Using a Naturalistic Flying Study to Derive a Taxonomy of Metrics to Measure Safe Flying Performance in Student Pilots

Murray Terwey\textsuperscript{a}, Carlo Caponecchia\textsuperscript{b}, Michael Regan\textsuperscript{c}

\textsuperscript{a}UNSW School of Aviation, Kensington, New South Wales, AUSTRALIA; \textsuperscript{b}UNSW School of Aviation, Kensington, New South Wales, AUSTRALIA, \textsuperscript{c}ARRB Group, Sydney, New South Wales, AUSTRALIA

1. Introduction

It has been found that the accident rate for general aviation (GA) in the US is 40 times higher than that of the regular public transport (RPT) sector of the aviation industry, with most accidents being a repeat of previous accidents (NTSB, 2014). In order to keep the GA sector affordable costs have been kept as low as practicable with virtually every aspect of the regulatory regime legislated below the requirements of the RPT sector. This is no more so than in the air work (AWK) category of GA where training aircraft operate. However, in recent years, technology has developed to the point where Flight Data Recording equipment (FDR) which was only ever affordable in the heavier more expensive aircraft can now be fitted in light GA aircraft. This makes it possible to understand for the first time how GA pilots perform during different phases and conditions of flight and the factors that enhance and compromise flight safety.

2. Previous studies of safe flying performance

Steckel and Patankar in 2012 conducted a study into the viability of conducting Line Operations Safety Audits (LOSA) in light training aircraft using an Appareo GAU2000 FDM and a Chase-cam video camera recorder. LOSA is used by many airlines, and employs a framework known as Threat and Error Management (TEM). LOSA was originally designed to use a human observer that would ride in the cockpit and record the threats that were encountered, the errors that were committed and how both of these were managed or not managed by the crew leading to an undesirable aircraft state (Klinect, 2005). Klinect found, however, that one of the greatest problems with accurate data collection using this method was observation reactivity or the Hawthorne effect, where the crew being observed act differently when being observed than when operating in a more natural environment (Kumar, 2014). Additionally Steckel & Patankar (2012) pointed out that it is not always possible or desirable, in a light aircraft, to have a human observer in the cockpit. This was where the FDM equipment was used and found to be feasible in the application of LOSA.

3. Naturalistic Flying Studies

Naturalistic flying studies, similar to those already conducted in driving, are a progression from the pilot study of Steckel and Patankar (2012), using FDM equipment to monitor flying performance in real time, and potentially over a long duration (Smith, 1982). Naturalistic studies have several benefits in transport studies, including that they can

• Determine the frequency and duration of exposure to risks
• Quantify changes in risk
• Identify the causal and contributing factors to safety critical incidents
• Aid crash Investigation.
• Obtain normative data on fundamental pilot behaviour and performance
• Better understand violations
• Validate findings from surveys, observational studies, simulator studies and crashes
• Enable the evaluation of countermeasures (Regan et al., 2013).

The first step in developing a naturalistic flying study is to develop a taxonomy of the safe flying behaviours that need to be measured to inform various future research questions. This paper will describe the development and preliminary validation of the taxonomy that will specify the metrics of safe flying to determine the level of safe flying performance of student pilots when applying the cognitive, technical, communication and interpersonal skills that must be combined when operating a GA aircraft safely in a
natural environment. This will later be used to organise data collected from FDM equipment (Appareo Vision 1000 and Garmin systems) used at the School of Aviation UNSW.

4. Method

The first stage is to derive the taxonomy through the completion an extensive review of literature in this area. This began with an examination of the competency standards set to determine the safe operation of aircraft at all levels form ab-initio up to air transport pilot (ATP) level. Particular attention was paid to the Australian Civil Aviation Authority’s (CASA) Day/VFR syllabus and the new CASR part 61 regulatory suite which was introduced mid-2014. Techniques that are used to measure pilot performance such as LOSA, transference of learning studies, the National Intercollegiate Flying Association (NIFA) scoring system and hazardous attitude questionnaire techniques were also examined. The resulting list of hundreds of indicators represents the combined number of indicators that are being used to measure pilot performance. The next stage of creating the taxonomy is to reduce the number of indicators down to those that represent indicators of safe flying performance. This is to be done through consultation with industry subject matter experts (such as instructors). The next phase is to determine which of these can be either directly measured or derived using FDM equipment that will be fitted to aircraft.

5. Results

Results will be discussed in terms of the contents of the taxonomy following the original development phases and refinement with subject matter experts, and examples of the metrics developed with the FDM equipment.

6. Discussion

The outcome of this study is to produce a taxonomy that will allow the interpretation of data collected from naturalistic conditions. A tool for organising and assisting in the analysis of the rich data provided through flight data monitoring is a crucial first step in improved ongoing measurement of pilot performance in GA.

References


