Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY REPORT

Aviation Research and Analysis Report 20060053

Final

Radiotelephony Readback Compliance and its Relationship to Surface Movement Control Frequency Congestion

Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY INVESTIGATION REPORT

Aviation Research and Analysis Report

B2006/0053

Final

Radiotelephony Readback Compliance and its Relationship to Surface Movement Control Frequency Congestion

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

Published by: Australian Transport Safety Bureau
Postal address: PO Box 967, Civic Square ACT 2608
Office location: 15 Mort Street, Canberra City, Australian Capital Territory
Telephone: 1800 621 372; from overseas + 61 2 6274 6440
Accident and incident notification: 1800 011 034 (24 hours)
Facsimile: 02 6247 3117; from overseas + 61 2 6247 3117
E-mail: atsbinfo@atsb.gov.au
Internet: www.atsb.gov.au

ISBN and formal report title: see 'Document retrieval information' on page v.

CONTENTS

DOCUMENT RETRIEVAL INFORMATION

Report No.	Publication date	No. of pages	ISBN
B2006/0053	June 2007	28	978-1-9221164-92-7

Publication title

Radiotelephony Readback Compliance and its Relationship to Surface Movement Control Frequency Congestion

Author(s)

Hughes, Kerri; McRandle, Brendan; Brokenshire, Ian

Prepared by

Australian Transport Safety Bureau
PO Box 967, Civic Square ACT 2608 Australia
www.atsb.gov.au

Reference No.

June2007/DOTARS 50287

Acknowledgements

The ATSB would like to thank Airservices Australia for the provision of air traffic control automatic voice recordings.

Abstract

Communication within the air traffic system relies heavily on the verbal interaction between pilots and air traffic controllers (controllers) to ensure the safe and efficient operation of air traffic. The use of standard phraseology and radio telephony procedures, such as readbacks, minimises the opportunity for misinterpretation between pilot and controller.

Some sectors of the industry have raised concerns regarding the use of excess or non-standard phraseology in readbacks on the surface movement control (SMC) frequency, resulting in radio congestion. The purpose of this report was to explore the relationship between excess or non-standard words in readbacks and its effect on frequency congestion.

A review of the Sydney SMC frequency tapes concluded that most users complied with the readback requirements stipulated in the Aeronautical Information Publication (AIP), with only the occasional radio transmission containing excess or non-standard verbiage. Overall, the tapes identified a high level of compliance with the AIP readback requirements; however, it was noted that the use of pleasantries was commonplace. While these did not appear to affect frequency congestion adversely, in times of high traffic density it seems inappropriate.

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal Bureau within the Australian Government Department of Transport and Regional Services. ATSB investigations are independent of regulatory, operator or other external bodies.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the Transport Safety Investigation Act 2003 and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to enhance safety. To reduce safety-related risk, ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not the object of an investigation to determine blame or liability. However, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to proactively initiate safety action rather than release formal recommendations. However, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation, a recommendation may be issued either during or at the end of an investigation.

The ATSB has decided that when safety recommendations are issued, they will focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on the method of corrective action. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations. It is a matter for the body to which an ATSB recommendation is directed (for example the relevant regulator in consultation with industry) to assess the costs and benefits of any particular means of addressing a safety issue.

About ATSB investigation reports: How investigation reports are organised and definitions of terms used in ATSB reports, such as safety factor, contributing safety factor and safety issue, are provided on the ATSB web site www.atsb.gov.au.

EXECUTIVE SUMMARY

Communication, whether verbal, nonverbal or written, provides individuals with the necessary tools to exchange information. Effective communication, however, depends on the sender and receiver achieving a mutual understanding and active listening. These principles are essential in aviation for the safe and efficient operation of an aircraft.

While technological advancements have resulted in the introduction of digital data link systems, verbal communication remains the most common form of communication in the air traffic system. The use of standard radio telephony phases and procedures, such as readbacks, is one of the inherent risk controls in pilot-controller communications.

Some industry stakeholders have raised concerns about excess verbiage or non-standard words in readbacks on the surface movement control (SMC) frequency, resulting in radio congestion. The purpose of this report was to examine any relationship between verbose readbacks and frequency congestion on the SMC. To do this, air traffic control automatic voice recordings of the SMC frequency at Sydney airport were obtained so that readbacks could be evaluated against the standards set out in the Aeronautical Information Publication (AIP).

