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Further Advances in the Development of a Personalised Respirator Face Seal

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ABSTRACT

The respirator developer is continually seeking technologies that will lead to improved levels of protection. Additional constraints are placed upon the military designer, as stringent restrictions are imposed with regard to the weight and bulk of equipment, power requirements and logistical burden. In pursuing improved protection, the human face remains the largest variable. Consequently, military respirators are constructed in a number of sizes to accommodate the maximum number of personnel. The very nature of a sizing policy results in a diverse distribution of respirator fit being displayed across the user population. An obvious means to improve the level of protection afforded is to increase the number of respirator sizes available and ultimately, to tailor the respirator face seal to the individual. Importantly, this approach imposes no additional burden on the military operator in the field.

Recent advances in 3-Dimensional scanning equipment, CAD software and rapid prototyping techniques have made the concept of a personalised seal achievable. In a pilot study conducted at Dstl Porton Down, a personalised respirator face seal was constructed and evaluated. For those exercises that are shown to place stress on the seal, a 70% improvement in protection was demonstrated. Notably, the subject in question lay towards the centre of the fit distribution. The process employed however was labour intensive, requiring the seal form to be manipulated within the CAD environment. A subsequent programme of work has been funded by the UK MoD with the aim of making the approach economically viable. Aspects of the programme are described, amongst which include, (i) the 3-Dimensional face scanning process, (ii) determining the optimum sealing locus and (iii) the development of algorithms to determine the optimum seal.