The Development of the Bachelor of Technology in Aviation Degree Program at the Australian Defence Force Academy

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***Abstract**:*

In 2001, the first students enrolled in a new degree program at the Australian Defence Force Academy (ADFA). This program, known as the' Bachelor of Technology in Aviation' (B'Tech Av), represented the fruition of three years work, and was jointly developed by representatives from the Australian Defence Force (ADF), the University of New South Wales(UNSW) and BAE Systems (Tamworth). This degree is available to prospective Air Force and Navy pilots who have successfully undertaken 'Flight Screening' provided by the Australian Defence Force Pilot Selection Agency. A feature of the B'Tech Av is that it combines an academic program provided by the UNSW with flight training provided by the ADF. This paper describes the development of the B'Tech Av program and includes a comparison between this and other Australian aviation degrees.

Introduction

The University College at the Australian Defence Force Academy (ADFA) is a College of the University of New South Wales (UNSW) and has provided undergraduate and postgraduate degree programs for the Australian Defence Force (ADF) since ADFA's commencement in 1986. In November 1998, the Air Force Commander of Training communicated a Statement of Requirement for a Bachelor of Technology in Aviation Degree Program (B'Tech Av) to the University College. Enrolments to the degree were to be restricted to prospective pilots and called for two years of study at ADFA followed by a twelve month flying training program provided by the ADF and BAE Systems. One of the major benefits of the proposed degree program was that it allowed students to begin their flying training one year earlier than their ADFA peers. This was important to the ADF as there was anecdotal evidence that younger students had better success at pilot training (Given 2002).

The Statement of Requirement set in train a cooperative development program between the UNSW and the ADF that culminated in the ADFA B'Tech Av delivered by the School of Aerospace, Civil and Mechanical Engineering (SACME). The first ten students enrolled in this new program in 2001 and it received full IEAUST accreditation in 2006.

This paper will discuss the issues and challenges that were experienced in developing ADFA's B'Tech Av degree. It will then describe the special features of the degree and how the structure of the program compares with other Australian aviation degrees. Finally the steps that are being taken to validate the degree are described.

Program Development

Central to the statement of requirement for the B'Tech Av program was that flying training provided by the ADF would be part of the 3 year degree program. This may not seem to be an unusual requirement as at the time, all Australian aviation programs integrated flying training with academic studies. However, what set the proposed ADFA program apart was that the first two years of the degree would be provided by the UNSW at ADFA, and the third year would be flying training to air force 'wings' standard provided by the ADF. For this reason, it was necessary to develop a unique model for this degree different from existing Australian aviation programs.

The proposed B'Tech Av program also had significant implications for the ADF who provide the three year Military Education and Training Program (METP). All ADFA students undergo this program in addition to their academic studies. The issue here was the B'Tech Av students would only be at the academy for two years before departing for their flying training at Tamworth NSW then Pearce WA. Accommodating the new program would require the ADF to make considerable changes to the organisation and delivery of the METP.

Another significant issue was that historically, the pass rate for students completing military flying training was 58% (Sawade, 2007). Because the flying training was an integral part of the proposed B'Tech Av program, it was necessary to make provision for the students who failed this component of the degree and this was part of the Statement of Requirement.

To address these issues and formulate a model for the new program, a working party was convened. This party included representatives from the RAAF Training Command, the UNSW, ADFA, the three services (Navy, Army and Air Force) and BAE Systems. (BAE systems provide the ground school component to pilots undergoing basic flying training at Tamworth, NSW.) The work of this party culminated in a formal proposal to the Academic Board of the UNSW and then a contract between Defence and the UNSW.

The proposal accepted by both the UNSW and the ADF, was that the emphasis of the ADFA component of the program would be aviation safety through an understanding of the aviation system as a whole – both from a technical and organisational point of view. Safety was agreed to be a primary consideration for ADF pilots and this emphasis was seen to complement the flying training undertaken later in the degree program.