Sydney airport was chosen because it accounted for the greatest number of aircraft movements during the reporting period. A review of the Sydney SMC frequency tapes concluded that most users complied with the readback requirements stipulated in the AIP, with only the occasional radio transmission containing excess or non-standard verbiage. Consequently, no relationship between verbose readbacks and frequency congestion could be identified. This may be attributed to the level of professionalism of SMC frequency users, user discipline in complying with radiotelephony requirements, user familiarity with the airport, and user appreciation of traffic density.

While the tapes identified that users are well disciplined in reading back ATC instructions and clearances on the SMC frequency, the tapes revealed a frequent use of pleasantries such as ‘good morning’, ‘thank you’, and ‘g’day’. Although these phrases are not endorsed by the AIP, their use appeared to have little adverse effect on frequency congestion. But in times of high traffic density it seems inappropriate.

ABBREVIATIONS

ACARS	Aircraft communication addressing and reporting system
ACD	Airways clearance delivery
ADC	Aerodrome control
AIP	Aeronautical Information Publication
ATC	Air traffic control
ATSB	Australian Transport Safety Bureau
CPDLC	Controller-pilot data link communications
SMC	Surface movement control
US	United States
VHF	Very high frequency

1 INTRODUCTION

1.1 Background to the report

Some comments received from industry suggest that radio congestion on the surface movement control (SMC) frequency is the result of verbose readbacks that do not comply with Aeronautical Information Publication (AIP) procedures.

Pilots and other SMC frequency users were reportedly exceeding the AIP read-back requirements by repeating an entire clearance or instruction to air traffic control (ATC), instead of just the critical information as set out in the AIP.

To date, reducing frequency congestion has focused primarily on the more efficient utilisation of the available radio spectrum, with little research conducted on user efficiency.

This report seeks to provide an assessment of whether additional efficiencies might be achieved by improving radio telephony training and by making radio users aware of the benefits of using concise radiotelephony procedures.

1.2 Objectives of the report

The purpose of this report was to review ATC automatic voice recordings to examine any relationship between excess verbiage in readbacks and radio congestion on the SMC frequency. Specifically, the objectives were to:

- determine whether radiotelephony readbacks are excessive or non-standard in comparison with the requirements of the AIP;
- determine the decrease in radio transmission time that might be achieved if radio users complied with the AIP; and
- identify the common characteristics of excessive readbacks.

2 COMMUNICATION

2.1 Why is communication important?

Before the relationship between verbose readbacks and frequency congestion can be examined, it is important to appreciate the purpose of communication.

> *"Communication refers to the process by which information is transmitted and understood between two or more people. We emphasize the word understood because transmitting the sender's intended meaning is the essence of good communication" (McShane & Von Glinow, p. 324).*

Communication provides a conduit for the exchange of information. Whether in a verbal, nonverbal or written context, it provides individuals with the tools to transfer knowledge, express ideas and opinions, display emotion, listen, provide feedback, etc. The process of communication can be divided into four key stages (McShane & Von Glinow, 2005):

The Communication Process

Stage 1:	The sender forms a message and encodes it into words, gestures, voice intonations, symbols and signs.
Stage 2:	The encoded message is transmitted to the receiver through the use of verbal, non-verbal or written communication.
Stage 3:	The receiver senses the inward message and decodes it into something meaningful.
Stage 4:	The sender seeks confirmation or feedback that the receiver has understood the transmitted message.

Effective communication is only achieved when the intended meaning of the sender and the perceived meaning of the receiver is the same. However, this is often hampered by what is commonly referred to as 'noise'. Noise means any disturbance within the communication process that disrupts the matching process between the sender and the receiver. It includes physical distractions, mixed messages, cultural differences or the absence of feedback (Wood, Wallace, Zeffane, Schermerhorn, Hunt, & Osborn, 1998). If any aspect of the communication process is affected by noise, the sender and receiver may no longer share a common understanding.

