Propulsion Engineering

WELCOME

1ST EPSRC - ATI PROPULSION PILLAR SUPPORT MEETING

Professor Pericles Pilidis
Head – Propulsion Engineering
Vice-President - ISABE
SATM - Cranfield University
19-20 October 2016

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Objective

Excerpt from EPSRC Letter of Award

A further allocation of institutional sponsorship is being made available to those institutions which have a coordinating role in the research community related to the Aerospace sector, specifically around the four pillars of the Aerospace Technology Institute's Technology Strategy. Cranfield University is one such institution and EPSRC expects Professor Pericles Pilidis to take a leading role in working with the research community, EPSRC and the Aerospace Technology Institute on the Propulsion pillar of the ATI strategy.

-The UK does not have an Aerospace Research Organisation

-It does have a very strong, global reach, aerospace academic community

-Can we make this into a ‘Distributed Research Organisation?

Aim: 1st Step to Integrate the UK Propulsion Research Community

UK - ATI EPSRC Supporting Mission

Aircraft:	A. Schafer – UCL
Structures:	K. Potter - Bristol
Systems:	B. Mecrow - Newcastle
Propulsion:	P. Pilidis – Cranfield

Many Synergies – specially Systems & Propulsion

GAS TURBINES

A CORE ACTIVITY AT CRANFIELD

1946 - Cranfield College of Aeronautics

One of the 4 units was Aircraft Propulsion

1969 - Cranfield Institute of Technology (University)

1993 - Cranfield University (change of name)

2016-7 AIRC

2 Sites, 4000 + PG s, Leading research & CPD university

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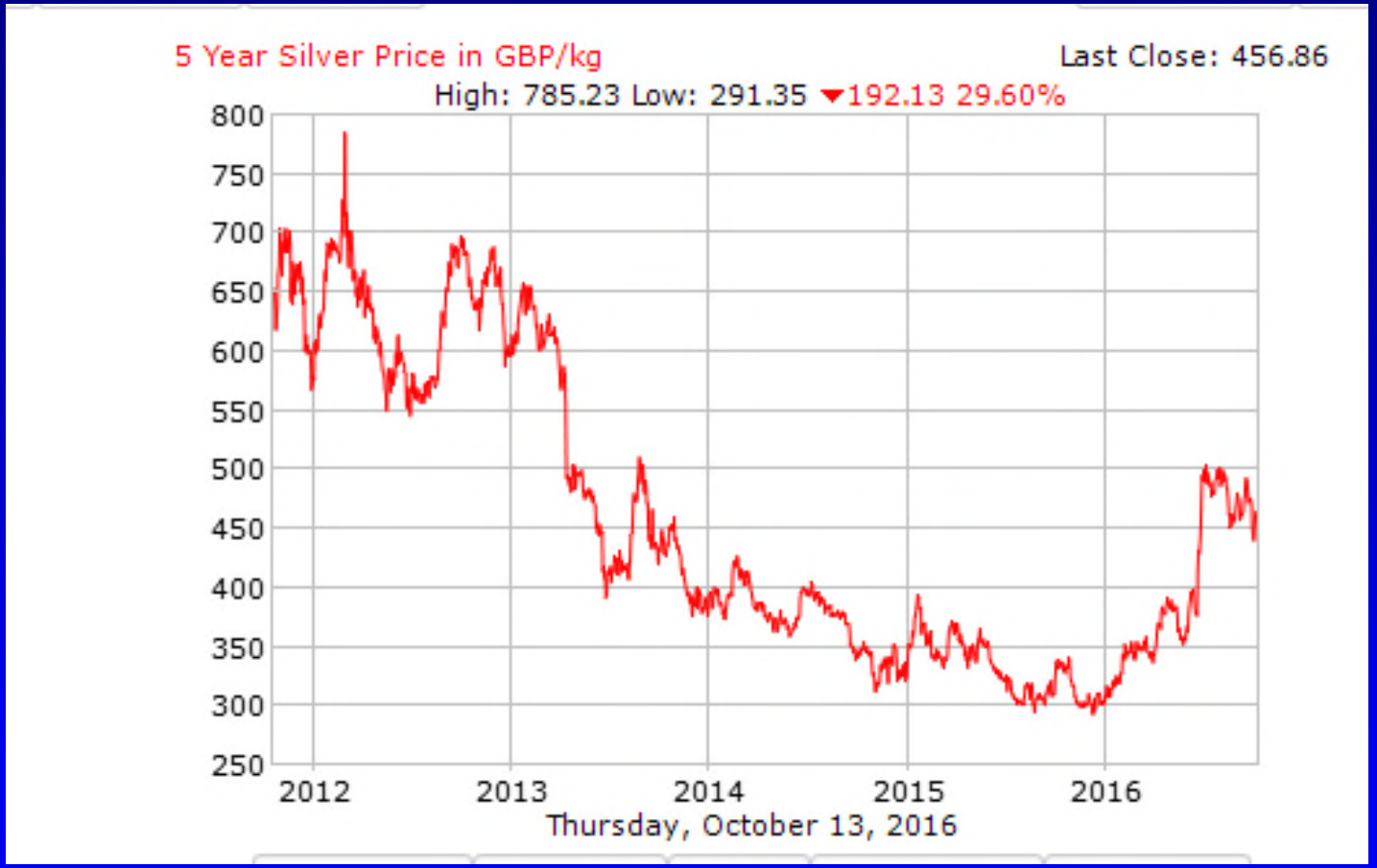

