalent to 180 F1 cars

Partner organisations

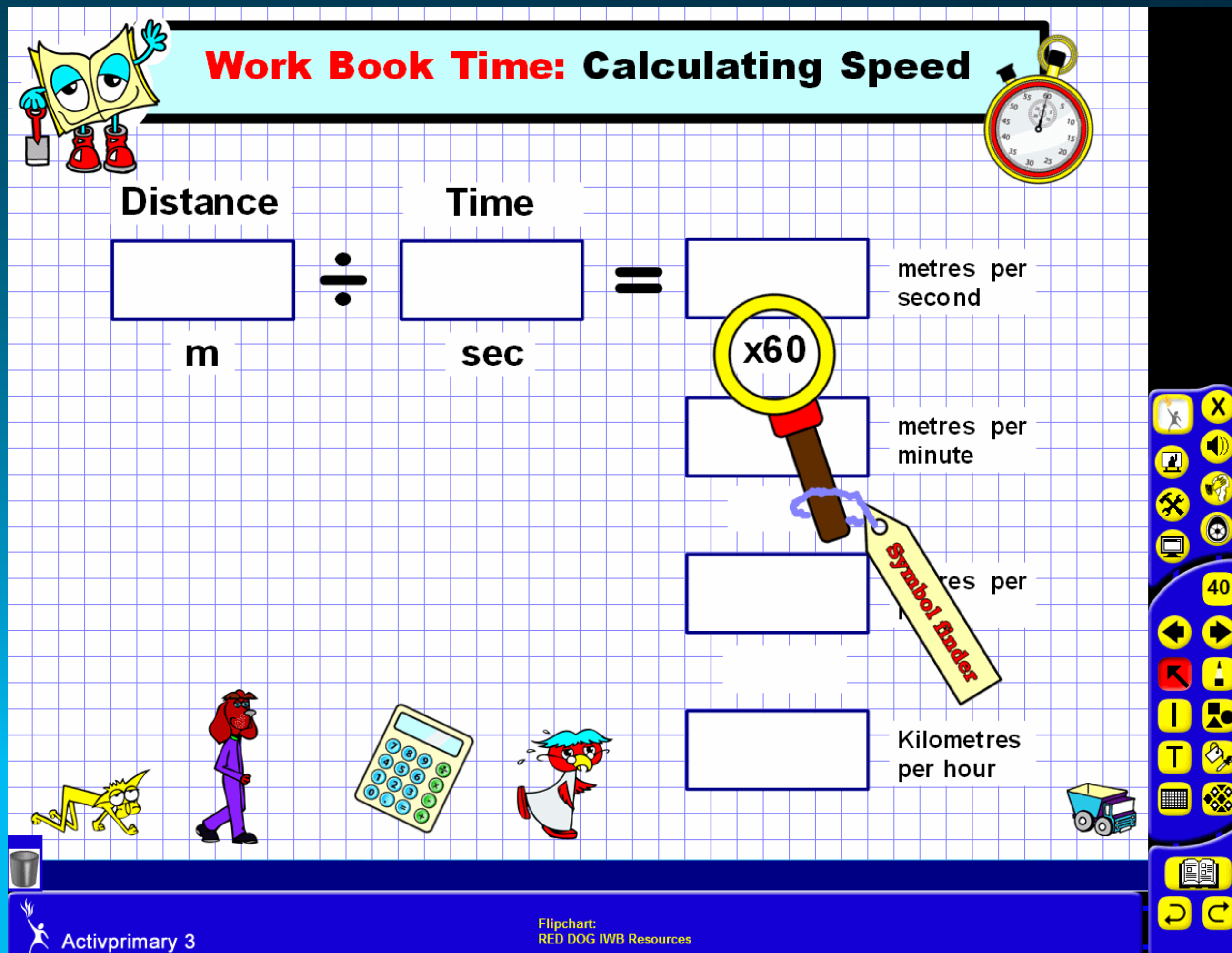
- Primary Engineer
- F1 in Schools
- Greenpower
- Young Engineers
- Junior Engineer for Britain – K'Nex Challenge
- Engineering Development Trust
- Science made Simple – Roadshow
- Smallpeice Trust
- ASE – DATA – NCETM etc

