GREENGLOW – A short History of the Project.

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Project Greenglow was a small speculative research Programme, funded by BAE Systems, investigating the science behind novel propulsion systems and new sources of energy. I was the Initiator and Technical Co-ordinator for the Project, which I ran, with support from many colleagues, in parallel with my other activities at the Warton Airfield Site, in Lancashire. Funding for Greenglow stopped in December 2004. I took early release from BAE Systems on 1st February 2005. Prior to leaving, I was given official permission to write a Book about the Project.

Although it is true that we made advances in our understanding, leading to new experiments, it is also a fact that no major breakthroughs were made. Our progress was slow, but steady. If you believe in the Kondratieff Cycle of Development, then 2011, or thereabouts, is the year in which it is predicted a breakthrough will lead to a new propulsion system. Even then, as my time in the aircraft industry has shown me, it is likely to take at least 20 years, or more, to design and build a new vehicle, especially one with a new propulsion system, although a test-bed version might appear sooner. So futuristic transport systems with new propulsion systems would still seem to be a long way off. Those of us with an interest in this new technology must just keep at it!

A short history of the period covering Project Greenglow, its preceding work and other important events is as follows:-

1986.
While in the Future Concepts Group, led by Tom Smith, I started a small Gravitational Study. Having been responsible for starting the Stealth Programme for the British Aerospace (BAe) Military Aircraft Division, at Warton, some time earlier, I was concerned that a breakthrough in Gravitational Physics might lead to some form of counter-measure, say a Gravitational Radar.

My theoretical approach was based on developing a gravitational analogue of Maxwell's Equations in electromagnetism. As I learnt later, from Professor Laithwaite of Imperial College, Heaviside had already done this in 1893. The theory predicts the existence of a new force field, associated with mass current, usually referred to, these days, as the gravitomagnetic force. Gravitomagnetism has never been detected. As those versed in General Relativity have explained to me, by assuming weak gravitational fields and low velocities, one can derive the linearised Heaviside Equations from Einstein's Tensor Equations.

I discussed Gravitational Research with a number of researchers in those early days. In particular, I met with Dr. Robert Forward, one time Head of Exploratory Studies at Hughes Aircraft, at his hide-away cottage at Reay in

the far north of Scotland. Also, I visited Professor Jim Hough, of Glasgow University, who was working on the detection of Gravitational Waves.

1990.
In March, I organised a University-Industry Round Table to learn about Gravity Research in the UK and to make the Universities aware of BAe's interest in the subject. Apart from one paper linked to Quantum Gravity, presented by Dr. Anders Hansson, the rest dealt mostly with classical gravitational theory. Although the idea of a Gravitational Radar being developed in the near future was totally dismissed, it was clear that interest in gravitational physics research was ratcheting up, so we kept our interest going, particularly with regard to the related subjects of inertial thrust and field propulsion.

Dennis Craven's USAF Report, "Electric Propulsion Study" (AL-TR-89-40), issued in August 1990, showed the US interest in gravity research.

Also during 1990, NATO published a Report (AGARD-AG-313) entitled "The Anatomy of the Gyroscope", which contained a Chapter devoted to Inertial Thrust Machines.

1989 – 1992
In 1989 I learnt that Sandy Kidd had built an Inertial Thrust Machine, which was being tested at Dundee University. This device was later tested in the BAe Warton Wind Tunnel Laboratory, but no inertial thrust was detected. In a second series of experiments, with a new device, on two separate test runs the device appeared to show a tiny increase in weight, outside the measurement error band. We were unable to explain why we got these results. This work was not pursued. Later in 1999, we looked at a similar type of device built by Tony Cuthbert but, again, we did not pursue the idea.

1992.
Brian Young, the former Technical Director at BAe Warton, used some of the results of the Gravity Study as the basis for his inaugural Lecture as Visiting Professor of Aerospace at Salford University. His Lecture was called "Anti-Gravity – the end of Aerodynamics?" and Brian was interviewed about it on the BBC Radio 4 Programme, "Science Now", in May1992.

1996.
Based on the electromagnetic analogue of gravity, I wondered whether there might be a connection between heat, magnetism and gravity. Professor Phil Bissell, of the University of Central Lancashire, designed and built an apparatus for us to test the idea. However, no effect was detected. As it later transpired, what we had been investigating was something called the Rhigi-Leduc Effect, which had first been investigated in 1887. It has nothing to do with gravity and the effect was at right angles to the one we had been looking for.

Bob Forward published his influential paper “Mass Modification Experiment Definition Study” for the USAF in the Journal of Scientific Exploration (Vol. 10, No.3, 1996).

This was also the year that NASA started its “Breakthrough in Propulsion Physics Programme” (BPP), with its three goals of 1) Propulsion without expelling mass, 2) Increasing Maximum Transit Speed, 3) New Energy Source to Power Propulsion Device.

1997 - 2000.
In response to the NASA BPP Program, I managed to persuade the Technologist Panel at BAe Warton that they should support a similar, although smaller, Programme, based on small University Studies. The collective name Project Greenglow was chosen, as it had links with our earlier Programme. We followed the BPP initiative and proposed the following three goals 1) Field Propulsion, 2) New Energy Source, 3) Supersede global transport.

Greenglow was an unclassified Programme and the Universities were encouraged to publish peer-reviewed papers of their work. Each year a Review of Progress was held either at BAe Head Office, in London, or at one of the participating Universities.