Effective communicators not only understand a message and manage noise; they also possess exceptional active listening skills. They recognise that being an effective receiver is as important as being an effective sender (Wood et al., 1998). Therefore, effective communication relies on the two key principles of mutual understanding and active listening.

2.2 Communication in aviation

Effective communication is an essential component for operations within the aviation environment. It provides pilots, cabin crew, ATC, maintenance personnel, and ground staff with the necessary tools to establish a mutual understanding of the nature of events relevant to the operation of an aircraft. Despite the introduction of technologies such as Controller-Pilot Data Link Communications (CPDLC)[1] and Aircraft Communication Addressing and Reporting System (or ACARS)[2], verbal communication remains the most prevalent channel through which information is exchanged within the air traffic system.

The air traffic system can be likened to an information management system in which information changes rapidly in a short period of time. The management of air traffic within this system largely depends on the timely exchange of information among ATC, and between ATC and pilots (NASA, 1981).

The management of Australia's air traffic system is broadly divided into three areas (Airservices Australia, 2006):

- **Enroute:** the management of air traffic over the majority of Australian mainland and on oceanic routes.
- **Terminal area:** the management of aircraft arriving and departing major city airports.
- **Tower:** the management of aircraft and vehicle movements on taxi ways, runways and in the immediate vicinity of an aerodrome.

This report focuses on the management of air traffic within the tower area. More specifically, it considers operations using the surface movement control (SMC) frequency.

In general, the tower is responsible for the control of traffic on the airport surface (both aircraft and vehicles) and aircraft airborne within the vicinity of the aerodrome. At major airports, operations within the tower are divided into three areas of responsibility: aerodrome control (ADC), SMC and airways clearance delivery (ACD), all of which have a discrete radio frequency. The ACD controller is responsible for a clearance that authorises a pilot to fly the aircraft from the departure airport to the destination airport. The surface of the aerodrome is controlled by SMC, with the exception of the runways and aprons, which are controlled by the ADC and airport operators respectively. Transmissions on the SMC frequency generally include engine start, pushback approvals[3] and taxi clearances. The apron[4] area is usually controlled by the airlines. This division of responsibility could reduce congestion on the ATC communication system by providing additional capacity through a separate apron radio frequency. However, in Sydney, this extra capacity is not present.

---

1 Data link facility that enables direct communication between air traffic controllers and pilots.

2 ACARS allows for two-way communication between flight crews, air traffic control, and airline operational personnel using a digital data link system instead of voice communications.

3 Pushback: when an aircraft is pushed back from the terminal building by a tug in preparation for taxi.

4 A defined area on the aerodrome intended to accommodate the loading and unloading of passengers, mail, or cargo; refuelling; or maintenance (Kumar, 2004).

The ATC system is a complex system that is reliant on human communication to support the transfer of information and to enable decision-making (IATA, 2004). Despite the use of advanced technologies, the need for clear and concise verbal communication within this system is crucial for the safe and efficient operation of air traffic.

The Tenerife Disaster

One of the most tragic accidents in aviation history involved the runway collision between two Boeing 747 aircraft, Pan Am Flight 1736 and KLM Royal Dutch Airlines Flight 4805, at Los Rodeos Airport on the island of Tenerife, Canary Islands on 27 March 1977.

Even though there were a number of significant factors that contributed to this disaster and claimed the lives of 583 people, the fundamental cause was the fact that the captain of the KLM aircraft initiated the takeoff without a clearance and did not heed the 'stand by for take-off' instruction from ATC.

This was further compounded by that fact that a transmission from ATC ("stand by for take-off…I will call you") and a transmission from the Pan Am crew ("we are still taxiing down the runway") occurred at the same time. This meant that the transmission was not received with full clarity. The accident investigation also identified the use of inadequate language by the KLM pilot as a contributory factor (Subsecretaria de Aviacion Civil of Spain, 1978).

The Tenerife disaster remains the most publicised accident highlighting the crucial role communication plays in aviation.

