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Cleared to Disconnect?
A Study of the Interaction between Airline Pilots and Line Maintenance Engineers

A thesis presented in partial fulfilment of the requirements for the degree of
Doctor of Philosophy in Aviation
at Massey University, Manawatū, New Zealand.

Tahlia Jane Fisher
2016
To those who fly aeroplanes
and those who maintain them
Abstract

Accurate information regarding the maintenance status of an aircraft is essential for safe and efficient airline operations, yet there is evidence to suggest that pilots and line maintenance engineers do not always communicate effectively with each other. To date the majority of this evidence has been anecdotal, and formal studies have focused primarily on the shortcomings of the aircraft logbook as a communication medium. Despite the notion that poor communication between these two groups can potentially have undesirable consequences, there has been little discussion about how this might manifest within an airline environment. The studies undertaken for this research examined three distinct aspects of the pilot-maintenance interface: 1) the intergroup relationship between airline pilots and line maintenance engineers, 2) operational radio communications between airline pilots and line maintenance engineers, and 3) the effects of deficient pilot-maintenance communication on aircraft operations and flight safety.

Thematically analysed discourse from a series of focus groups held at a large New Zealand airline, found that communication difficulties are primarily the result of an interrelating set of organisational, physical and psychosocial barriers, all of which influence the nature of the intergroup relationship between pilots and line maintenance engineers. The use of Interaction Process Analysis (IPA) to examine radio calls between pilots and maintenance personnel identified that while the two groups share similar communication patterns and styles, indications of these barriers were present within their communication exchanges. The effects of deficient communication were then examined using data from the United States Aviation Safety Reporting System (ASRS). Using Correspondence Analysis (CA) to map associations between deficient pilot-maintenance communication and adverse outcomes, evidence was found that poor communication can be associated with both schedule disruptions and potential safety ramifications.

Ultimately, this research has important implications for airlines, particularly given the degree to which organisational factors can influence the efficacy of communication between these two groups. In light of the findings which suggest that problematic interactions between pilots and maintenance personnel can have both commercial implications and pose a threat to flight safety, it is recommended that airlines give consideration to facilitating joint Crew Resource Management (CRM) training for these two groups.
Acknowledgements

I would firstly like to thank my supervisors Dr Ross St George, Dr Ritchie de Montalk and Dr Richard Batt. Conducting a PhD in a part-time capacity has its fair share of challenges so thank you for your continual guidance, expertise and, in particular, your patience (Ross!) with this project, especially when I had to press pause not once, but twice to have children. Juggling research, fulltime work and two small boys was no mean feat but you never lost faith in me and provided me with steady encouragement and reassurance throughout. A special thanks must be made to you Richard. When I told you about my idea for this research having only just met, you could have simply wished me good luck. Instead you offered your time, knowledge, and wonderfully considered feedback, all from afar, whilst busy with your own work and family commitments. Thank you for that.

I wish to acknowledge the New Zealand division of the Royal Aeronautical Society, the New Zealand Aeronautical Trusts and in particular the family of Ian Diamond who so generously honour Ian’s longstanding commitment to aviation engineering with the Ian Diamond Memorial Scholarship to which I was the inaugural recipient.

Thank you to all those pilots and engineers who took part in my research. I am especially grateful to the Chief Pilot who facilitated the participant airline’s sponsorship of this research as well as access to the personnel and data required for two of my three studies.

I am immensely indebted to my manager, Alan, who not only allowed me the time I needed to complete this work, but who has always continued to ensure that the well-being of my family and I come first and foremost. A special thanks must also go to Murray – your insights into the world of aviation maintenance provided me with the humourous motivation I needed at times.

Of course a big thank you must be made to all my family who have continually supported me in this lengthy journey. I could not have done this without your help, particularly once the boys arrived halfway through. Thank you for the countless hours of babysitting you undertook to facilitate my study. To my parents, I can only say that the fact I signed up to an undertaking as daunting as a PhD is a reflection of the continual encouragement I received throughout my childhood that I could do anything I set my mind to.