The Universities involved were:-

Lancaster University. Developing Gravitational Theory leading to new ideas for experiments, led by Prof. Robin Tucker.

Dundee University. Theoretical Investigation of a Microwave Thrust Device, led by Prof. Paul Smith. The Study was based on earlier work by Professor Segey Vinogradov, originally of Kiev University.

Sheffield University. Investigating Dr. Podkletnov’s claim that Superconductors can provide gravitational shielding. I learnt about the sheffield interest through a “WIRED” Magazine article. The Study was led by Dr. Clive Woods and the experimental work was done by his Research Assistant, Dr. Steve Cooke. I arranged for Dr. Podkletnov to visit the UK, where he gave a Lecture about his experimental results at Sheffield University. In several papers by Ning Li & Doug Torr, it was proposed that the underlying cause of Superconducting “Gravity Screening” was gravitomagnetism. However, other Academics have dismissed this idea.

In the year 2000 Dr. Clive Woods moved to the University of Iowa, in the USA, to take up a Professorship, so this particular Study came to an end.

Glasgow University. This was a Goals & Metrics Study for Greenglow, with the idea of introducing some formalism in our approach. The work was jointly funded by BAe and Rolls-Royce. The work was led by Professor Colin McInnes, well known for his work on Solar Sails, with support from Professor Matthew Cartmell and Spencer Ziegler.

1998.
I asked John Allen, the Visiting Professor of Aerospace Design at the Cranfield Institute of Technology, to investigate the design changes, which might result if an Anti-Gravity Drive ever became available. He submitted a Report which, following subsequent updates, was finally published in the Journal Progress in Aerospace Sciences (Vol. 38, 2002) as "The Quest for a Novel Force".

It is of interest to note that John Allen was the Chief Future Projects Engineer at BAe Kingston up until 1982. Also, he has had an interest in the subject of Anti-Gravity for a very long time. For example, see his introductory Chapter on the "Future of Aeronautics", with a foreword by the Duke of Edinburgh, published by Hutchinson in 1970.

2000 -2004.
The year 2000 was the year of the merger between BAe and GEC Marconi, out of which came the formation of the BAE Systems. The separate Company Research Centres were combined as the Advanced Technology Centre (ATC). It was decided that responsibility for funding Greenglow should pass to the ATC, under the direction of Dr. Brian Wardrop, the ATC Chief Technologist. After Dr. Wardrop's retirement in 2002, the Budgetary Control was passed to Dr. Vaughan Stanger. I remained as the Technical Co-ordinator based at Warton, the Site becoming the centre of the Air Systems Business Unit.

In September 2000, the NASA BPP Team and those engaged on Project Greenglow, met at Warton to share results and discuss future plans. The BAE Systems Team was led by Dr. Bill Martin, while Marc Millis led the NASA Team.

The NASA BPP Team invited the Greenglow Academics to present papers at the 37th AIAA Joint Propulsion Conference, at Salt Lake City, in 2001. Three papers were presented.

The Greenglow Academics were also influential during the formation of the Institute of Physics (IoP) Gravity Group and Dr. Walter Johnston, from BAE Systems, was co-opted onto the Group's Committee as the Industrial Representative.

In February 2001 John Allen and I attended the First International Workshop in Field Propulsion, held at Sussex University. The Workshop, part-sponsored by the BNSC, was organised by Graham Ennis and was an interesting and well run event. The joint Chairmen were Mr. Ennis and Dr. Anders Hansson.

ATC funding for the Project Greenglow was finally agreed in 2001, with the following Universities:-

Lancaster. Gravitational Theory & Experiment. Of particular interest was the attempt to detect the earth's gravitomagnetic field, using the Giant Ring Laser sited in Canterbury, NZ. As before, the work was led by Prof. Robin Tucker, with support from Dr. David Burton.

It's worth noting that the NASA Gravity Probe-B Satellite Experiment was launched on 20th April 2004 which is also hoping to detect the earth's gravitomagnetic field.

Dundee & Strathclyde. The investigation of Microwave Thrust, based on illuminating a resonant cavity, was continued by Professor Paul Smith and Professor Sergey Vinogradov. A simple experiment to test the concept was done at Strathclyde University by Professor Alan Phelps.

In early 2002, Professor Paul Smith moved to Macquarie University, in Sydney, Australia, and the Study came to an end.

Kingston. John Allen took up the post of Visiting Professor in the Faculty of Engineering, where he has continued to support the Greenglow Programme, through a series of Lectures, Visits and Papers.

Birmingham. The Experimental Measurement of the Casimir Force. The Study is led by Dr. Clive Speake, with the experimental work being carried out by Research Fellow Dr. Giles Hammond. The apparatus is complete and funding from 2005 onwards has been agreed with the EPSRC.

The Casimir Force is associated with the virtual photon fluctuations of the Quantum Vacuum. If it were possible to condition the Vacuum background adjacent to a conducting body, say locally altering it from its ambient state, then it might be possible to extract energy from the Vacuum, or even use the unbalanced force for propulsion purposes. It is much too early to say whether such ideas have any validity.

In May 2003, there was an International High-Frequency Gravity Wave Conference held in the USA, sponsored by the MITRE Corporation. The Co-Chairmen were Dr. Robert Baker and Dr. Ning Li. The BAE Systems representative at the Conference was Dr. Walter Johnston.

We held the Last Review of Project Greenglow at Birmingham University in December 2004. The Meeting was attended by Academics and by Scientists from Industry and Government Institutions.

That is the end of the Greenglow story, so far.

February 2005.