

The Development of an Advanced Respirator Test System (ARTS) for the Evaluation of Respirator Performance within the UK Armed Forces

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Respirator fit within the UK Armed Forces is currently assessed using the Respirator Test System (RTS). This comprises a CNC device (PortaCount[®] model 8020, TSI), an Aerosol Containment Facility (ACF) and a laptop PC incorporating dedicated software. Although capable of evaluating the current in-service equipment, the continued improvement of respirator technology, combined with the desire to improve the resolution and accuracy of the measurement technique has prompted the development of the Advanced Respirator Test System (ARTS).

Although capable of single particle detection, the resolving power of the current RTS instrumentation is limited by two factors. These are, (i) the inability of the CNC to resolve elevated aerosol concentrations due to coincidence counting effects and (ii) the error incurred by the generation of aerosol particles within the respirator. The latter is a consequence of the inability of light-scattering detection systems to discriminate between particles entering the respirator volume via respirator leak paths from those naturally generated within the internal volume (i.e. the in-mask generated fraction).

One possible means of overcoming these limitations is through increasing the dynamic range of the CNC device. By successfully achieving this, the impact of the in-mask generated fraction may be nullified and the challenge concentration increased to a level that enables high levels of protection to be resolved.

Given this, Dstl has developed a self-calibrating dilution system that is inserted upstream of the challenge sampling port. In calibration mode, the system employs the CNC to determine the precise level of dilution, which is subsequently adopted to assess the challenge concentration when configured in the measurement mode of operation.

The complete system comprises, a self-calibrating dilution unit, a commercial aerosol generator, and dedicated control software. The underlying principles of the dilution arrangement and the development of the ARTS technology are described.