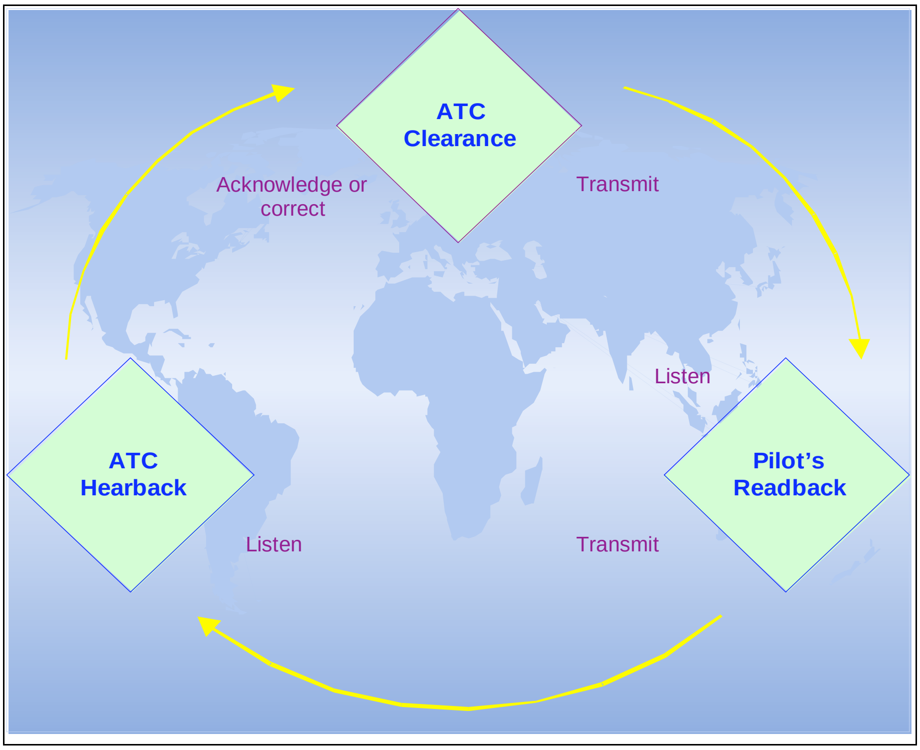
2.3 Pilot–ATC (controller) communications

For pilots and ATC to communicate effectively, messages and information must be transmitted, received and understood (Gless, 1992). The pilot–ATC (controller) communication process, often referred to as the readback/hearback loop, is a procedure developed for actively listening and confirming messages between pilots and ATC (Prinzo & Britton, 1993).

Essentially, pilot–controller communications occur in four stages. The first stage involves a controller compiling a message in the form of a clearance or instruction and encoding it into words. This clearance is then transmitted to the pilot verbally, or through the use of data link technology. The second stage involves the pilot actively listening to the clearance. This relies on the pilot analysing the transmission and extracting the critical information. This information is then transmitted back to the controller (stage three). This is commonly referred to as a 'readback'. Extracting and reading back the critical parts of a clearance demonstrates to a controller that the pilot has sensed the inward message and decoded it into something meaningful. This now establishes a mutual understanding between the pilot and the controller. That is, the intended meaning of the sender and the perceived meaning of the receiver are the same.

The final stage involves the controller actively listening for a correct readback from the pilot. This is known as a ‘hearback’. This allows the controller to identify any misunderstandings and make the necessary corrections. Figure 1 provides a graphical representation of how the pilot–controller communication process operates.

Figure 1: Pilot–controller communication process



Source: (Flight Safety Foundation, 2000)

Air traffic controllers and pilots are the predominant, but not exclusive, users of the communications element of the air traffic system. The logistics of transporting passenger and/or cargo from point A to point B is a multifaceted process. As a result, operations within the confines of an aerodrome, particularly at major airports, are complex and diverse. At any one time, there are a number of people operating on the airport including tug drivers towing aircraft to maintenance hangars and airport operations officer vehicles operating on the aerodrome that need to communicate with ATC. All users of the air traffic system, irrespective of whether they are pilots or ground personnel, must follow the pilot–controller communication process. By conforming to this process, the adverse operational consequences inherent in voice communications can be minimised (Orlady & Orlady, 1999).

ATSB Report: 200505170

The ATSB released a transport safety investigation report into an incident that occurred at Sydney (Kingsford Smith) Airport on 20 October 2005. A Boeing 777 aircraft commenced the take-off run on runway 34 left when an aircraft tug, towing a Boeing 747 aircraft, crossed the departure end of the same runway.

