Australian Government

Department of Transport and Regional Services

REPORT

NATIONAL AIRSPACE SYSTEM (NAS) STAGE 2(b) CHARACTERISTICS AND THE AIRSERVICES AUSTRALIA AIRSPACE RISK ASSESSMENT OF CLASS E OVER CLASS D TOWERS

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Report of Jeff Griffith concerning Australia's National Airspace System (NAS) Stage 2(b) characteristics and the Airservices Australia Airspace Risk Assessment, Class E over Class D Towers.

I was first involved in Australia's airspace reform efforts to improve safety in 1996 when I came to Australia at the invitation of Airservices Australia to conduct an assessment of Australia's NAS. I was asked to provide information on the United States (U.S.) NAS that would be helpful to Airservices Australia in making airspace changes. At the time, I was employed by the U.S. Federal Aviation Administration (FAA). I found there was a high interest in the way the U.S. conducted operations in the different classes of airspace, since the FAA had implemented significant airspace changes in recent years resulting in the implementation of Class A,B,C,D,E and G airspace in the U.S. on September 16, 1993.

In 2002 I retired from the FAA. Working as a consultant, my new employer, The Washington Consulting Group, Inc., was contracted by the Australia NAS Implementation Group (IG) to assist in carrying out their responsibilities for reform of the Australia NAS. Specifically, I was to provide technical input into the development of each NAS characteristic and to review the IG's operational documentation to ensure technical accuracies. The objective was for Australia NAS to put in place procedures and operating practices used in the U.S. NAS that have proven to be safe and efficient in the U.S. NAS for many years.

I came to Australia 22 April 2003 to 2 May 2003, and again 17 November 2003 to 1 December 2003. In both instances, I was favourably impressed with the work of the IG in planning and implementing Stage 2(b) NAS characteristics. In my reports, I acknowledged the excellent work of the IG and looked forward to moving ahead with Stage 2(c) NAS characteristics, building on the positive momentum generated by the team in past months.

Most recently, I was contacted by Mr. Martin Dolan, A/Deputy Secretary, Department of Transport and Regional Services. In a letter dated 13 August 2004, Mr. Dolan informed me that Airservices Australia had recently proposed some enhancements to Stage 2(b) NAS characteristics and that the Civil Aviation Safety Authority was currently examining the safety case for the enhancements. Modelling that had been done by Airservices Australia indicated heightened risk at some locations. In particular, the outcomes from the risk analysis under the model appear to predict a greater number of accidents in Australian airspace than has actually occurred in similar U.S. airspace. Since it is the U.S. system that is being implemented, this appeared to be anomalous.

Mr. Dolan's aim is to get a better understanding of the empirical reality of the U.S. system, and have that applied as a test for the Airservices Australia model, specifically;

- Whether the assumptions on which the model has been developed are also appropriate for the U.S.
- Assuming as a working hypothesis that the Airservices Australia model is correct, what are the anomalies between the model outcomes and the U.S. experience; and

- What might explain any differences observed.

I was asked to work on this matter and provide results of my work. I am fully qualified to provide the information requested by Mr. Dolan. I retired from the FAA as Deputy Director of Air Traffic, a senior executive position at FAA Headquarters in Washington, D.C. I was responsible for the daily operation of the U.S. NAS with over 600 air traffic control facilities, 24,000 personnel and an operations budget of USD $3.5 Billion a year. My FAA career covered 32 years and included holding positions as an air traffic controller, supervisor, manager of three air traffic control facilities, regional manager and program director. I also served three and one-half years as an air traffic controller in the military.

