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RTO TECHNICAL REPORT (PART I)

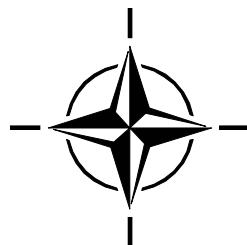
TR-HFM-121-Part-I

Virtual Environments for Intuitive Human-System Interaction

(Environnements virtuels d'interaction
Homme-Système Intuitive)

National Research Activities in Augmented,
Mixed and Virtual Environments

This is a Compendium to the Final Report (TR-HFM-121-Part-II).



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The Research and Technology Organisation (RTO) of NATO

RTO is the single focus in NATO for Defence Research and Technology activities. Its mission is to conduct and promote co-operative research and information exchange. The objective is to support the development and effective use of national defence research and technology and to meet the military needs of the Alliance, to maintain a technological lead, and to provide advice to NATO and national decision makers. The RTO performs its mission with the support of an extensive network of national experts. It also ensures effective co-ordination with other NATO bodies involved in R&T activities.

RTO reports both to the Military Committee of NATO and to the Conference of National Armament Directors. It comprises a Research and Technology Board (RTB) as the highest level of national representation and the Research and Technology Agency (RTA), a dedicated staff with its headquarters in Neuilly, near Paris, France. In order to facilitate contacts with the military users and other NATO activities, a small part of the RTA staff is located in NATO Headquarters in Brussels. The Brussels staff also co-ordinates RTO's co-operation with nations in Middle and Eastern Europe, to which RTO attaches particular importance especially as working together in the field of research is one of the more promising areas of co-operation.

The total spectrum of R&T activities is covered by the following 7 bodies:

- AVT Applied Vehicle Technology Panel
- HFM Human Factors and Medicine Panel
- IST Information Systems Technology Panel
- NMSG NATO Modelling and Simulation Group
- SAS Studies, Analysis and Simulation Panel
- SCI Systems Concepts and Integration Panel
- SET Sensors and Electronics Technology Panel

These bodies are made up of national representatives as well as generally recognised 'world class' scientists. They also provide a communication link to military users and other NATO bodies. RTO's scientific and technological work is carried out by Technical Teams, created for specific activities and with a specific duration. Such Technical Teams can organise workshops, symposia, field trials, lecture series and training courses. An important function of these Technical Teams is to ensure the continuity of the expert networks.

RTO builds upon earlier co-operation in defence research and technology as set-up under the Advisory Group for Aerospace Research and Development (AGARD) and the Defence Research Group (DRG). AGARD and the DRG share common roots in that they were both established at the initiative of Dr Theodore von Kármán, a leading aerospace scientist, who early on recognised the importance of scientific support for the Allied Armed Forces. RTO is capitalising on these common roots in order to provide the Alliance and the NATO nations with a strong scientific and technological basis that will guarantee a solid base for the future.

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Virtual Environments for Intuitive Human-System Interaction

(RTO-TR-HFM-121-Part-I)

**National Research Activities in Augmented,
Mixed and Virtual Environments**

Executive Summary

The missions that NATO is being called on to perform today place new performance requirements on military personnel driving a need for new approaches to training and equipment design. New computer technologies have the potential to prepare militaries for their new missions. During these missions, military operators will have to interact with highly complex C4ISR (Command, Control, Communications, Computer, Intelligence, Surveillance, Reconnaissance) systems and weapon system designs under high physical, mental, and emotional workload. Preparation for these challenges has to include both: Training military commanders, staffs and operators by means of appropriate media and designing equipment to include well thought out human-system interaction (HSI) that takes advantage of advances in technology and reduces operator workload and training requirements.

Augmented, Mixed, and Virtual Environments (AMVE) are new paradigms and media that provide a realistic training environment and a natural HSI using complex realistic or abstract synthetic environments. They allow trainees and human operators to experience synthetic environment that are appropriate for the tasks to be performed. Ideally, military personnel should be presented the same cues in the synthetic world that they would experience in the real world. They should be able to interact with synthetic entities as if they were real. In recent years AMVE-technologies have expanded from their original application as training media to a broad spectrum of military applications.