The investigation found that the tug driver, who had 17 years experience and had never been involved in an incident, responded to a clearance issued to the pilot of a taxiing aircraft. The driver believed he heard a clearance to cross the runway from the SMC. The driver acknowledged the clearance; however, the SMC remained unaware of the situation due to a radio overtransmission. In the absence of a response from SMC, the driver crossed the runway, resulting in a runway incursion[5].

The findings of the investigation identified the following contributory factors, all of which highlight the importance of an effective pilot-controller communication process:

- the tug driver used the clearance intended for an aircraft crossing another runway;
- the tug driver relied on his readback of the clearance to confirm the validity of the clearance; and
- the majority of the tug driver's readback of the clearance was over transmitted and hence, not received by SMC.

The tug driver did not question SMC about the clearance to cross the runway even though doubt existed in his mind about the contents of the clearance (ATSB, 2006).

2.4 Readback requirements

The language and cultural differences that are inherent in the international aviation community can result in significant communication problems. Voice communications between pilots, controllers, and other radio users are susceptible to misunderstanding through noise and language differences, which have the potential to degrade the system's reliability, as well influence expectations, biases, and other cognitive factors (Rantanen, McCarley, & Xu, 2002). Standard terminology and procedures have been devised to increase word intelligibility and reduce the risk of misinterpretation (Orlady & Orlady, 1999). The use of common procedures, such as readbacks, limits and controls the opportunity for error (Wilson, 1990).

A readback is defined as '*a procedure whereby the receiving station repeats a received message or an appropriate part thereof back to the transmitting station so as to obtain confirmation of correct reception*' (ICAO, 2001).

5 A runway incursion refers to any intrusion of an aircraft, vehicle, person, animal or object within the confines of a runway strip or helicopter landing site that creates a collision hazard or results in a reduction of aircraft safety (Commonwealth of Australia, 2003).

Readbacks are one of the inherent risk controls in pilot–controller communications. The essential requirement of a readback is to clearly communicate to the controller that the specific instruction or clearance has been received and understood. This involves carefully analysing the controller's transmission, and reading back only the portion that constitutes a clearance or instruction (Ambrose, 2004). Reading back a clearance or instruction verbatim makes it difficult for the controller to ascertain whether or not the critical information contained in the transmission has actually been understood by the recipient. Readbacks of controller transmissions are a standard procedure required by the AIP GEN 3.4 'Communication Services', which lists those aspects of a clearance, instruction or information that should be read back to ATC.

Figure 2: AIP readback requirements

AIP GEN 3.4 COMMUNICATION SERVICES

4.4 **Read-Back Requirements**

4.4.1 Pilots must transmit a correct read-back to ATC clearances, instructions and information which are transmitted by voice. For other than item *a*., only key elements of the following clearances, instructions, or information must be read back ensuring sufficient detail is included to indicate compliance:

a. an ATC route clearance in its entirety, and any amendments;

b. en route holding instructions;

c. any holding point specified in a taxi clearance;

d. any clearances or instructions to hold short of, enter, land on, conditional line-up on, take-off on, cross, or backtrack on, any runway;

e. any approach clearance;

f. assigned runway, altimeter settings directed to specific aircraft, radio and radio navigation aid frequency instructions;

Note: An 'expectation' of the runway to be used is not to be read back.

g. SSR codes, data link logon codes;

h. level instructions, direction of turn, heading and speed instruction.

While the importance of good readbacks should be stressed, they do not necessarily guarantee a mutual understanding between ATC, pilots and other users. Along with hearbacks, readbacks considerably increase the probability that any misunderstandings will be identified (Orlady & Orlady, 1999).

2.5 Readbacks and frequency congestion

The safe and expeditious flow of air traffic depends on accurate and efficient communications between pilots and ATC. This requirement becomes even more crucial as the amount and complexity of air traffic increases (Cardosi, Falzarano, & Han, 1998).

An air traffic controller's workload is often determined by the number of radio transmissions. The more superfluous words, the more repeated instructions, or requesting readbacks and confirming details, the less traffic can be processed (O'Keeffe, 2005). Comments from industry suggest that radio congestion on the SMC frequency is the result of verbose readbacks that exceed the requirements of AIP GEN 3.4.