Networks – IEBE (NEBPN) - STEMNET

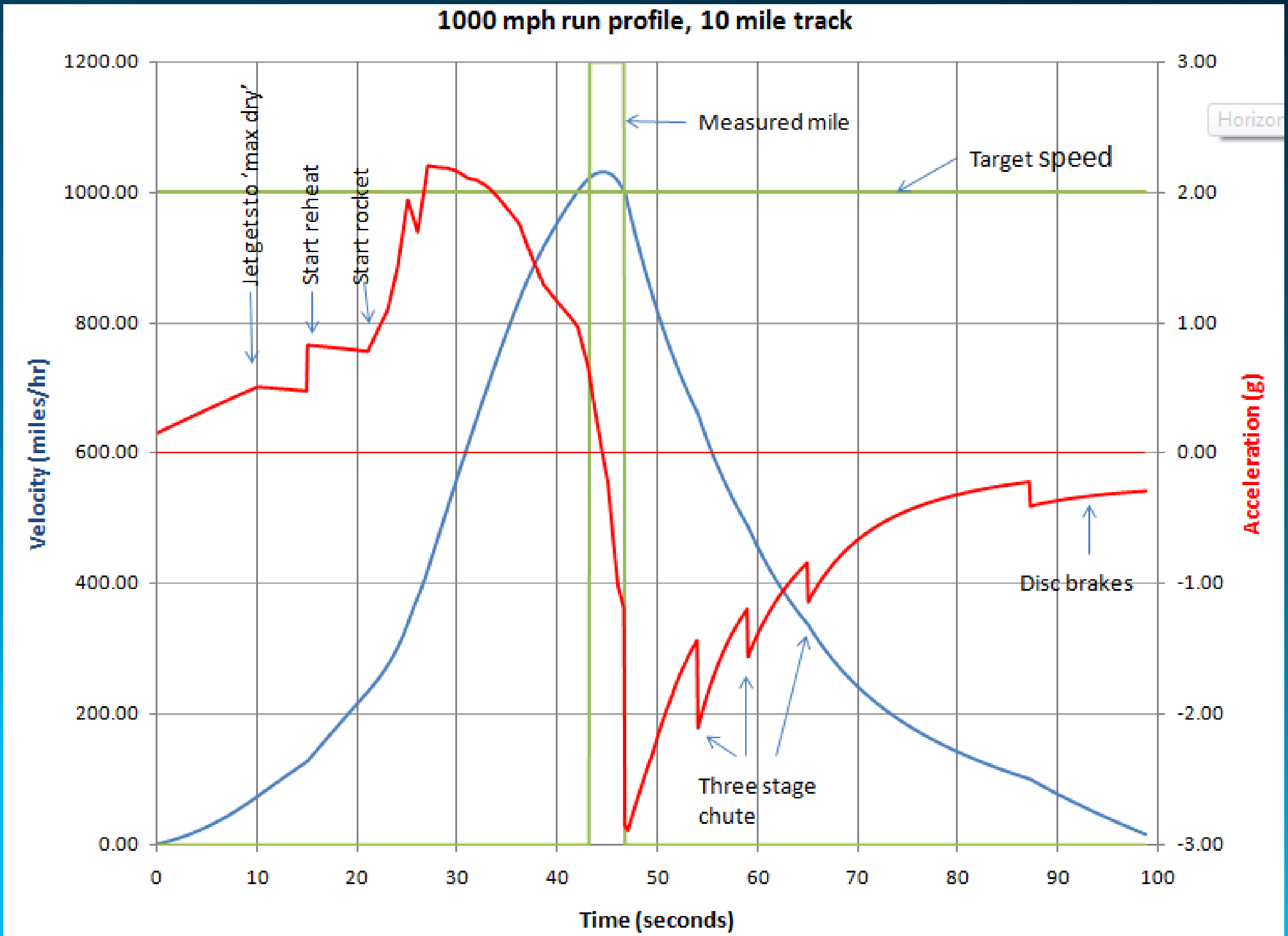
Initiatives supported

- Curriculum resources
- Work experience
- Internships
- CPD
- PDP
- STEM Ambassadors
- Education centre(s)
- Presentations
- Roadshow

Primary Engineer - Years 1 to 6



Interpretation of performance graphs



Performance graph information

	A	B	C	D	E	F	G	H
6	Jet max.thrust		lb	18,000		Rocket	SI (sec)	212
8			V mph	S miles	t seconds	Mach no	g before	g after
10	start run (jet only)		0	0.00	0.0	0.000		
11	Start rocket		250	0.39	11.0	0.328		
12	Start meas.mile		989	4.50	33.2	1.300		
13	Peak velocity		1031			1.355		
14	End of meas. mile		1009	5.50	36.7	1.325		
15	dt secs.	D/q sq.m						
16	Chute 1	1	546	7.77	48	0.718	-1.04	-1.66
17	Chute 2	2	365	8.63	55	0.480	-0.84	-1.39
18	Airbrake	0	-			-		-3.00
19			150				-0.1	
20	End of run			9.96	90.5			
21	Stopping dist.			4.46				