The major academic challenge in designing the B'Tech Av program was posed by the fact that the military flying training and ground school did not begin until the third year of the degree program. It was necessary then to design the first two years of the program in a way that complemented the flying training. Because the program was to be provided by an engineering school, it was decided that the program would blend coursework in aviation and engineering basic sciences. The first year of the proposed program would share many courses with the SACME's Aeronautical Engineering program. This provided the economy of scale and administration that has become the norm at most contemporary educational institutions (Toohey, 1999).

Having decided on the basic structure of the degree, the next step was to develop an appropriate curriculum and recruit staff specifically to develop and present coursework in aviation safety. In addition to aviation safety, new courses were also developed in aviation systems, aerodynamics, meteorology, flight mechanics and aviation resource management. A number of external bodies and individuals were consulted to refine and guide the development of the program. These organisations included the ADF Directorate of Flying Safety (now Directorate of Defence Aviation and Air Force Safety (DDAAFS), The Australian Transport Safety Bureau (ATSB), ADF Basic Flying Training School (BFTS) at Tamworth and the RAAF Advanced Flying Training School (2FTS) at Pearce.

Alternatives for Failed Pilots

As mentioned previously, it was necessary to build into the B'Tech Av program an alternative educational pathway for students who failed flying training. This would allow these students to complete their degree. Initially the following two pathways were offered:

1. Return to ADFA for three additional years in order to complete an engineering degree.
2. Attend UNSW at Kensington for one additional year to qualify for a Bachelor of Aviation (Aviation Management).

The first of these options was included at the ADF's request. A student embarking on this option would not complete his or her engineering degree until more than six years from initial entry to the UNSW. This was not considered a desirable pathway. The second option was more realistic and two students have completed their degree in this way. Recently, the SAME introduced a third option in which students return to ADFA and complete coursework related to aviation management. Two students have now graduated in this manner which allows students to return in either the first or second academic session to recommence their studies. This is important as students can be 'scrubbed' from flying training at any time of the year.

Partnership Experiences

One of the major challenges facing the launch of the B'Tech Av program was to integrate the academic program with the ADF's military flying training. Originally it was agreed that B'Tech Av students would undertake a number of third year academic courses during their initial flying training. This arrangement was seen to be desirable as it linked the academic and military flying training components of the degree program. Subsequent to the degree's commencement, it was discovered that the ADF basic flying school were not prepared to change their training program to accommodate the new degree. To alleviate this situation, the UNSW agreed to run a 'summer school' so that the B'Tech Av students could complete their academic studies before leaving the academy for flying training. This illustrates the need for flexibility when dealing with industry partners whose priorities may not be aligned with those of the academic institution.

The partnership also creates complexities in terms of academic administration. This is because the university must track its B'Tech Av students through four separate organisations: UNSW coursework, ADF basic and advanced flying training schools, and ground school conducted for the ADF by BAE systems. This becomes particularly challenging as the B'Tech Av students lose their group identity when they are merged with other students during ADF flying training.

Program Features

Aviation Project.

The B'Tech Av academic program culminates in a two semester research project, which students complete immediately prior to their departure for flying training. The research project is structured to encourage students to adopt a deep approach to learning through problem solving and independent study – the benefits of which have been discussed by Biggs (1999).

One of the advantages of the blending of engineering and aviation coursework is that this allows students to undertake research in a wide variety of topics. An example is a recent project (Welsh, 2005) of an Investigation of Landing Approach Techniques in which a student used the school's airborne laboratory to analyse and compare landing approaches flown with reference to airspeed and angle of attack. In this research, the student was able to draw on his aviation knowledge to understand how to quantify the quality of a landing approach from a piloting point of view. He also used his engineering knowledge to assist in the development of the appropriate instrumentation and data analysis. Another project involved a student characterising the turbulence generated by a prominent hangar close to the landing threshold at Canberra Airport (Nelson, 2004). Since the construction of the hangar, a number of incidents had taken place involving landing aircraft experiencing strong turbulence just before touch down. For this work, the student tested a model of the hangar and surrounding buildings in the CSIRO's Pye Laboratory environmental wind tunnel (Figure 1). He then used his results to assess the effects of this turbulence on landing aircraft and made suggestions to ameliorate this problem.