Up until now, frequency congestion has been controlled by providing additional radio transmission frequencies to manage the same air traffic task. For example, Sydney Airport utilises two SMC positions during busy periods. This also provides pilots with increased situational awareness. However, frequency congestion across the aviation very high frequency (VHF) spectrum in high-density traffic areas such as the United States (US) and Europe has resulted in the reduction of channel spacing standards. A 25 kHz channel spacing standard was adopted by the US in 1972 and the United Kingdom in 1980. In 2000, Europe adopted a channel spacing of 8.33 kHz. Since 1991, Australian aeronautical frequencies have been assigned with 50 kHz channel spacings. However, increased demand has since seen this reduced to 25 kHz in certain classes of airspace (Airservices Australia, 2004). The implementation of 25 kHz channel spacing has made more efficient use of the available VHF spectrum and hence, provides additional capacity that can be allocated to aviation users.

The relationship between excess verbiage[6] and frequency congestion was cleverly described by Ambrose (2004) in the 'The South Beach Diet for Speech':

> *"When transmitting, we all need to suspend excess oratory in favor of high-protein, low-fat speech. To put our broadcasting code on a diet, count and restrict syllables just as weight loss champions watch calories or carbohydrates.*
>
> *The more cumbersome alternative to a high-protein response consumes … more syllables and unnecessarily uses up the same amount in airtime" (p. 56).*

If excess verbiage in radio transmissions is of concern, the question of why an ATC clearance or instruction would be read back in its entirety needs to be asked:

- **High workload:** Is it quicker to repeat a clearance word for word in times of high workload and then extract the meaningful information after the pilot–controller communication process has been completed?
- **Frequency congestion:** Is frequency congestion actually reduced by completing a full cycle of the pilot–controller communication process expediently, instead of delaying the process by analysing and extracting the critical information?

---

6 Excess verbiage: an abundance of useless words, as in writing or speech; wordiness (The Macquarie Dictionary, 1997).

- **Readback requirements:** Does reading back a clearance in full ensure that the readback requirements stipulated in the AIP have been met? The answer to this is yes; however, doing such might not only increase air time, it also makes it difficult for ATC to ascertain whether or not the critical elements of a clearance were understood.

For whatever reason, the need for clear and succinct readbacks will not only enhance safety, it will provide ATC with valuable time within which to manage the flow of air traffic.

The following example demonstrates the differences in radio transmission time between a clearance that is read back in its entirety compared with a clearance that is read back in accordance with AIP GEN 3.4.

Full version: Sydney ground good morning alpha bravo charlie for bay fifty eight (ABC)

Alpha bravo charlie g'day via bravo six then charlie to the gate (SMC)

Thanks via taxiway bravo six then taxiway charlie alpha bravo charlie (ABC)

AIP version: Sydney ground alpha bravo Charlie for bay fifty eight (ABC)

Alpha bravo charlie via bravo six then charlie to the gate (SMC)

Bravo six then charlie alpha bravo charlie (ABC)

The full version of the above transmission totals 34 words compared with the AIP version, which totals 27 words. The readback component of the transmission for the full version and AIP version (in red) total 11 and seven respectively. While only a difference of four words, over time, the cumulative effect of such excess verbiage may increase frequency congestion.

Adding to the issue of reading back an ATC clearance or instruction verbatim, is the frequent use of colloquial exchanges such as good morning, thanks, and g'day. Such exchanges are often used to establish a rapport with ATC or to indicate closure (changing frequencies). This may be acceptable during times of low traffic; however, excessive use has the potential to increase frequency congestion, especially during busy periods.

A research paper released by the United States Federal Aviation Administration titled 'An Analysis of Approach Control/Pilot Voice Communications' (Prinzo, 1996) sought to develop baseline data on ATC–pilot communications. The paper analysed ATC and pilot voice communications at three terminal air traffic control facilities (TRACONs). The TRACON audio tapes were transcribed and coded using the aviation topic–speech act taxonomy, which categorises ATC–pilot communication elements[7] according to their purpose and identifies varying types of communication errors. One error identified in the report was the use of excess verbiage in transmissions.