Engineering Diploma maths level 3

- Calculation of energy required to accelerate the vehicle and then stop
- Study of three stage acceleration and four stage deceleration
- Use of energy equation in acceleration/deceleratio
- Calculating the stability of the vehicle with respect speed

Engineering Diploma maths level 3

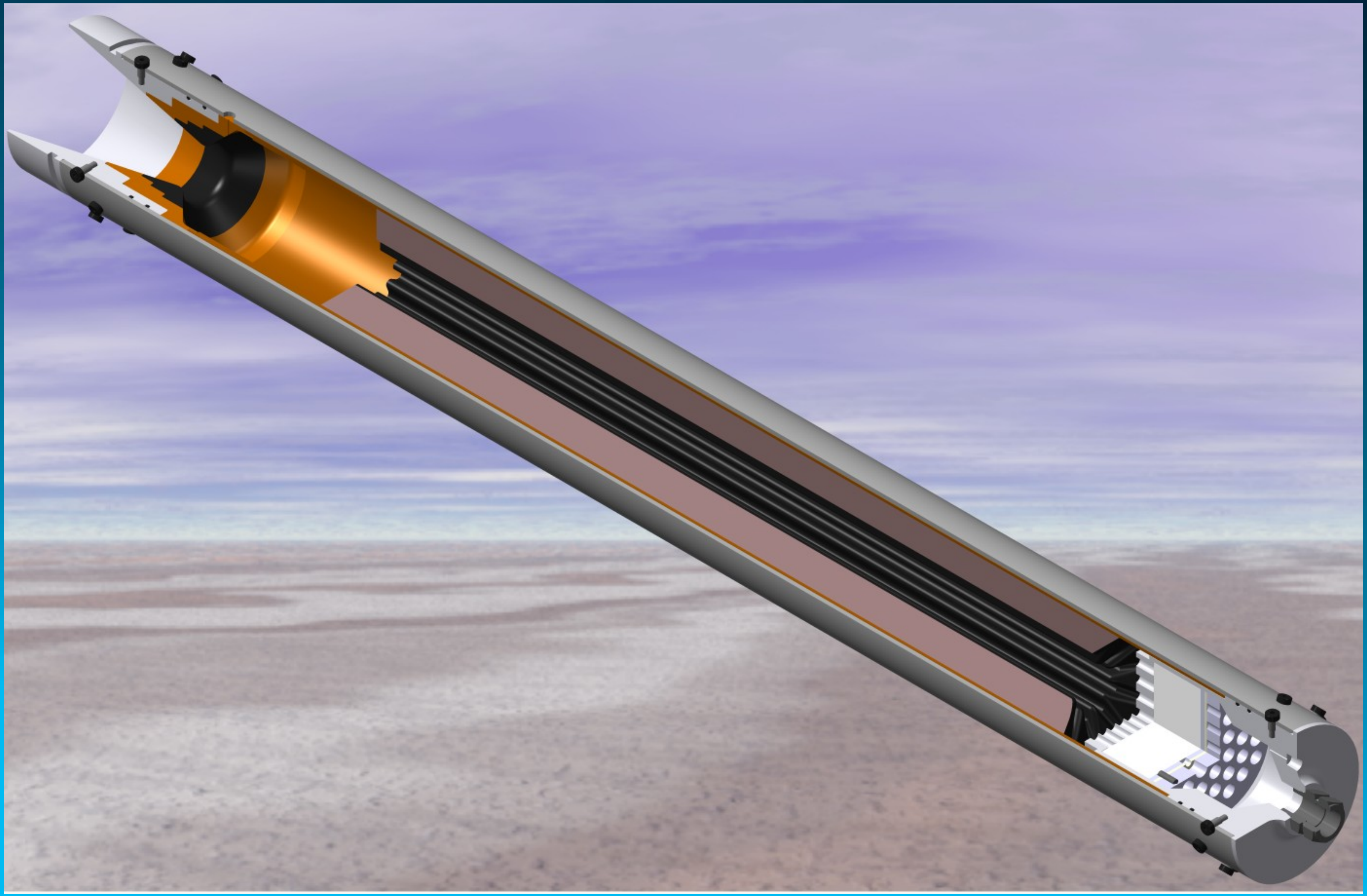
- Calculating coefficient of friction between wheels and surface
- Consumption rate of fuel, heat dissipation from engine, cooling chamber using water/ice mixture
- Calculating engine power, pump efficiency
- Study of the solid wheels, material being used and its properties