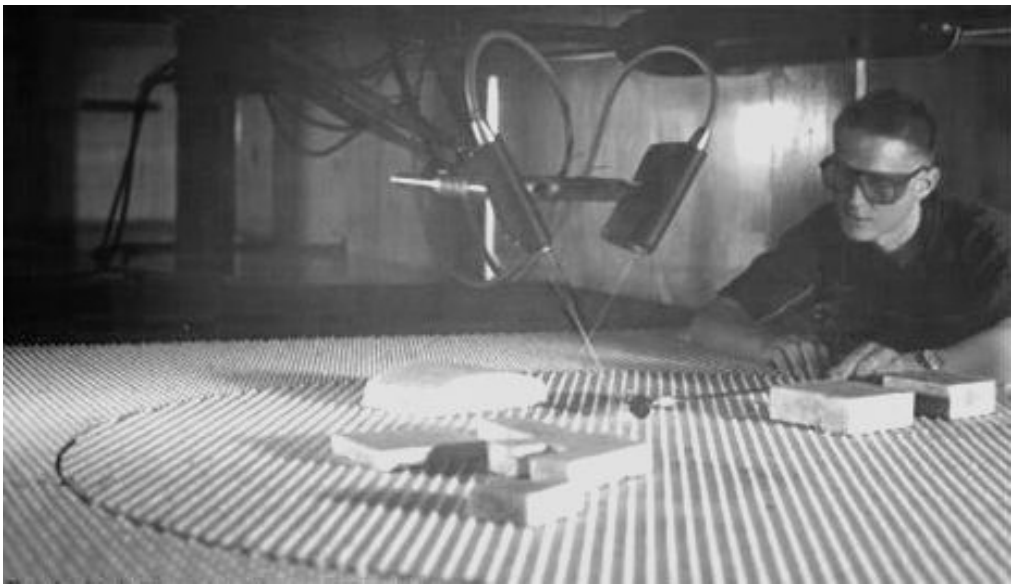

Figure 1. Officer Cadet David Nelson using laser Doppler velocimetry to measure runway turbulence generated by a model of nearby hangar and business park at Canberra Airport.

Aviation Safety Studio.

A unique feature of ADFA's B'Tech Av program is its Aviation Safety Studio. The importance of both the studio and research project is that they provide the students with the opportunity for independent learning. The word 'studio' is used in here to describe 'a general approach to interaction with students, that is instructor facilitated, student centred and very hands on' (Little and Cardenas, 2001). The purpose of the Aviation Safety Studio is to expose students to the many facets of Aviation Safety through studies of aircraft accidents or incidents in an innovative, enjoyable and educational environment. The studio runs for 5 consecutive weeks and comprises five sessions each of 3 hours.

For the purposes of the studio, students form themselves into 'Accident Investigation Teams'. Each team then selects a particular aviation accident or aviation safety theme. Teams then analyse the accident/theme with a view to identifying issues and contributing factors and consequently demonstrate how the aviation system has changed (or should be changed) in order to prevent future incidents and accidents. Students are strongly encouraged to identify systemic failures in the aviation system.

The studio culminates with each team making an assessed presentation to an audience including class members, academics and invited military guests. Marks are awarded for the understanding and analysis of the accident/theme, additional research and evidence of academic argument to substantiate the team's view, and creative achievement. Teams are encouraged to be innovative in their choice of presentation style. Various forms of presentations have been made including: television documentary; a play in which students took the role of ATSB investigators; courtroom inquiry re-enactment; re-enactment showing events from several points of view - for example as experienced by the pilots, engineers, aircraft operators, aircraft manufactures, the regulator, the general public etc.