7 A communication element is defined as a fundamental unit of meaningful verbal language (Prinzo, 1996).

The findings of the report identified the following three key points relating to excess verbiage:

- Pilot and ATC communications became more conversational and verbose when the transmissions included ‘advisory’ and ‘request’ speech acts. These categories represent the ‘do something’, ‘tell something’ and ‘ask something’ of a communication element.
- It was evident that excess verbiage increased the amount of time required to transmit, understand, and respond to a transmission by pilots and ATC.
- Using excess verbiage rarely alters the meaning of a transmission; however, it does have the potential to increase frequency congestion by precluding other radio users from making transmissions.

Even though the report was published 10 years ago, it provides some valuable insight into the relationship between excess verbiage in radio transmissions and frequency congestion, and remains pertinent to pilot-controller communications today.

Radio users have an obligation to avoid unnecessary consumption of air time during periods of high traffic (Ambrose, 2004). The air traffic system would be more effective and efficient if users comply with the requirements of AIP GEN 3.4 and limit additional calls to those needed for safety and operational purposes (O'Keeffe, 2005).

3 METHODOLOGY

3.1 Data sources

Air traffic control audio tapes were provided by Airservices Australia for Sydney airport. The tapes provided automatic voice recordings of the SMC frequency for the period covering 21 to 25 March 2006.

3.2 Method of analysis

The project involved reviewing the audio tapes of the SMC frequencies for Sydney airport to ascertain whether or not readbacks were excessive. To do this, a one-hour sample of automatic voice recordings for each day over the 21 to 25 March period was obtained. The one-hour sample chosen was extracted from the peak traffic period in the morning, around 0700 hours to 0800 hours.

This sample size also ensured that a minimum of 10 ATC clearances and associated readbacks per day were available for assessment. Thus, there were at least 50 readback examples for Sydney airport for the 5-day period. The clearances and readbacks were then transcribed and compared to assess compliance with the procedures described in AIP GEN 3.4.

4 RESULTS AND DISCUSSION

Of the airports considered for analysis, Sydney recorded the greatest number of aircraft movements. Based on a daily average calculated for the month of March, Sydney recorded 788 movements per day. By comparison, Melbourne recorded 507 movements and Brisbane recorded 456 movements.

Due to the level of traffic experienced at Sydney airport, the SMC services are provided on two frequencies during busy periods: SMC 1 and SMC 2. Surface movement control 1 is responsible for the east side of the airport (predominately domestic air traffic) and SMC 2 controls the west side (mainly international air traffic). For the purposes of this report, only the SMC 1 frequency was analysed.

The SMC 1 automatic voice recordings for the period 21 to 25 March between the hours 0700 and 0800 were transcribed and evaluated for compliance with the AIP. The analysis revealed that the majority of users, both pilots' and ground personnel, read back ATC instructions and clearances in accordance with AIP GEN 3.4. Excess verbiage was only identified in a small number of cases.

The high standard of readback compliance on the SMC frequency may be attributed to:

- The level of professionalism of the users operating on the frequency.
- The discipline of the users in complying with radiotelephony requirements.
- The users' familiarity with operating at the aerodrome.
- The users' appreciation of the density of traffic using this frequency, and the importance of succinct, professional communications.

There was no evidence found to support concerns expressed about frequency congestion and verbose readbacks. However, of note, was the frequent use of pleasantries such as 'good morning', 'thank you' and 'g'day'. These were mainly used to display a level of courtesy, or as a means of initiating or finalising a radio transmission. The inclusion of these colloquial exchanges in communications usually invited a similar colloquial response. Whilst courteous, in times of high traffic density, it seems inappropriate.

Other services within the air traffic system often involve more complex communications such as departure and arrival, compared with those experienced on the SMC frequency. However, for the purposes of this report, only the SMC frequency was explored.

5 CONCLUSION

The effective transfer of information is a complex process, which requires information to be conveyed and transferred clearly, concisely, and in a timely manner by the sender; and attended to, understood, acknowledged and clarified by the receiver. This transfer of information through communication is the basis of interactions that underly all group dynamics (Driskell & Adams, 1992).

The process of human communication is prone to error. One of the principal defences against mis-communication between pilot and controller is the employment of standardised phraseologies and the readback process. Their familiar use and expectation reduces ambiguity in communication (IATA, 2004).

