Pilot Perception and Confidence of Location During a Simulated Helicopter Navigation Task

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OVERLAND VISUAL navigation at low altitudes, which we define as flight at or below 200 ft (~61 m) above ground level (AGL) is an increasingly important task for rotary wing aviators. Surprisingly, the factors that determine success in low level navigation are not well understood. Our research seeks to further the study of aviation by quantitatively studying pilot performance in a controlled experimental environment.

Airborne navigation—the act of understanding where the aircraft is and which direction it should travel next—is important both for mission accomplishment and hazard avoidance. If the aircraft is not where it is supposed to be, it cannot accomplish its mission. Hazard avoidance encompasses both point hazards, such as power lines, and area hazards, such as active ranges. Military settings include hazards of enemy action, which may be of either type. At higher altitude, navigation may be performed by various means including: dead reckoning, visual navigation, radio aids to navigation, global positioning system (GPS), and inertial navigation systems. GPS and inertial navigation systems are frequently combined, and are referred to as hybrid navigation or simply G/INS. A summary of several common methods follows; for details, see Eschenbach and Stanski-Pacis and de Voogt (6,10). Adam et al. (1) address issues arising around the usability and potential pitfalls with current cockpit GPS systems and Casner (2) discusses training requirements for GPS usage.

The low-level navigation environment is different from navigation at altitude for several reasons. Radio aids to navigation may be unreliable. This increases the relative importance of other methods, particularly visual navigation. Visual navigation also is of increased importance at low altitudes for hazard avoidance. Although training is a part of all navigation tasks, it is most critical for visual navigation. A look at the Naval Safety Center’s statistics page (8) points to the importance and risk of helicopter overland navigation. For example, on 21 December 2011, an MH-60S struck trees and crashed in an open area during a day mountain flight.

Crew coordination at low altitudes requires division of duties between the flying pilot, who we will henceforth refer to as the ‘pilot at the controls’ (PAC) and the nonflying pilot, who we henceforth refer to as the ‘pilot not at controls’ (PNAC). The PAC is typically responsible for the tasks required to safely pilot the aircraft and for critical responses during emergencies. The PNAC is responsible for communication, planning, and navigation. Both pilots are responsible for the identification and avoidance of obstacles, as appropriate. We are reminded in the work of de Voogt et al. (5) that the notion of ‘crew’ frequently includes those who are not physically present in the aircraft, including other aircraft in a formation, controllers, and ground crews.

Broadly speaking, a pilot may be on-course or off-course, and he may perceive himself to be on-course or off-course. Sullivan (11) summarizes this, as does Table I.

Table I

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From the Naval Postgraduate School, Monterey, CA.

This manuscript was accepted for review in July 2012. It was accepted for publication in March 2013.

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DOI: 10.3357/ASEM.3505.2013