BLOODHOUND SSC engines

EJ200
Jet Engine

Eurofighter
Typhoon

Hybrid rocket

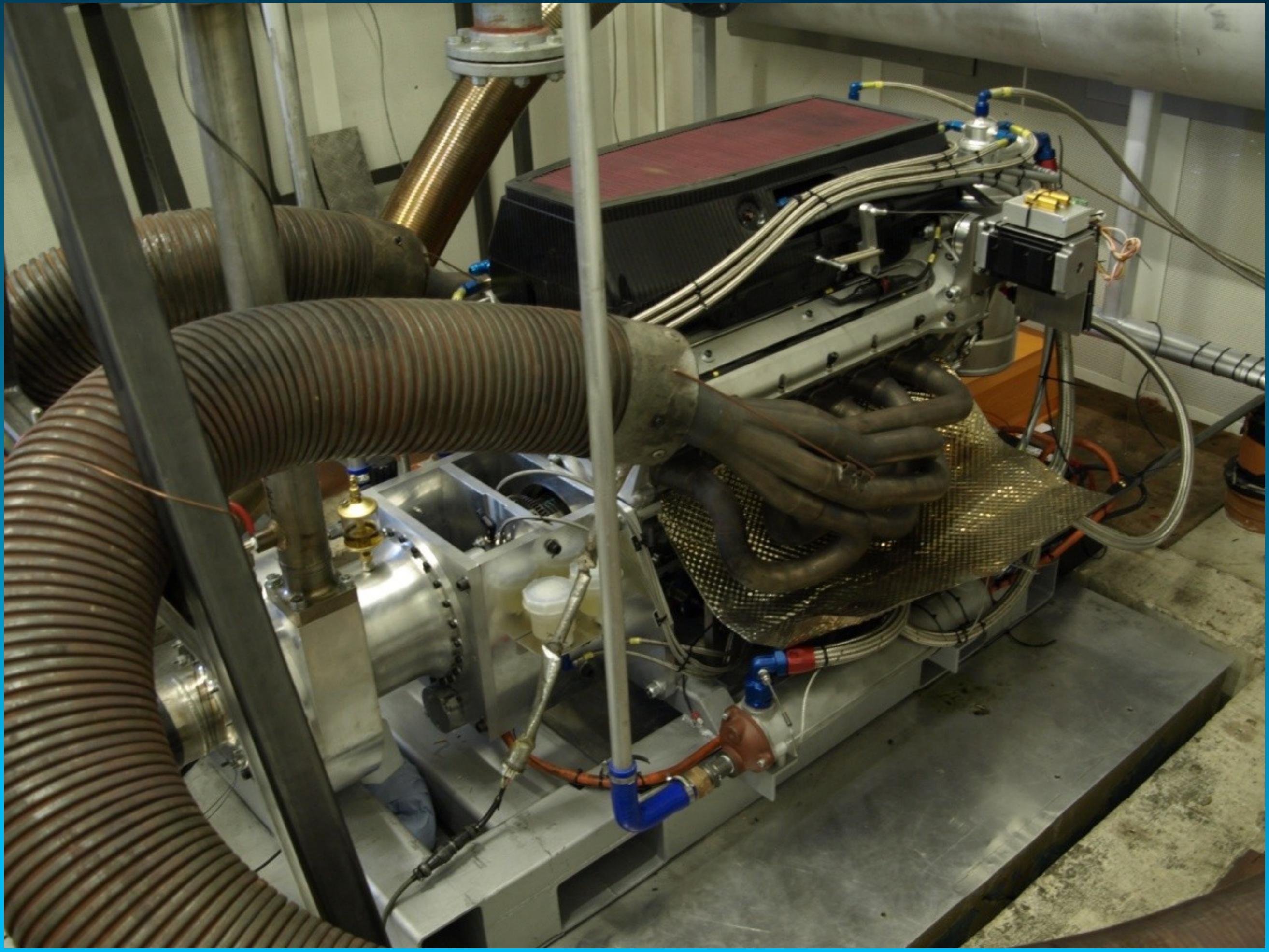


Rocket designer

Daniel Jubb
Rocket scientist

Hybrid rocket test firing

MCT V12 petrol engine



Prepare car for return run

- Change hybrid rocket
- Refuel jet tank/high test peroxide/ice radiators
- Download information
- Systems and physical check

Annie Beresford

Design engineer

Search for the run location - geography

- Run location requirements – length, location etc
- Salt lake or plye desert?
- Researched 35 locations
- Recently visited Australia, USA and South Africa
- And the preferred run location?

