21 December 2006

Dear Mike

Public Support for Science and Innovation

For the last four weeks I have taken your draft research report to Sydney once, for a week, and to Merimbula twice. Fortunately all three trips were made by car so I haven't had to worry about excess baggage!

In general terms I agree with your discussion of science and innovation in 1.3 but I cannot resist the temptation to assert that Mathematics is as much an Art as a Science. I was in the Maths Faculty at Queen Mary College, London University from 1950 to 1955 gaining a B.Sc. (lions) in 1953 and a M.Sc. in 1955. My wife was in the Maths Faculty from 1952 to 1955 gaining a B.A. (Hons). She took exactly the same undergraduate subjects as I did however at school she had concentrated on languages while I had focussed on science!

Given that, throughout the forty years between leaving QMC in 1955 and retiring from the Australian Public Service in 1995,1 was involved in the application of `science', including the `social sciences', I thought that I ought to be able to be able to make a contribution but didn't (for a change) want to end up writing 30 pages.

On Tuesday I decided that I should draft a letter running to a few pages based on key events I have been involved in from the UK, through Canada and on to Australia. As a result it is a personal contribution as opposed to one of those written to a PC inquiry on behalf of one of the two or three groups that still occupy some of my time.

BRISTOL

When I joined what was then the Bristol Aeroplane Company's Guided Weapons Division I was employed as a supersonic aerodynamicist (part of my M.Sc was based on the mathematics of compressible hydrodynamic flow). In 1958 I was moved to Project Work and then, between 1964 and 1969 was head of Advanced Projects and Research for Guided Weapons and Civil Technology - such as Saturation Diving (north sea oil), Holography (pattern recognition, forger prints) Optical Communication (lasers).

I was a member of the Aerodynamics Committee of the UK's Aeronautical Research Council for three years. It was Government Policy to ensure that there were always `industrialists' on the Committees and on the Council.

My appointment coincided with work I was leading on vertically launched `anti missile' missile systems for the defence of ships.

The final system, called Sea Wolf, is now in service. At the time the project was code named Confessor and we called the vertical launch test vehicle Sinner. For a variety of reasons the vehicle was like a very long pencil, although launched vertically within a couple of seconds it had to be flying horizontally.

I knew that the vortex sheets would be unstable. There was nothing in the literature (including the USA and France) so I raised it with my colleagues on the Aerodynamics Committee. Three of them had a mixture of relevant unpublished work (they didn't think anyone would be interested) one had a PhD student. Overall I said at the time that we saved somewhere between 9 and 12 months.

Holography was somewhat similar. A member of the `team' had been at the Cavendish before the war (like Barnes Wallis he never retired) and knew Dennis Gabor at Imperial College (I.C.). Gabor had been one of the first Physicists to move on from the theory to experiments and had a `practical physicist' who had just finished his PhD who accepted our offer to come to Bristol. We were first in the field with contracts from the Home Office, Min Tech. and a variety of other public and private groups.

The key message I learned from these and similar experiences was that you had to make sure you had lots of contacts in the pure and applied sciences and were not ashamed to ask them to explain what they were doing. In my experience Australians do not seem to be good at this.

OTTAWA

I went to Canada in April 1969, initially to be the Inaugural Director of Science and Technology with the (new) Canadian Transport Commission (CTC). The CTC had economic regulatory responsibility for all modes of transport, operational regulatory responsibility for railways and a wide mandate to explore economic, technical and social aspects of all modes of transport (including commodity pipelines) and, because they were an integral part of Canadian National and Canadian Pacific, telecommunications.

From the CTC's Ottawa base I tried to apply a similar approach to the one I had learned to use from Bristol. It seemed to work, though I sometimes felt that some of the Dominion Research Laboratories were more cautious than their Provincial equivalents. Generally I was made welcome by the Universities and Industrial Laboratories, possibly because my background was reasonably well known.

I should add that I was invited to join both the Transport Research Forum (in the USA) and the Canadian Transport Research Forum. Both provided a much wider range of skills and contacts from Finance, Banking, Economics, O.R., Human Factors, Science and Engineering than was achieved by the Australian Transport Research Forum.