In preparing for this task, I reviewed the Airspace Risk Assessment, Class E Over Class D Towers, Version 1.0 and associated documents. My findings are as follows:

1. The assumptions on which the model has been developed are not appropriate for the U.S. The methodology for the Airspace Risk Modelling included fast time simulation of the airspace using the Total Airspace and Airport Modeller (TAAM) and a Fault Tree Analysis to provide an estimate of the probability of the collective failure of all the collision avoidance mechanisms; i.e., a midair collision. Failure probabilities for each of the fault tree nodes is established by a formal assessment process using a panel of pilots and controllers that debate individual questions and use a Shang voting process to cast votes. The use of humans in a process to address predetermined questions through a vote to determine collision risk is a process which I have not seen used in the U.S. TAAM is an excellent tool for designing sectors and calculating capacity and delay for airports based on different traffic mixes and volumes. While the modeller contains flight plan information and can search for conflict points, the randomness of a VFR flight through Class E airspace in a nonradar environment (even as shown in Appendix 9) may not be captured appropriately, based on my experience with TAAM which dates back to 1996. I am not aware that TAAM has been certified as a collision risk model. Additionally, there is no evidence of a validation process used for the outcomes of the Airspace Risk Assessment.

I have participated in safety risk assessments in the U.S. The process used is scientific using high fidelity simulation models and conceptual tools. Here is an example of the process used for conducting one risk assessment:

The purpose of the risk assessment was to determine the level of safety for conducting Simultaneous ILS Approaches to parallel runways. The methodology involved pilots and controllers simulating the procedure in a controlled environment. Both received training on the procedure and were afforded the opportunity to gain a level of proficiency. The participants chosen were from backgrounds that involved daily performance in a similar environment using similar procedures. The purpose of this assessment was to determine if simultaneous approach operations could safely be expanded to three parallel runways from the well established procedure of two parallel runways.

Controllers were situated in a laboratory control room where they vectored multiple aircraft to the final approach courses and cleared them for approach. Other controllers monitored the approaches on radar and were responsible for terminating the approach of certain aircraft if other aircraft "blundered" into their flight path. The parallel flight paths were less than a mile apart, and aircraft descended to the same altitude while executing the approach. Remote pilot operators followed the controller's instructions, resulting in aircraft situational awareness on the radar display to be precise. Blunders were scripted by the project director, and controllers never knew when a blunder was going to occur. This allowed for the measurement of response times and the sessions were recorded to allow for high fidelity playback. This process was followed for multiple scenarios over many days in order to collect enough data to populate the model for the validation necessary to draw conclusions.

On the airborne side, pilots were situated in high fidelity flight simulators and flew ILS approaches over and over again. Pilots were issued "go around" instructions unannounced and randomly to simulate a response to the blunder of another aircraft on an adjacent approach. Pilot reaction and response times were measured and data collected also for validation and drawing conclusions.

This process for conducting a safety analysis is quite different from the one used for the Airspace Risk Assessment for Class E over Class D Towers described above. To draw a comparison to the Airspace Risk Assessment, the following is provided: As a controller, if you ask me a question like: "What is the likelihood you will not notice a blunder while monitoring simultaneous ILS approaches?" I will probably tell you that I will notice them 99% of the time. This does not consider the real world environment of monitoring simultaneous ILS approaches. In reality, I may have turned my head to coordinate a sequence or a spacing interval with the controller vectoring aircraft to the final approach course; or, I may be conducting a position relief briefing for another controller to assume the operational position and momentarily look away from the radar display just when an aircraft blunders into the flight path of an aircraft on the adjacent final approach course, and not noticed the blunders. These actions must be accurately measured and accounted for in the analysis when conducting a risk assessment.

2. In Section 4.3, it is stated that in accordance with ICAO standards TCAS is not considered in the estimation of collision probability in the modelling. TCAS is a proven and acceptable method of collision avoidance between aircraft. In the U.S., I am aware of many instances where a TCAS Resolution Advisory played a significant role in collision avoidance. It is not reasonable to exclude the benefit of TCAS from the Airspace Risk Assessment. Additionally, the Stage 2(b) characteristics require aircraft operating in Class E airspace to be equipped with an operating transponder that has altitude reporting capability. This requirement is above what is required in the U.S. where transponder with altitude reporting capability is only required above 10,000 feet and within 30 miles of certain airports that have a high density of passenger traffic. This requirement in Australia adds another level of safety beyond what exists in the U.S. NAS.