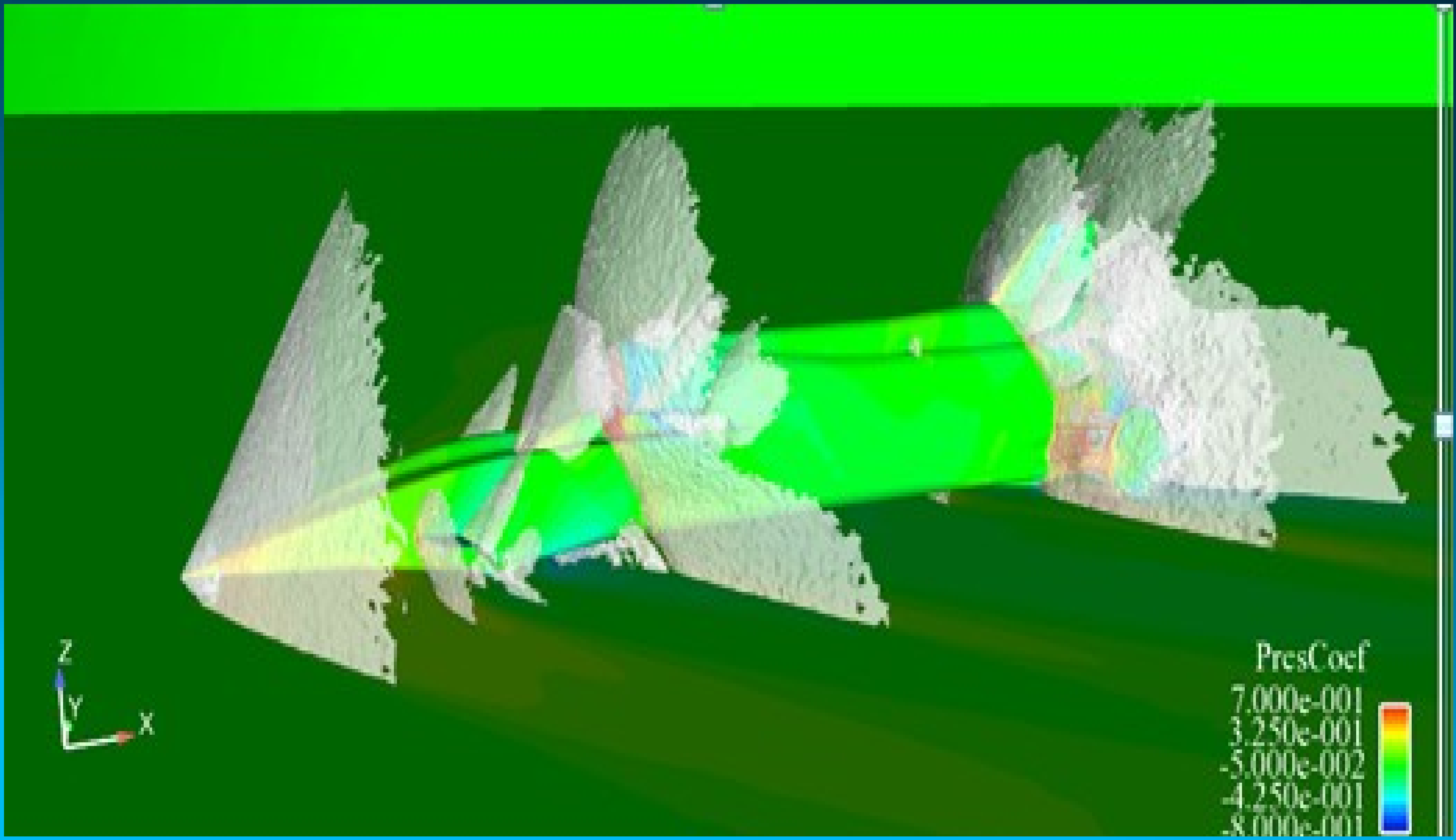
Run location

Northern Cape South Africa

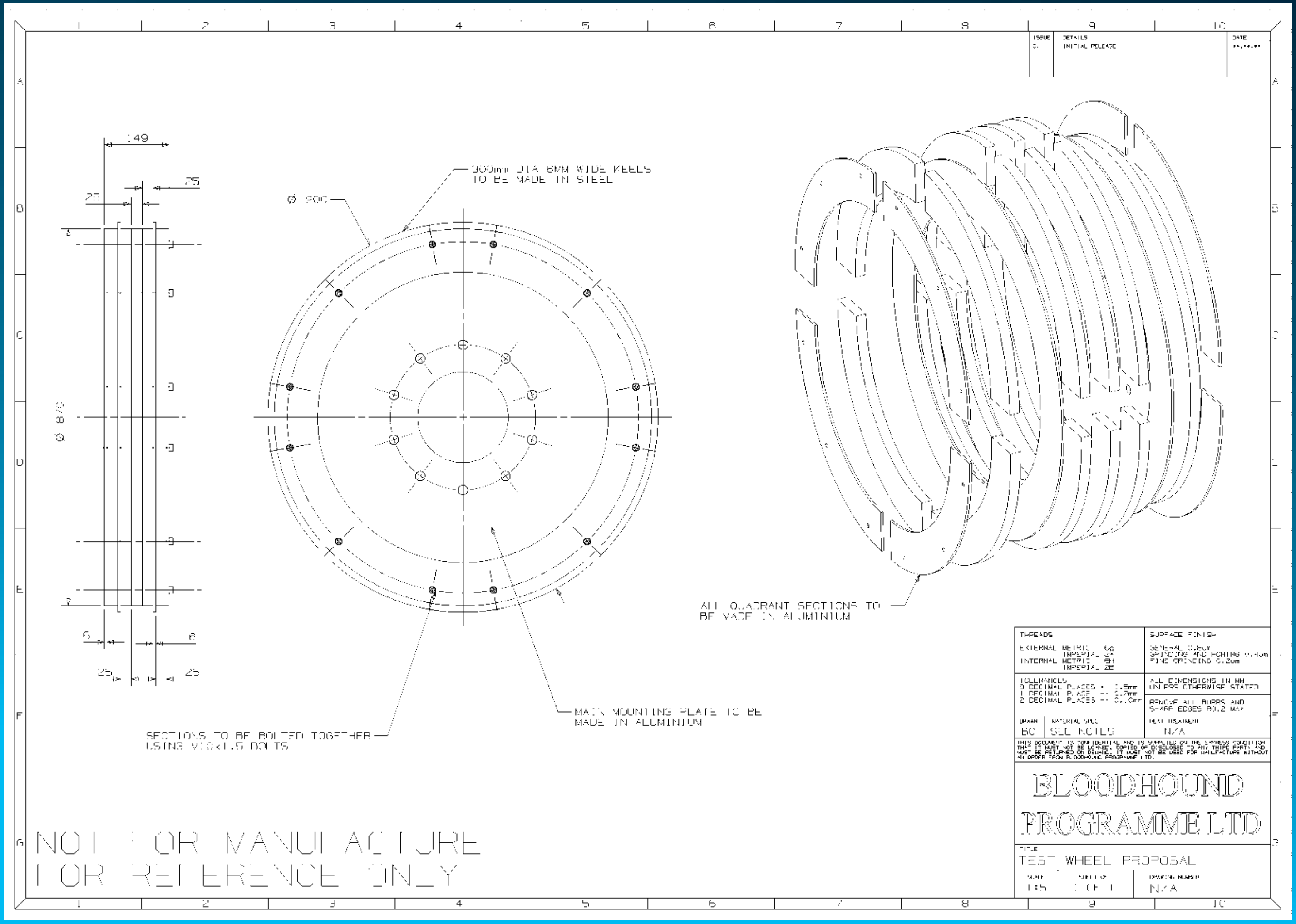
BLOODHOUND SSC pushing the boundaries

- Engineering – forces -12 tonnes/sq m
- Science – hybrid rocket research and design
- Aeronautical design, computational fluid dynamics (CFD)
- Materials – composites, textiles
- Wheels – 10,300 rpm, 50,000 radial G
- Manufacture – new processes, 200 companies