Source - http://goldprice.org/spot-gold.html

A civil aircraft GT: worth > 3 times its weight in silver

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Image Courtesy of Rolls-Royce

OBJECTIVE

Develop and Apply Knowledge and Analysis for the Economic and Technical Benefit of the International Gas Turbine and Related Industries

This high technology global industry is worth £50b p/a

- Air, Land & Sea
- 250+ Individuals in GTs

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PROPULSION ENGINEERING ACTIVITIES

Benefits From Synergy

GT Education - Postgraduate
- Industrial CPD

Research - GT Engineering
- Comb/Icing/Turbo

The whole >> sum of the parts
Self grown through value added

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Programme

1200 –	Arrival, introductions & lunch at Lord Kings Norton Room, Mitchell Hall, Cranfield	
1330 -	ATI-EPSRC introduction:	Dr. Daniel Smith – Mark Scully
1415 -	Description of Objectives:	Prof. P. Pilidis
1445 -	Views on Calls for Proposals	Prof. P. Pilidis
1515 -	Diversity	Dr. Jen Fensome
1545	Networking Break	
1600 -	Examples: Collaborative Opportunities:	Dr. Suresh Sampath/Dr Areti Malkogianni
0900 –	Gas Turbines & Propulsion – at Lord Kings Norton Room, Mitchell Hall, Cranfield	
0945 -	Integrated Propulsion Simulation	Dr. P. Laskaridis
1030 -	Networking Break	
1045 -	Systems Pillar Support -	Prof. P. Malkin (Newcastle Univ)
1130 -	Turboelectric Propulsion	Dr. D. Nalianda
1200 -	Future Propulsion & the Environment	Prof. R. Singh (Invited Lecture)
1300 -	Lunch & end of meeting	

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UK Propulsion Research Community
EPSRC Supporting Mission

People	Skills + Multi-level Connectivity Know what we collectively know
Facilities	Future – Synergy - Integration
Tools	Tried & Tested - Accessibility
Togetherness	Connectivity – Complementary Working Teams

UK Propulsion Research Community
EPSRC Supporting Mission

Aim:

1st Step to Integrate the UK Propulsion Research Community

National Assets	Connected Integrated GTEDP Lab TURBOMATCH/HERMES/HECTOR - UK Toolkit
Network	Working Together