To assist in this, students have available a multi media studio which includes video recording facilities and professional lighting. The studio also includes an aircraft simulator complete with a control console, a 1m plasma screen and three large screens abutting each other that can be used to show a panoramic 'outside' view' (Figure 2). The simulator is based on the Microsoft Flight Simulator. Most airports/regions, aircraft types (civil and military), seasons, times of day and weather patterns can be simulated.

Figure 2. The Aviation Safety Studio showing the large screen flight simulator.

Field Work Program.

It was considered important to provide the B'Tech Av students with first hand exposure to the aviation system during their academic program at ADFA. This is provided by a number of activities including:

1. SACME's airborne laboratory program (Harrap, 2007) in which, students are introduced to a number of facets of the aviation system including aircraft performance/flight test, airspace design and flight rules and procedures.
2. Field trips to the DDAAFS, ATSB, 34 Squadron (the VIP transport squadron) and the Canberra Air Traffic Control Tower at Fairburn.
3. Guest lecturers and safety practitioners from industry organisations including Qantas, CASA, and the ADF.
4. Visits and short postings to Australian Defence Force Bases including Amberley, Richmond, Nowra and Williamtown.

Validation and comparison with other Australian aviation degrees.

The last decade has seen a number of universities offer aviation degrees. Some have flourished whilst others have perished. Although demand for places in these courses may be strong, cites class sizes are restricted to uneconomical numbers by HECs quotas (Waddington, 2004). For example, in 2002, the authors were able to identify ten aviation degree programs. In 2006, this number had fallen to seven. Several of these courses offer students a choice between a management stream and a flying stream. The latter, like the ADFA B'Tech Av, incorporates flying training in the degree program. Courses which include flying training are relatively expensive compared with other university degrees and this is another factor limiting their marketability.

A common feature of all undergraduate aviation (flying stream) courses is that flying theory and practice accounts for approximately 25% of the coursework. The remainder of the courses primarily blend general science, engineering and aviation safety in various proportions. Figure 3 below compares the content of the Australian aviation degree programs (flying stream) offered in 2006. This data was compiled from university course handbooks. (The ADFA B'Tech Av course outlines may be found at http://www.unsw.adfa.edu.au/student/handbook/index.html.)

