100 YEARS OF AEROSPACE AT BRISTOL AND TODAY'S SKILLS NEEDS

SUMMARY
The skills underlying much of aerospace achievement at Bristol are identified. They famously found application nationally in parts of industry where they were lacking, and are now included in the BAC100 displays.

Some of those new skills are now notably absent both from industry and higher education. Urgent corrective action is needed, and is recommended.

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May 2015

INTRODUCTION
Skills in aluminum alloy structures and aerodynamics are clearly the basis of today's British involvement in Airbus.

Veiled by secrecy are the many skills at Bristol involved in Guided Weapons and Space, but they have important lessons for today.

The Bristol guided weapons activity began with a few structural and mechanical draughtsmen, and grew with University graduates in science and physics. It soon became clear that they all needed more knowledge and skills, so every year they were entitled to ask for them and be given them [(1)] .

There were many.

THE NEW SKILLS
Draughtsmen had to learn electronics, control, and complex systems.
Technologists had to learn all basic engineering skills as well as supersonic aerodynamics, control systems, guidance and propulsion.

I decided we would seek foreign sales against American competition. With a pound near three dollars that meant that we must greatly reduce cost to be competitive on price, so we researched and applied the fifty or so then known ways [(2)] of cost reduction through design and production learning.

As a result we sold abroad and the team then learned many other skills, including safety engineering, configuration management, environmental engineering, second and third line servicing and systems engineering.

These skills proved to be unique in Britain, so the Government called them in to rescue two important projects whose complexity was too great for other teams to handle. They were [(3)] the nuclear submarine which launched the deterrent, and the British re-entry warhead for that missile.

The Bloodhound 1 missile was developed for less money and time than its competitors, so the Government sought the reasons. The main one lay in the project review procedures, in which decisions were CONTINUALLY reviewed by an INDEPENDENT TEAM of our engineers.

These methods were further improved [4] and resulted in a series of ON TIME ON BUDGET developments starting with Bloodhound 2, in which team skills and wider review procedures both played a part.

The complexity of Bloodhound 2's guidance was such that DIGITAL CONTROL was desirable innovation. It was in fact [5] the first in the World, leading to applications in every industry and every home. It happened through engineers, not managers, and has lessons for other such radical improvements.

RELEVANCE TO TODAY'S PROBLEMS

Everyday engineering has to live with a history where firstly entrepreneurs personally gave needed skills to their staff, but when the Universities took over they concentrated on science.

In U.K. in the 1950s this led to a separate degree in engineering design, which to this day omits electronic and systems design and all relevant management subjects such as cost reduction through design.

Higher education of managers totally excludes
Engineering [6] and is not made good by short courses.

However Britain continues to lose manufacturing industry to Third World countries, particularly China and potentially India.

CORRECTING TODAY'S PROBLEMS

In fundamental terms, the departmental structure of industry is unfitted for the introduction and survival of better methods.

For example, cost reduction through design and production learning requires a mixed team from many functions, while the introduction of automation is best conducted at working level. There is no proper educational backing for either of these, and the limited mindset of narrowly educated managers and designers strongly hinders introduction.

Initiatives are therefore needed on both knowledge and application of such methods. One such is ready for use in Australia.

Reference notes.

1. BAC 100 Exhibition - Modelling complex systems
2. BAC 100 - Saving the company from bankruptcy.
3. BAC 100 - Rescuing complex projects from overspend and delay.
4. BAC 100 - Giving designers the skills they need.
5. BAC 100 - The World's first process control by digital computer.
6. Swinburne University is aiming to introduce the subject to their teaching.
They have studied competitiveness and find the Western World 20 to 40% out in cost competitiveness, and attribute the final cause to the strategic concept of design which features in my paper. {In view of the Swinburne analysis some editorial comment, when my article is published, may be appropriate}.