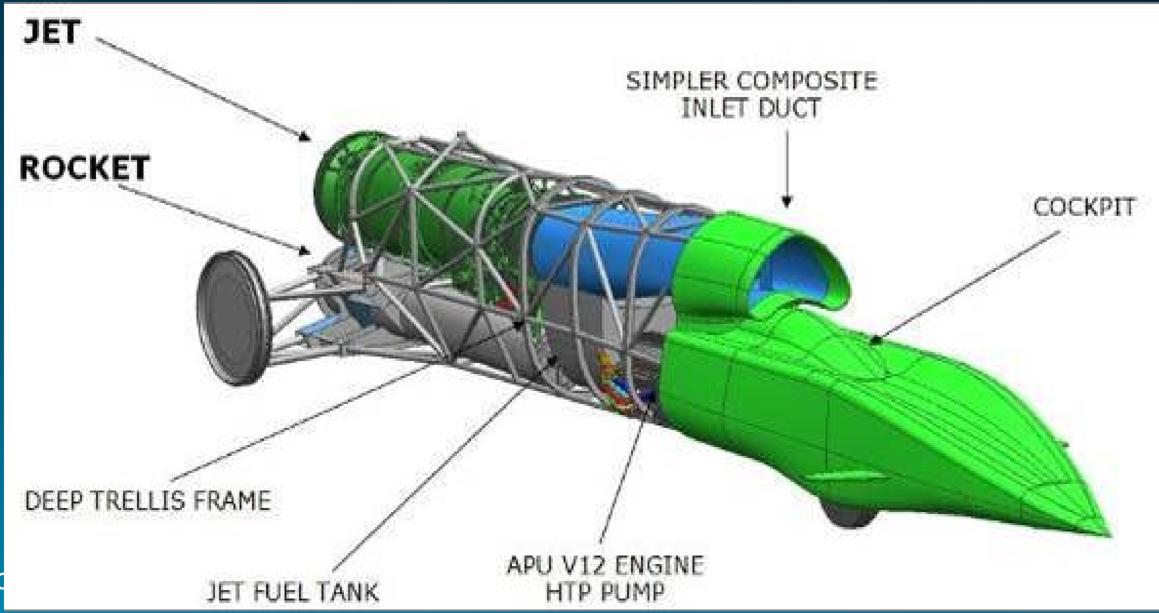
Computational fluid dynamics (CFD)



Lockheed Martin UK



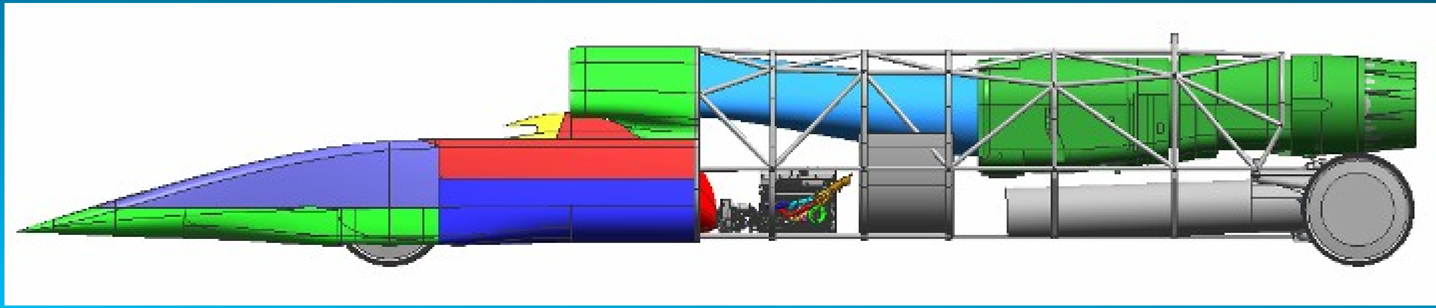
Major design change



- Reduces axle load variations during ac
- Structurally more complex at rear
- Simpler intake duct for EJ200
- Rocket slides in like torpedo

Final power plant layout

- The jet over rocket (JoR) design reduces the unwanted high load transfer effects
- Jet 90kN
- Rocket 120kN angled down 2 degrees



New external shape

Aussie Invader 5R

The competition

Fossett LSR

The competition

North American Eagle

What is working well?

