Team Error in Air Traffic Control:

recognition, detection and recovery.

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A thesis submitted for the degree of
Master of Ergonomics
at Massey University
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New Zealand

June 2002

Acknowledgements

No work of this nature is a solo effort. There are many people who have been willing to share their ideas and time in order for these studies to be a success. Firstly my discussions and continued debate with Steve Shorrock, Mike O'Leary, James Reason and Rene Amalberti have been excellent in the development of my thinking. However without the support and encouragement of the air traffic controllers this work would never have been possible. For this I would like to thank my ATC friends in Australia and New Zealand, the controllers from Dutch Mil., Greg Hindson and all those who were such a vital technical support in the simulation studies.

I would also like to acknowledge the help given by the members of the Safety Group at ATC, the Netherlands, who when heavily involved in their own incident investigations were always happy to help me out in my work.

Thanks also to Pink, Emily and Floyd who after waiting so patiently may now be able to have some attention. However the biggest thanks goes to my husband, who gave me the space and support to pursue this work, the encouragement that I was doing something valuable but more importantly, as a controller, was my greatest critic.

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ABSTRACT

'Accidents appear to be the result of highly complex coincidences which could rarely be foreseen by those involved ... accidents do not occur because people gamble and lose, they occur because people do not believe that the accident that is about to occur, is at all possible.'

Wagenaar and Groeneweg (1987)

The air traffic management system is considered a high reliability, low risk activity. It is also seen as inherently safe despite the tightly coupled nature of the activities involved. Tightly coupled systems are characterised by time-dependant processes in which planned and unplanned interactions occur quickly and are also associated with the co-ordination of activities which must occur in a pre-defined sequence adhering to a set of strict rules and procedures. They are also very precise and vulnerable to unexpected events in which the activities must be undertaken correctly or not at all. All these characteristics can be found in the air traffic management (ATM) system and in particular in their 'team related' activities. In these systems there is little opportunity to improvise when things go wrong, and recovery is very time dependant.

However there is almost no existing information about the types of error found in the ATM system and the recognition, detection and recovery from the errors made. Therefore in order to obtain information to better understand these issues, three distinct but complimentary studies were undertaken.

In the first study a technique to identify both the cognitive and contextual factors of erroneous behaviour was developed. Several incidents were analysed using this technique, revealing that planning and decision making was the most problematic cognitive area and team difficulties accounted for the majority of the contextual conditions associated with the errors.

Results also indicated the importance of the relationship of all the members of the air traffic management team – including pilots – and their role in the detection, recovery and management of the situation. This resulted in the development of a new technique – *the Joint Error Detection of Incidents – JEDI* – to be used in the exploration of the chronology of occurrences.

In the second study controllers were questioned with regard to their attitudes towards error, safety and teamwork. Findings from this work suggested the majority of controllers were

aware of the team interaction issues, but were more concerned with their relationship with other teams, particularly in emergencies and unusual situations.

In the third, a study was undertaken to record the erroneous activities and outstanding events during ATM simulation sessions. The results of these activities revealed that rather than controllers making errors, they were able, in the majority of the cases, to assess the outstanding event in relation to their professional knowledge and experience. These events have been termed *'Expert Judgement Deviations'* and consist of behaviour which enable the system to continue in its tightly coupled structure. This study was also able to determine the differences between errors and violations and again indicated that errors were mostly attributable to failures in planning and decision making. This study also highlighted the importance of team issues but demonstrated that the team, as defined in the literature, was probably not a suitable concept in such an environment. From the insights gained in this research it was argued that, although the team was an important concept, the separation of aircraft undertaken by controllers was an individual activity. However it was also realised that without the co-operation and co-ordination between controllers the overall goals of safety would be compromised. Therefore the term *'dynamic sets'* was introduced and used to describe the majority of the controllers work in the Air Traffic Management system.

PREFACE

The initial focus for this work evolved from two major European air traffic management projects under the auspices of the Eurocontrol EATCHIP and EATMP programmes. Within these projects I was the technical manager and leading research scientist. However despite their ground breaking work within the air traffic management system; Team Resource Management is now used throughout Europe, in Australia and Japan and the Human Error in ATM retrospective approach is used throughout Europe and the United States of America, there has been no effort to include the team and group dynamics within human error recognition, detection and recovery. It is for this reason that these issues are now tackled within this thesis. Initially the issues with regard to the present and future air traffic management system are discussed and the problems of changing systems, including new technology and procedures, are explored. This leads to the observation that the 'team' within this environment has never had a more important role in terms of the errors which are generated, and more importantly those errors which are recognised and managed. A detailed exploration of the team and the role it plays within the air traffic control environment reveals

there exists a well developed ability to deviate from accepted practice and that the team is capable of not only exacerbating critical events but also recovering from these potential threats to safety.

As a result of the earlier phases of this work the following articles have been either published or accepted for publication. The first two papers relate to the early developments regarding the human error identification within air traffic management incident analysis. The third refers to the work undertaken in the analyses of air traffic incidents and the last is associated with the work undertaken in the simulated air traffic control environment.

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