Objective: Dec 2016 – March 2017

1 – Have a Multi - University Research Team

Formed via call for quotations working together

2 – Consultancy (Certification + Pathway)

3 – ISABE 2017 in Manchester (Sept 2017)

4 – Opportunity Lookout

5 – Skills Database

6 – Exchanges of young staff

7 – Test: Forthcoming CS2 calls

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Objective: Dec 2016 – March 2017

1 –Multi - University Research Team working together
Formed with help of call for quotations

Gas Turbine Skills (Cranfield)
Electrical Systems (Newcastle)
Mechanical transmissions (Partner)
Electrical Machines (Partner)
Certification (Consultancy)
Storage (Partner)

GT Diagnostics (Cranfield)
Vibration Diagnostics (Partner)
Electrical Protection (Partner)
System Control (Partner)
Pathway (Consultancy)
Other? (Partner/s)

Agile Call - Fixed T&Cs – If successful Quotation will be followed by PO
~ £10 -15 k each - (one researcher for 4 months + access to local experts)
Judged by 4 member Panel (ATI-EPSRC-Cranfield-Newcastle)
Results in Nov – Start in Dec 2016

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3 – ISABE 2017 in Manchester (Sept 2017)

Donated Mail List

Objective: Dec 2016 – March 2017

7 - Test: Forthcoming CS2 calls (Nov-Dec 2016)

Team working together will seek partnerships to form bid teams

Preparing Skills Database

4 Workshops – similar format

Day 1 – Strategy

Day 2 - Tactics

Invited Lecture

Website with information and updates

Next 14-15 December

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Addressing the 4 EPSRC Prosperity Outcomes

CONNECTED in executing aerospace research around areas of national strength.

PRODUCTIVE on the basis of integrated development of new wealth generating ideas in an area of strength.

RESILIENT because of the multiplicity of members of the network.

HEALTH aspects arise from the long term environmental benefits of hydrogen fuelled distributed propulsion.

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GT Laboratories for Elements of Nat Asset 1

Compressor - 4 kg/s & 20 Bar

Pebble Bed Air Heater - 1600K - 15 bar

2 GTs 1350 hp - 45000 rpm

5 ax CNC prototype machining

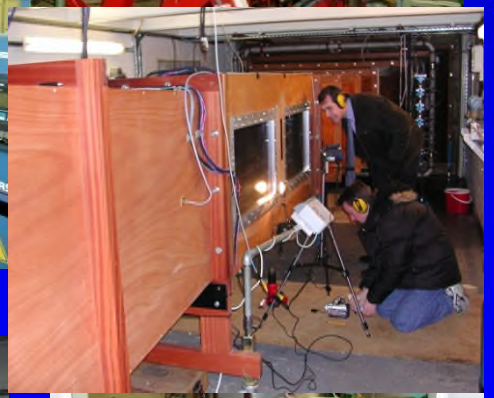
Radial Comp/Turb - test -1 MW

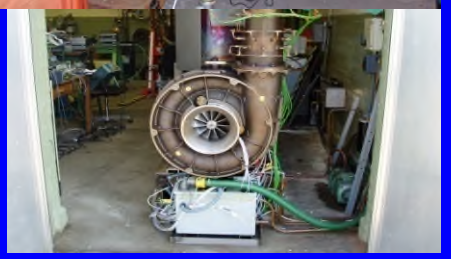
Instrument development
rig 1100C at 4 kg/s 17 Bar