3. The fatality rates for Class E over D summarized in Section 1.4 of the report are not consistent with what is actually happening for the same classification of airspace in the U.S. Table 2 shows 5.38 fatalities at Hobart per 100 years. A review of National Transportation Safety Board reports of fatal midair collisions for the last 20 years did not show any fatalities, as a result of midair collision in E airspace above D airspace in the U.S.; i.e., zero fatalities. The Table notes that Industry Class E airspace in some

locations offers slightly better improvement over Class E than Class C and attributes this to the fact that a speed limit of 250kts IAS is applied in Class E airspace and assumed in Industry Class E, that does not apply in Class C. In the U.S. operations are restricted to 250kts IAS below 10,000 feet.

4. Controller workload has not been properly considered in the risk assessment. If Class C airspace is implemented over Class D airspace; i.e., the Stage 2(b) characteristics are reversed, workload for the controller will increase significantly. The same controller will be responsible for traffic on the aerodrome, in the circuit and separation of IFR and VFR aircraft in Class C airspace. This has not been addressed in the Risk Assessment and is a significant factor. I reviewed a number of incident reports contained in the ATSB database and found many incidents where aircraft (multiple) taxied onto runways without a clearance from ATC; aircraft (multiple) commenced takeoff roll without a clearance from ATC; aircraft lined up on the runway without a clearance from ATC and a mower entered a runway with out a clearance from ATC. A critical responsibility of the tower controller is to continuously scan the movement area to ensure there are no conflicting aircraft or vehicles (or some other unsafe situation) on the runway when issuing control instructions and clearances. If the tower controller is also responsible for separating IFR and VFR aircraft in Class C airspace, this could lead to the controller not observing an unsafe situation on the aerodrome resulting in an accident or incident. If any action is contemplated that would implement Class C airspace over Class D airspace, it is strongly recommended that a risk assessment be conducted to consider controller workload prior to taking action.

5. I had occasion to meet with six control tower managers to discuss Class E operations. I appreciate the opportunity to meet with these gentlemen and the discussion they provided. In the discussion, they related to me what was said to be a common occurrence in Class E airspace as follows: A VFR aircraft in Class E airspace calls the tower and reports position, altitude and intentions. Subsequently an IFR aircraft; e.g., a Dash 8, calls inbound at an altitude above the VFR aircraft. The tower controller advises the Dash 8 of the VFR aircraft whereby the Dash 8 stops descent at an altitude above the VFR aircraft and proceeds at that altitude until over the airport before descending further to land. This is definitely not what happens in the U.S. NAS.

a. This situation tells me that the pilots of both aircraft are not following the guidance provided in the training and education material for implementation of the Stage 2(b) NAS characteristics after nearly eight months. The VFR aircraft should have monitored the tower frequency to hear other aircraft for alerted see and avoid. The Dash 8 should have followed ATC instructions in the clearance and also been alert to the other aircraft since awareness now existed. If this is truly a common occurrence, additional training and education for pilots must be considered.

b. I observed that Notices to Airmen C1718/04 and C177/04 have been issued advising VFR pilots intending to operate in Class E airspace 8,500 feet and below within 36 NM of several airports that they are encouraged to contact the respective tower on VHF and monitor that frequency whilst operating in that airspace to assist in the provision of traffic information. Pilots are advised that they should notify tower of any change to reported track, level or intensions. This matter is confusing and raises the question as to whether proper evaluation and progress reporting have been accomplished during implementation of the Stage 2(b) characteristics.

It is my observation that there are no anomalies between the Airspace Risk Assessment model and the U.S. experience. There simply is no correlation between what is reported as the results of the Airspace Risk Assessment and what actually occurs in the U.S. NAS. Comparing the results of the study to the empirical data available for the U.S. NAS, the modelling technique used to complete the assessment is in question. Furthermore, the results of the assessment have not been validated. It is urged that decision makers proceed cautiously. To reverse the Stage 2(b) NAS characteristics could reverse safety. Decision makers have no sure way of telling. It is recommended that this matter be looked at properly before any further decisions are made.

Respectfully submitted,

Jeff Griffith
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