Bloodhound theme provides a 'hook'

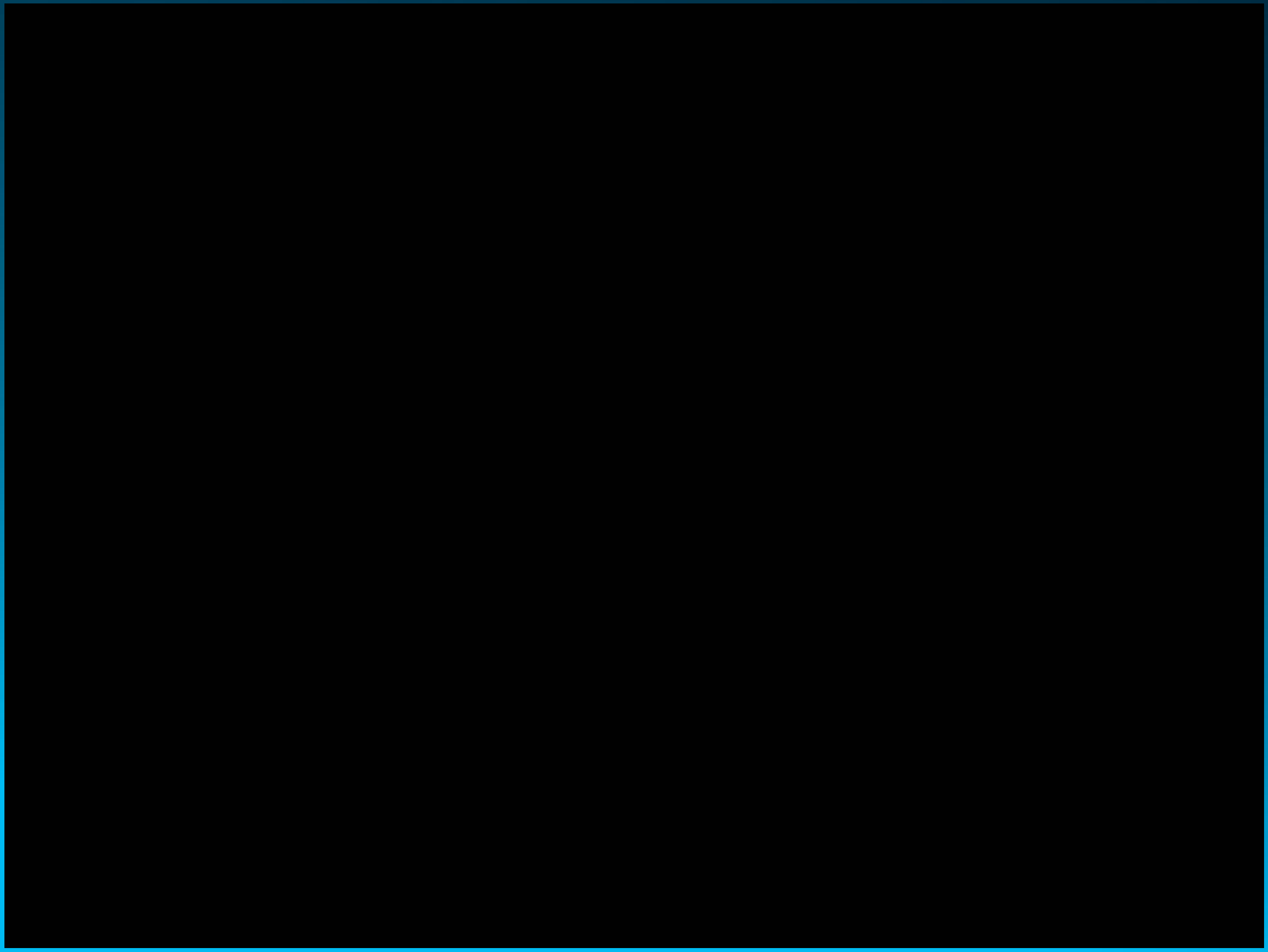
- Bloodhound provides a 'hook' around which to build STEM lessons (and other subjects)
- Encourages a cross-disciplinary approach
- Opportunity to teach 'STEM by stealth' - scientific enquiry undertaken in 'fun' ways
- Approach aids students' understanding of more complex constructs

What is working well?

Emerging outcomes

- Changed the perception of engineering as ‘dull’
- Increased enthusiasm of students for engineering or STEM more generally
- Raised career aspirations
- Increased participation in engineering courses (one teacher comments it is at a ‘record level’)
- Growth in engineering club with better gender balance than previously (now more girls than boys)
- Led to other activities e.g. ‘Family STEM Day’

BLOODHOUND SSC - The Race



BLOODHOUND SSC