In the early 70's one area that seemed to be very promising was the application of hovercraft technology - both UK and French versions - in Arctic Canada (to avoid damage to the Tundra and Muskeg) and, in a tracked version, as a high speed people

mover on the Quebec City, Montreal, Kingston, Toronto, Guelph corridor. The President of the CTC assembled an interesting mixture of scientists, engineers and industrialists from across Canada (the Canadians are far more careful about such things than Australians are) and they proved to be very helpful. We picked up the LC. work on linear motors, took it further through the Institute of Guided Ground Transport at Queens University, Kingston and subsequently spun it off into Industry in Ontario.

By the middle of 1970 the Trudeau Government had restructured the Transport Portfolio and I was asked by the Minister and Deputy Minister (Secretary) to move to Transport Canada as Chief of Staff (designated Policy, Planning and Major Projects, XPPP).

XPPP had four strategic planners - an urban geographer (Derek Scrafton who moved to Adelaide as Director General of Transport for South Australia), a retired Captain from the Royal Canadian Navy with an engineering background, a Mechanical Engineer who cut his teeth on Ramjets, and a former Aeronautical Engineer from de Havilland of Canada who wanted to work inside the Public Service for a few years.

All were good communicators, were interested but not overawed by Pure and Applied Science, and were good at spotting work in the Universities and Research Institutions that might be applied to solve (or minimise) operational problems and open up new applications of `old' technology.

The former Naval Captain led a multi year trial of a Short Take off and Landing (six degrees rather than three) passenger service between Rockcliffe Airport, close to the Governor General's residence (and the Prime Minister's) in Ottawa, and the Victoria Parking Lot in Montreal (close to the site of the 1967 centennial celebrations).

The others were similarly engaged in innovative projects from Newfoundland to Victoria Island. Of particular interest was a weekend I spent in Saskatoon.

Soon after I moved to Transport Canada I was nominated as its representative on the Canadian Research Managers Association.

In 1972 the focus for a weekend seminar was `Transport and Communications'. Joe Kates, then Canadian head of Kates, Peat, Marwick, Mitchell and Chairman of the Canadian Science Council was asked to lead on Communications and I agreed to lead on Transport. Over 100 members of the Association were present at what proved to be a very stimulating seminar.

It was quite clear that those who attended had clear views on the role of research management and the wide range of disciplines that had to be covered. From my perspective the participants had done a surprising amount of reading before the weekend and the focus really was on ways in which Science and Technology, including Human Factors, Social Science and Economics could help to solve problems that had to be addressed in the Public and Private Sector in Urban and Regional Areas and in Northern Canada as well as those in the South.

Some ten years later the (then) Australian Academy of Technological Sciences decided that its sixth Invitation Symposium, Sydney 30th September and 1St October 1982 should cover Transport and Communications. Sir Rupert Myers was the Convenor, Technical Sessions I agreed to act as 'rapporteur' and give the Symposium Summary at the end of the two days.

As I said to a couple of close colleagues after the 1992 meeting the key difference between the two events was that in Sydney those attending had come to `listen and hopefully learn' in Saskatoon they were there to make a contribution.

CANBERRA

For the purpose of this inquiry it is probably easier if I separate my time with Transport, from that with Defence Support and then with Communications.

The 1973 decision to merge the former Departments of Civil Aviation and Shipping and Transport was the first time all the Commonwealth's interest in Domestic and International Transportation were in one portfolio.

Although it was relatively easy to get the runway pavement specialists from Civil Aviation and the main road engineers from Shipping and Transport to use the same scientific and engineering descriptors this was not the case in other areas. Consequently there were a number of situations where progress in one transport mode had been delayed because the use of different language elsewhere had hidden a relevant discovery in another.

When I went through the list of organisations and individuals who had made submissions and/or participated in informal discussions with you I was surprised that there were nothing from the Australian Road Research Board (ARRB). Its offices and laboratories are on the outskirts of Melbourne.

It was well established when I moved to Australia and I accepted an invitation to join the Board in 1974. At that time the Board consisted of all the Heads of the State Road Authorities, the Head of the Australian Department of Works (Alan Reiher) and me. All but one had technical, scientific and engineering backgrounds and had a genuine interest in issues from the behaviour of pedestrians and drivers, to the design, construction and maintenance of low cost roads.

There was no equivalent in Canada but for many years the UK had its Road Research Laboratory (RRL), which became the Transport and Road Research Laboratory (TRRL) in Callaghan Government days. In my view neither version was as effective as ARRB

Since the funding of ARRB came from the State Road Authorities, and the two Australian Departments the Board was very interested in progress and value for money. In 1975 Max Lay moved from being Engineering Research Manager with BHP Melbourne to become Executive Director of ARRB. He moved on in 1989.