Titanium Fire Rig

Wind tunnel up to M 0.9

Icing Tunnels





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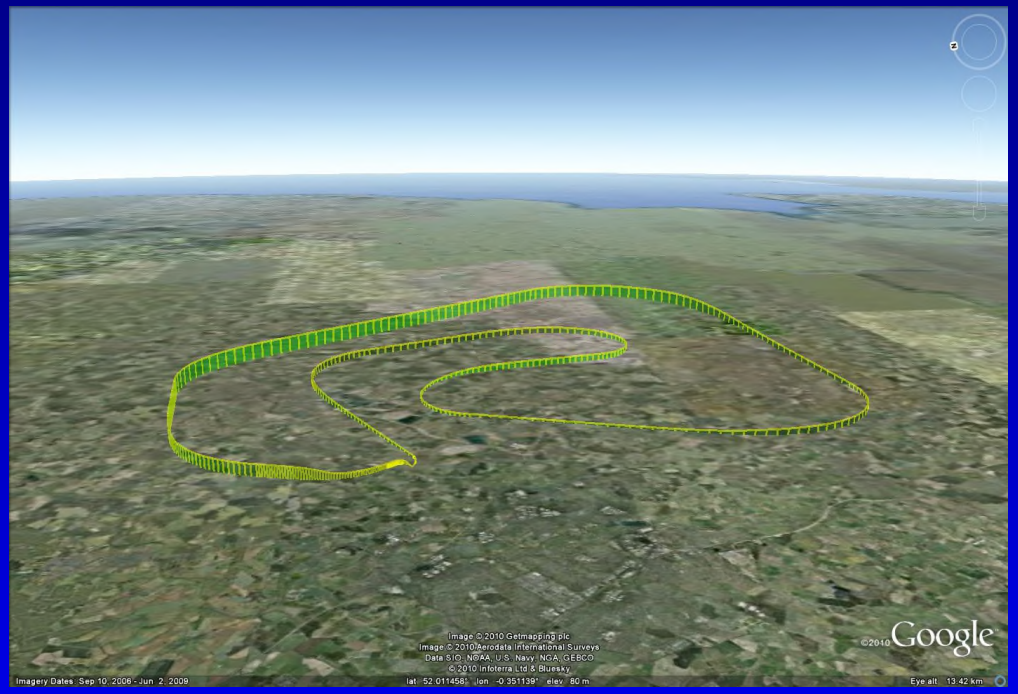
Nat Assett 2
Mission assessment

Helicopter Flight
Around Cranfield

TURBOMATCH/HECTOR



Total mission time	1.05 Hrs
Total mission range	168.5 Km
Total fuel burn	558Kg
Total CO2 emission	1779Kg
Total NOx emission	2 Kg
Total CO emission	3 Kg

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Cranfield is grateful for this opportunity. A scenario from Brexit is that the Aerospace Sector will lose EU funding support. Initiatives like the EPSRC-ATI pillar support institutional awards could constitute the launching pad for other UK national schemes to support the continuing international success of the British aerospace industry, a major generator of national wealth and export success.

-The UK does not have an Aerospace Research Organisation

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Questions & Comments

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Image Courtesy of Rolls-Royce

GAS TURBINE EDUCATION

MSc Thermal Power

60/70 + candidates
March - October Start dates
Members from 15 + Nations
Many users of GTs
China and India
European Double Degrees
4 Options Reflect Applications
Industrially Relevant Projects
International Publications

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Combustion, Icing & Turbomachinery Research

Compressor - 4 kg/s & 20 Bar

Pebble Bed Air Heater - 1600K - 15 bar

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5 ax CNC prototype machining

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Image Courtesy of Rolls-Royce

GAS TURBINE EDUCATION

Continuing Professional Development Programme

- 14 Regular courses
- 3-5 Special courses p.a.
- UK and abroad
- Special 3-9 Month CPD
- At all organisation levels
- Industrial/Academic Balance

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GAS TURBINE ENGINEERING

CORE COMPETENCE

- Modelling - Cont. Upgrade
  - Design, Off-Design
  - Degraded, Transient
  - CFD, Integration

- Research Focus on:
  - Novel Cycles - TERA
  - Diagnostics + Lifing
  - Performance Modelling
  - Testing

Image Courtesy of Airbus Industrie