Finally, I must express my immeasurable gratitude to my husband Andrew who more than anyone understands the magnitude of this venture and the demands it has made on our family life. While undertaken with the best of intentions, the pursuit of knowledge is mercenary with time. For all those days I missed with you and the boys because of study – time that can never be reclaimed - I thank you for being so forgiving.
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Glossary of Aviation Terms

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<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>AAIB</td>
<td>Air Accidents Investigation Branch (UK)</td>
</tr>
<tr>
<td>ACARS</td>
<td>Aircraft Communication Addressing and Reporting System</td>
</tr>
<tr>
<td>AME</td>
<td>Aircraft Maintenance Engineer</td>
</tr>
<tr>
<td>AMEL</td>
<td>Aircraft Maintenance Engineer Licence</td>
</tr>
<tr>
<td>AMT</td>
<td>Aircraft Maintenance Technician</td>
</tr>
<tr>
<td>AOA</td>
<td>Angle of Attack</td>
</tr>
<tr>
<td>AOG</td>
<td>Aircraft on Ground (‘grounded’ due to a defect)</td>
</tr>
<tr>
<td>AQP</td>
<td>Advanced Qualification Program</td>
</tr>
<tr>
<td>ASRS</td>
<td>Aviation Safety Reporting System</td>
</tr>
<tr>
<td>ATC</td>
<td>Air Traffic Control</td>
</tr>
<tr>
<td>ATPL</td>
<td>Air Transport Pilot Licence</td>
</tr>
<tr>
<td>ATSB</td>
<td>Australian Transport Safety Bureau</td>
</tr>
<tr>
<td>BASI</td>
<td>Bureau of Air Safety Investigation (Australia)</td>
</tr>
<tr>
<td>CAA</td>
<td>Civil Aviation Authority (UK)</td>
</tr>
<tr>
<td>CAANZ</td>
<td>Civil Aviation Authority of New Zealand</td>
</tr>
<tr>
<td>CAR</td>
<td>Civil Aviation Rules (NZ)</td>
</tr>
<tr>
<td>CASA</td>
<td>Civil Aviation Safety Authority (Australia)</td>
</tr>
<tr>
<td>CRM</td>
<td>Crew Resource Management</td>
</tr>
<tr>
<td>DDG</td>
<td>Dispatch Deviation Guide</td>
</tr>
<tr>
<td>EGPWS</td>
<td>Enhanced Ground Proximity Warning System</td>
</tr>
<tr>
<td>EGT</td>
<td>Exhaust Gas Temperature</td>
</tr>
<tr>
<td>FAA</td>
<td>Federal Aviation Authority (United States)</td>
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<tr>
<td>FO</td>
<td>First Officer</td>
</tr>
<tr>
<td>FOD</td>
<td>Foreign Object Damage</td>
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<tr>
<td>GPWS</td>
<td>Ground Proximity Warning System</td>
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<tr>
<td>HF</td>
<td>High Frequency</td>
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<tr>
<td>ICAO</td>
<td>International Civil Aviation Organization</td>
</tr>
<tr>
<td>IDG</td>
<td>Integrated Drive Generator</td>
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<tr>
<td>LAME</td>
<td>Licensed Aircraft Maintenance Engineer</td>
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<td>MEL</td>
<td>Minimum Equipment List</td>
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<tr>
<td>MHz</td>
<td>Mega Hertz</td>
</tr>
<tr>
<td>MOC</td>
<td>Maintenance Operations Control / Maintenance Operations Centre</td>
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<td>MRM</td>
<td>Maintenance Resource Management</td>
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<tr>
<td>NATS</td>
<td>National Air Traffic Services (UK)</td>
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<td>NIGS</td>
<td>Nose-In Guidance System</td>
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<tr>
<td>NTS</td>
<td>Non-Technical Skills</td>
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<tr>
<td>NTSB</td>
<td>National Transportation Safety Board (US)</td>
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<tr>
<td>OTP</td>
<td>On-Time Performance</td>
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<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
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<tr>
<td>PF</td>
<td>Pilot Flying</td>
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<tr>
<td>PM</td>
<td>Pilot Monitoring</td>
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<td>PIC</td>
<td>Pilot in Command</td>
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<tr>
<td>QRH</td>
<td>Quick Reference Handbook</td>
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<tr>
<td>RTF</td>
<td>Radio Telephony</td>
</tr>
<tr>
<td>SatPhone</td>
<td>Satellite Phone</td>
</tr>
<tr>
<td>TAG</td>
<td>Trans-cockpit Authority Gradient</td>
</tr>
<tr>
<td>TAT</td>
<td>Total Air Temperature</td>
</tr>
<tr>
<td>VHF</td>
<td>Very High Frequency</td>
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