Of the various applied research organisations that I have been associated with in Australia ARRB stands out as one that was most comfortable with basic Science

(including Social Science) and the application of relevant work throughout Australia. In the late 80s early 90s I was involved in the development of some of the Cooperative Research Centres, In my view ARRB was more productive and more relevant. I am sure that you would find a discussion with Max useful. I think that his home address is still 18 Bruce Street, Bulleen.

In 1982 the Prime Minister accepted advice from the Utz Committee to establish a Defence Support Portfolio. At that time it was responsible for all the publicly owned Defence Manufacturing Facilities (Aerospace, Dockyards, Munitions and Ordnance), Defence Purchasing and the Defence Science and Technology Laboratories of DSTO.

The work of the Laboratories was of a very high standard with an appropriate level of interaction with Universities and other Basic and Applied Science Research Laboratories. However the level of accountability and relevance to the `clients' was not as high as that achieved by ARRB.

I believe that I should mention two productive examples of the application of public funding in the Laboratories and the Factories that are relevant to your terms of reference.

The first is the development of the Karinga cluster bomb between 1972 and 1982. The design and development of the cluster bomb fuze and of the bomblets themselves was of an extremely high standard. It involved very close cooperation between the Laboratories and Ammunition Factory, Footscray.

The second is Project Winnin, an active expendable decoy system to protect shipping against missile attack. The lead laboratory was the Electronics Research Laboratory (ERL) at Salisbury, with participation by the Government Aircraft Factories and the Ordinance and Explosives Factories, Maribyrnong.

Earlier in this letter I mentioned working on the Vertical Launch Test Vehicle Sinner, in the lead up to Sea Wolf. At the time we considered a decoy option, which we believed could be cheaper and almost as effective. However we did not believe that we could achieve a sufficiently 'stiff' ontrol system to ensure that the decoy really could deceive the incoming missile. ERL and GAF solved some basic problems that the Bristol Research and Development team could not.

After Bob Lansdowne retired I moved to Communications. One of the first briefings I received related to the availability of the first Aussat satellites and their use to provide TV services to communities in regional and rural Australia. It would be necessary to encrypt the air to ground signal to meet the requirement that listeners/viewers in a State always received News and Current Affairs programs from their State rather than the adjacent State.

At that time suitable systems were available, and in use, for cable services but systems for air to ground were simply at the `breadboard' stage. I was advised that my predecessor had, on advice, committed the Department to having an operational system available within 12 months. A decision that I described as `courageous'.

A B-MAC based breadboard was available in Toronto, Canada using British Telecom designed circuits. Although it involved producing modules suitable for manufacture, negotiating production contracts (with Plessey Australia) and ensuring that qualified installers were available we met the commitment. A key element was that a couple of years earlier the Department had been able to recruit two well qualified applied scientists who were able to assess the relevance of the Toronto work, refine the breadboard to meet Australian environmental requirements, and supervise the various stages through to operational use.

The examples from Defence Support and Communications relate to different combinations of Science leading to Systems Innovation. They also illustrate a capacity to deal with extremely complex applied science and technology issues and to meet very tight timetables. I believe that this capacity is not generally acknowledged in the Community or by any number of policy advisers in public and private institutions.

Since I retired from the Public Service I have tried to maintain regular contact with some former colleagues in North America and the United Kingdom. Although the examples I have used have to relate to the time frame when I was working in a particular field and/or a particular country I am confident that the differences I have drawn attention to are still relevant.

This then allows me to finish by referring to some interesting developments in the UK that I couldn't find referenced in the Draft Research Report. As a Fellow of the Royal Aeronautical Society I still read the Societies Monthly Publications. Inevitably the funding of applied science and technology developments for military purposes is a subject of ongoing interest to the Society.

In 2005 the UK Ministry of Defence published its revised Defence Industrial Strategy, it has now published its Defence Technology Strategy. As a further example of courageous behaviour it provides a framework to 2030. Keith Hayward, who is the Society's Head of Research has condensed it down to the attached page published in the December 2006 edition of The Aerospace Professional.

I hope that you will find that some of the above is relevant to the kind of contribution to the debate that you are obviously trying to make.

If there are any issues raised in this letter that need clarification I can as usual be contacted through 02-62814493. We will be up and down to Bega Valley Shire in January and the first half of February but I still check the messages every evening. Faxes I only read when I am in the ACT.

Regards

C.C. Halton