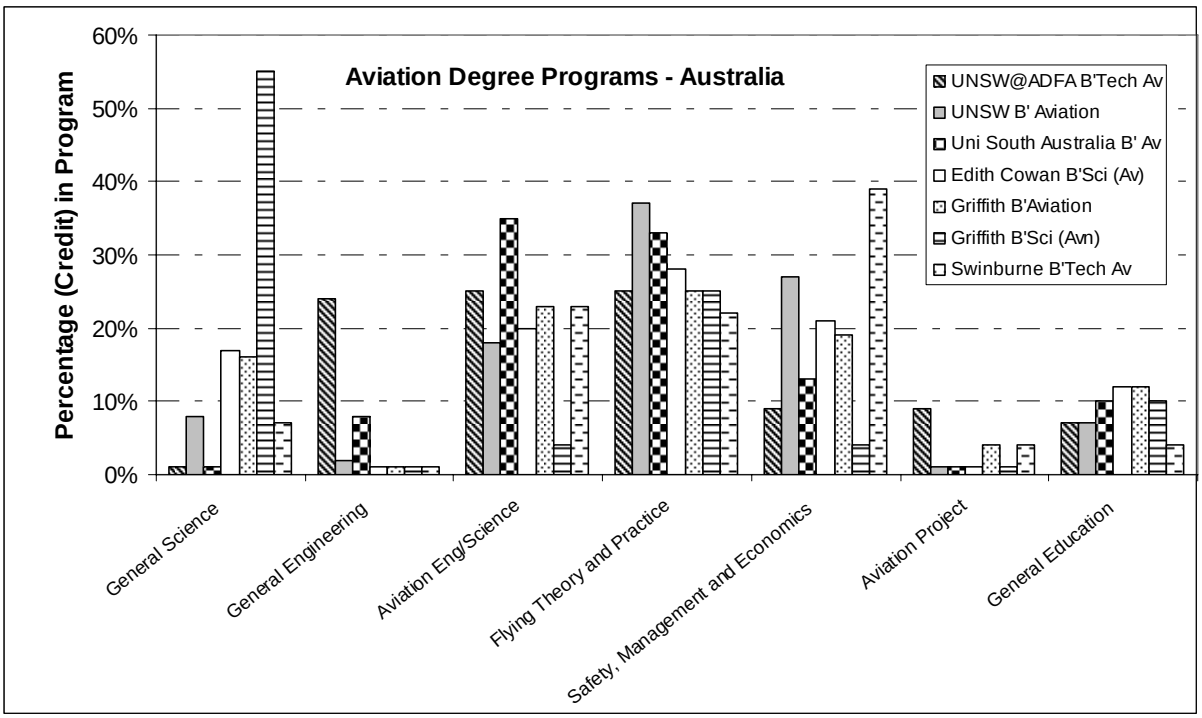

Figure 3. Comparison of Australian aviation degree content 2006 (flying streams). (Bars in same sequence as legend.)

The data in figure 3 illustrates that except for general education and flying training, there is considerable variation between the content of the degrees. However all degrees blend courses in science, engineering and safety, management and economics in different proportions. To some extent this reflects the nature of the department hosting the degree. For example, the Griffith B'Sci (Av) is very strong in general science whilst ADFA's B'Tech Av is strong in general engineering. It may well be argued that the diversity shown by the individual degree programs is a strength in that graduates from the various programs bring different skills to the aviation community.

The SACME is in the process of validating its B'Tech Av program by surveying its graduate students but early indications are encouraging:

1. A review of the B'Tech Av program (Given 2003) reported that graduating students 'were unanimous in stating that, even with the benefit of hindsight, they would elect to do the B'Tech Av degree rather than any other degree on offer at ADFA'.
2. Of the 3 graduating classes, our students have enjoyed considerable success in the very competitive military flying training program. Indeed all but one student in our first graduating course was offered career placements within the military fast jet squadrons. (Fast jets are only offered to the upper echelon of pilot graduates) Furthermore, B'Tech Av students regularly win prizes at graduation and two students have been 'dux of course'.

Steps are currently underway to distribute a questionnaire that will illicit comprehensive feedback on elements of the academic program including the relevance of the content of each subject and how well the program prepared students for flying training and their role as pilots within the ADF. This survey will provide empirical data to support an internal program review which is planned for 2008.

In addition to the validation exercise mentioned above, the B'Tech Av program has been reviewed by a number of organisations. Indeed, the ADF commissioned their own review of the degree just one year after its launch (Given, 2002) and a second follow up review the next year (Given 2003). This reflected the division of opinion regarding the degree held by various groups within defence. The results of this review were favourable and recommended the degree should proceed. The degree has also been twice reviewed by the IE Aust for the purposes of accreditation and, in 2008 will be reviewed by the SACME as part of a review of all programs offered by the School.

Conclusion

The ADFA B'Tech Aviation degree has been enthusiastically received by students and has generated considerable interest in the civilian and military communities. Unlike other Australian aviation degree programs, students enrolled in the ADFA B'Tech Av do not commence their flying training until the final year of their degree program. This led to some unique requirements for the design for this degree and these were described in this paper.

The degree now achieves its maximum allowable enrolment, and graduate students are recommending the course to prospective pilots entering ADFA. Graduate students have also enjoyed considerable success in their academic studies and flying training.

ADFA staff have made a strong commitment to the degree program. The foundations of the program have been laid and the program enjoys support from both the Institution of Engineers Australia and the Directorate of Defence Aviation and Air Force Safety. Currently, graduate students are taking part in a survey to validate the degree program. The results of this survey, together with a School review will guide the program's future development.

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