This report provides an overview of AMVE research and development activities in the participating nations. The military application of these technologies was found in training, teleoperation, operational mission support and command & control. Training encompasses vehicle operation training, individual skills and collective tactical training, and command and control training. Teleoperation refers to the remote control of unmanned vehicles. It also includes telemedicine, i.e. remote diagnostics and surgery. Operational mission support consists of new technologies for supporting the dismounted soldier or infantryman in his operational mission. Finally, in command & control, AMVE-technology is applied to visualize tactical situation data and geographic data in a realistic way.

Although AMVE is a research topic, there have been successful implementations of the technologies. Early on it became clear that AMVE was too large a field to include civil applications as well as military ones. Consequently, this report is limited to military institutions, companies or lead projects in the defence sector only. Even still more than 100 different activities and their interrelationships are described in detail making this report a source of information for interested persons, researchers and managers in this field.

Environnements virtuels d'interaction Homme-Système Intuitive

(RTO-TR-HFM-121-Part-I)

Activités nationales de recherche dans des environnements augmentes, mixtes et virtuels

Synthèse

Les missions confiées à l'OTAN à l'heure actuelle imposent de nouvelles contraintes de performances aux personnels militaires, qui génèrent le besoin de nouvelles méthodes de formation et de conception des équipements. Les nouvelles technologies informatiques offrent le potentiel nécessaire en vue de préparer les militaires à leurs nouvelles missions. Au cours de ces missions, les opérateurs militaires devront interagir avec des systèmes C4ISR (Commandement, Contrôle, Communications, Informatique, Renseignement, Surveillance, Reconnaissance) et des systèmes d'armes extrêmement complexes tout en assumant une charge physique, mentale et émotionnelle élevée. La préparation à ces défis doit s'appliquer : à la formation des commandants militaires, des personnels et des opérateurs au moyen de supports adaptés et à la conception des équipements pour y inclure une interaction homme-système (IHS) bien pensée, tirant parti des avancées technologiques et réduisant la charge de travail des opérateurs et les contraintes de formation.

Les environnements augmentés, mixtes et virtuels (AMVE) constituent les nouveaux paradigmes et supports offrant un environnement de formation réaliste et une IHS naturelle utilisant des environnements réalistes ou synthétiques abstraits. Ils permettent aux stagiaires et aux opérateurs humains d'expérimenter des environnements synthétiques correspondant aux tâches à réaliser. Idéalement, les personnels militaires doivent obtenir dans l'univers synthétique les mêmes indications que celles rencontrées dans le monde réel. Ils doivent pouvoir interagir avec les entités synthétiques exactement comme dans la réalité. Ces dernières années, les technologies AMVE ont évolué de leurs applications initiales en tant que supports de formation vers un large spectre d'applications militaires.

Ce compte rendu donne un aperçu des activités de recherche et de développement AMVE au sein des nations participantes. Une application militaire de ces technologies s'est révélé dans les domaines de la formation, de la télé-exploitation, du soutien en mission opérationnelle et du commandement et contrôle. La formation recouvre la formation à l'exploitation véhicule, la formation individuelle et collective aux compétences tactiques, ainsi que la formation au commandement et au contrôle. La télé-exploitation concerne la commande à distance des véhicules sans pilote. Elle recouvre également la médecine, c'est-à-dire télédiagnostic et chirurgie. Le soutien en mission opérationnelle recouvre les nouvelles technologies de soutien au combattant ou au fantassin débarqué durant sa mission opérationnelle. Enfin, dans le domaine du commandement et contrôle, la technologie AMVE est utilisée pour visualiser les données de situation tactique et les données géographiques de manière réaliste.

Bien que l'AMVE soit un sujet de recherche, il existe des mises en œuvre réussies de ces technologies. Il est apparu assez tôt que l'AMVE était un domaine trop vaste pour inclure à la fois les applications civiles et militaires. C'est pourquoi ce compte rendu se limite aux institutions militaires, aux sociétés ou aux grands projets du secteur de la défense uniquement. Même dans ces conditions, plus de 100 domaines différents ainsi que leurs interactions sont décrits en détail, ce qui fait de ce compte rendu une source d'informations pour les personnes, les chercheurs et les gestionnaires concernés par ce domaine.

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