This study did not find evidence of frequency congestion caused by excess verbiage in radio transmissions. While this report focused on a sample of professional pilot radio users operating at a major airport, it highlights the importance of a disciplined application of the Aeronautical Information Publication requirements to ensure the efficient and effective use of air traffic services. This not only assists with the smooth processing of traffic, but also contributes to the safety of the air traffic system.

6 REFERENCES

Airservices Australia. (2004). VHF communications transmitting and receiving equipment: Introduction of 25 kHz channel spacing. Canberra: Airservices Australia.

Airservices Australia. (2006). Different types of air traffic control work. Retrieved 16 November, 2006, from www.airservicesaustralia.com/employment/atc/atc_types.asp

Ambrose, K. (2004). Say more, talk less. *Bussiness & Commercial Aviation, March*.

ATSB. (2006). *Runway incursion - Sydney (Kingsford Smith) Airport NSW - 20 October 2005* (200505170). Canberra: ATSB.

Cardosi, K., Falzarano, P., & Han, S. (1998). *Pilot-controller communication errors: An analysis of aviation safety reporting system (asrs) reports*. Cambridge, MA: Federal Aviation Administration.

Commonwealth of Australia. (2003). Transport safety Investigation Act & Regulations 2003. Retrieved 12 December, 2006, from http://scaletext.law.gov.au/html/pastereg/3/1798/0/PR000090.htm

Driskell, J. E., & Adams, R. J. (1992). *Crew resource management: An introductory handbook* (DOT/FAA/RD-92/96). Washington, DC: Federal Aviation Administration.

Flight Safety Foundation. (2000). FSF ALAR briefing note: 2.3 - pilot-controller communication. *Flight Safety Digest, August-November*.

Gless, R. D. (1992). Communication creates essential bond to allow air traffic control system to function safely. *Flight Safety Foundation Accident Prevention, 49*(5).

IATA. (2004). *IATA position paper.* Paper presented at the International Civil Aviation Organization Aviation Language Symposium, Montreal.

ICAO. (2001). Annex 10 to the convention on International civil aviation: Aeronautical Telecommunications. *Volume II*, 1-3.

Kumar, B. (2004). *An illustrated dictionary of aviation*. New York: McGraw-Hill.

McShane, S. L., & Von Glinow, M. A. (2005). *Organizational behavior* (3rd ed.). New York: McGraw-Hill/Irwin.

NASA. (1981). *Information transfer problems in the aviation system* (NASA TP-1875). Washington, D.C.: NASA.

O'Keeffe, D. (2005). View from the tower. *Flight Safety Australia, January-February*, 36-37.

Orlady, H. W., & Orlady, L. M. (1999). *Human factors in multi-crew flight operations*. Aldershot: Ashgate Publishing Company.

Prinzo, O. V. (1996). *An analysis of approach control/pilot voice communications* (DOT/FAA/AM-96/26). Washington, D.C.: Federal Aviation Administration.

Prinzo, O. V., & Britton, T. W. (1993). *ATC/pilot voice communications - a survey of the literature*. Oklahoma: Federal Aviation Administration.

Rantanen, E. M., McCarley, J. S., & Xu, X. (2002). *The impact of communication delays on air traffic controllers' vectoring performance*. Paper presented at the 46th Annual Meeting of the Human Factors and Ergonomics Society, Santa Monica.

Subsecretaria de Aviacion Civil of Spain. (1978). *Part one of the spanish report*. Spain: Subsecretaria de Aviacion Civil.

The Macquarie Dictionary. (1997). *The Macquarie Dictionary* (3rd ed.). Macquarie University, NSW: The Macquarie Library Pty Ld.

Wilson, D. R. (1990). My own mouth shall condemn me. *Flight Safety Foundation Accident Prevention, 47*(6).

Wood, J., Wallace, J., Zeffane, R. M., Schermerhorn, J. R. J., Hunt, J. G., & Osborn, R. N. (1998). *Organisational behaviour: An Asia-Pacific perspective*. Milton, Queensland: Jacaranda Wiley Ltd.

Radiotelephony Readback Compliance and its Relationship to Surface Movement Control Frequency Congestion