

## AN INVESTIGATION OF HAND-HELD PEN-BASED COMPUTING FOR COMBAT SOLDIERS

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**Abstract.** This paper describes the design and evaluation of a mobile computer system that has the potential to support the Australian Army's dismounted infantry command and control functions. Whilst commercial systems have made significant improvements in hardware, it has been observed that current software has not been designed to cater specifically to Australian Army needs. The work described in this paper represents the first step in identifying user and system requirements for this application. A concept demonstrator of the hand-held computer (based on the Apple Newton 2000) was prepared for use during a field exercise in February 1998. The objectives of the study were to identify requirements of the hand-held computer as well as to investigate the methodology for evaluation of such systems. User feedback from the 1998 study is discussed as well as the future directions for this work. This includes the transfer of knowledge to a Windows CE based computer and the planned use of this system in the investigation of human performance and computer interaction issues.

### INTRODUCTION

Australia's program in soldier modernisation, Project WUNDURRA, was initiated in late 1993. At that time an enabling program of research was instigated by the Land Operations Division of the Defence Science and Technology Organisation (DSTO) in order to provide the necessary scientific support. Project WUNDURRA relates to the evolutionary process of soldier modernisation through the incorporation of appropriate technologies and the adoption of improved procedures. A major theme to this research is the principle of the Soldier Combat System (SCS) that is a part of larger systems ranging from the section to the company level.

In October 1995, Australia initiated a series of evaluation studies with the primary aim of establishing a robust methodology for evaluation of SCS enhancements. The methodology, referred to as the 'battlelab' methodology, involves a combination of modelling and field studies [1]. The studies compared baseline and enhanced sections engaged in a variety of operational situations. An infantry section is comprised of nine soldiers and is commanded by a non-commissioned officer (NCO), usually a corporal. The infantry section has been identified as the smallest discrete unit for analysis. During the studies the baseline sections were equipped with current equipment whilst enhanced sections were provided with a variety of technological enhancements including thermal weapon sights, hand-held computers and intra-section communications.

During the field component of early studies the potential of hand-held computers to enhance the capability of an infantry section was identified [2,3]. This impact would be realised not only through enhancing the direct actions of the section, but also through improving the degree of cooperation between the section and adjacent units. However, potential improvements were not realised during these trials, due to the immature nature of the system employed. This was evident in several key features. First, the system was not intuitive, given the soldiers' previous experience and training. Second, the system could not operate at night without excessive illumination, this being a threat to section security. Third, soldiers using the system considered the weight and power requirements excessive. Unlike headquarters at battalion and above that have access to relatively controlled environments in which to operate (command post or vehicle), section and

platoon commanders are required to carry any command-support equipment used. This equipment would be required to operate in all weather conditions from hot/humid to cold/wet, during both day and night. A fourth issue was the lack of suitable mechanisms for recording user interactions with the system for evaluation purposes.

The current schedule for Project WUNDURRA<sup>1</sup> has a planned acquisition phase post-2005. It has been assumed that within this time frame commercial portable computing systems will solve many of the hardware-related problems identified in early studies. Hence the focus of the current research is on identifying the functional requirements and user interfaces for this system. The vehicle for this research is a concept demonstrator based on commercial hand-held computing devices and other components.

This paper outlines the design and implementation of a concept demonstrator of a hand-held computer for combat soldiers. It then presents the results of an observational study carried out to evaluate the effectiveness of this system. The results are then discussed in terms of future enhancements.

### ENHANCING SCS PERFORMANCE

Initial work on Project WUNDURRA provided a framework for analysis of the system, based on the observation of a series of eleven generic infantry section and platoon activities and eight core skills [4]. During field studies and other analytical work this framework has proved useful in analysing the impact of new technologies and procedures on small unit capabilities. An initial hypothesis that new technologies have a direct impact on the application of core skills has been confirmed during these studies. An initial analysis of the benefits of any new technology can be investigated by considering its impact on the core skills. The potential impact of a hand-held computer on infantry core skills and associated functionality are outlined in Table 1.

As described previously the infantry section is the smallest tactical unit on the battlefield. An infantry platoon comprises three sections plus a headquarters; a company comprises three platoons; and a battalion has a strength of between three and four companies. While this structure in which the section operates may change, and in fact the composition of a section itself may change over time, the basic tasks of an

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<sup>1</sup> An aboriginal word meaning 'warrior'.