

Overview of DSTO Rotary Wing Flight Modelling Activities in Support of the Australian Defence Force

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Abstract: The Defence Science and Technology Organisation (DSTO) within Australia's Department of Defence is an organisation devoted to applying science and technology to protect and defend Australia and its national interests. It delivers expert, impartial advice and innovative solutions for Defence and other elements of national security.

This paper outlines the activities of the Rotary Wing Operations (RWO) area within DSTO in support of the Australian Defence Force (ADF).

The RWO area is dedicated to helicopter flight modelling and is responsible for the development, provision, verification and maintenance of a range of rotary winged aircraft performance and flight behaviour models both manned and unmanned. These models are used to support accident investigation, human-in-the-loop (HIL) simulation, and operations research activities carried out within DSTO. The RWO area also provides advice and support to ADF rotary wing aviation.

This paper outlines the current and future work activities from the RWO area. This work can be divided into several broad sections as follows

- **Chinook and slung load dynamic simulation.** This is one of RWO's key areas of research. It involves developing a comprehensive simulation program to assist in defining the operational limits of various Australian Army helicopters when carrying slung loads. At present, the focus is on the Chinook carrying various external slung loads, however, the method can be extended to other helicopter/load combinations.
- **Helicopter incident/accident investigation and risk reduction.** This area is led by the Air Vehicles Division (AVD) of DSTO and RWO provides on-going support to AVD and the Directorate of Defence Aviation and Air Force Safety (DDAAFS), to understand events and conditions leading up to rotary wing accidents, through flight modeling and simulation, as well as providing accident reconstruction. Work also covers improvements in flight modelling capability to allow more accurate investigation of 'severe manoeuvres' that might lead to accidents.
- **Alternative helicopter-ship operating limit methodologies.** The RWO area has been investigating various alternative methodologies that claim to expand the operating limits and improve safety when compared to the current Royal Australian Navy (RAN) practice.
- **Helicopter performance standards.** In recent years the RWO area has begun to investigate the possibility of adapting the current helicopter aeronautical design standard (ADS-33) to the maritime environment.
- **Helicopter on-deck simulation.** For a number of years, the RWO area has been engaged with the issue of helicopters on ship decks, whether restrained for transit or unrestrained prior to take-off. In doing so the RWO areas has developed a Helicopter-ship on-deck dynamic simulation model, which has been used successfully by the RAN to estimate ship motion limits for helicopter on-deck operations.
- **Ship airwake modelling.** The RWO area began working in this area when developing Computational Fluid Dynamic (CFD) models of a simplified frigate as part of an international collaboration program with other research organisations. The RWO area has since used this expertise to perform numerous related analyses.

Keywords: *Helicopter, Helicopter Flight Models, Slung Loads, Helicopter-ship interface, Computational Fluid Dynamics (CFD), Accident Investigation, Flight Dynamic Modelling*

Abstract only