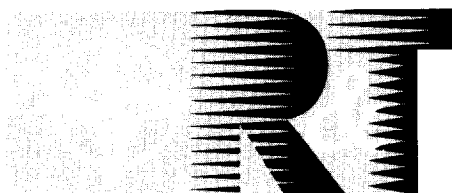


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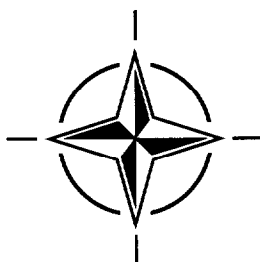
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Collaborative Crew Performance in Complex Operational Systems

(l'Efficacité du travail en équipage dans des systèmes
opérationnels complexes)

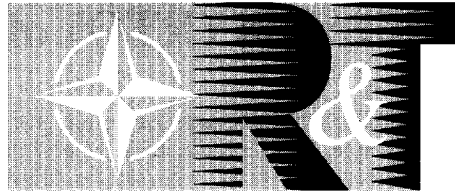
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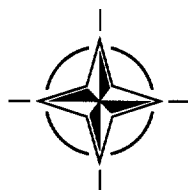
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RTO is the single focus in NATO for Defence Research and Technology activities. Its mission is to conduct and promote cooperative research and information exchange. The objective is to support the development and effective use of national defence research 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 coordination with other NATO bodies involved in R&T activities.

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The total spectrum of R&T activities is covered by 6 Panels, dealing with:

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- SCI Systems Concepts and Integration
- SET Sensors and Electronics Technology
- IST Information Systems Technology
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Collaborative Crew Performance in Complex Operational Systems

(RTO MP-4)

Executive Summary

The first symposium of the Human Factors and Medical Panel of the Research and Technology Organization (RTO) focused on the theme *collaborative crew performance in complex operational systems*. This theme denotes two primary trends that are applicable to systems research, design, and engineering: a) collaboration and b) complexity. As new systems are planned and fielded in the next millennium, collaborative crew performance in complex operations will need to be addressed in effective ways to enable successful missions. This symposium's goal has been to identify the multi-dimensional problems and challenges that scientists and engineers encounter as they consider crews in complex systems; and then take a global look at innovative solutions. The problems, challenges, and solutions generated span across many countries; represent a plethora of philosophies, theories, frameworks, approaches, designs, technologies, measures, and contexts; and provide a cornerstone for understanding the many constraints inherent in crew activities. The papers represent an outstanding gathering of experts, specialists, and researchers in this field and are cogent for answering questions such as:

- How to establish research programs in collaborative crew performance?
- What are the influences of individual differences in crew operations?
- How are crew measurements different from individual measures?
- How can cognitive engineering be applied to the design of collaborative systems?
- What theories of groups are relevant to study crews in complex domains?
- How would an ethnographic approach to crew interface design be implemented?
- What collaborative technologies are available to enhance crew performance?
- What collaborative paradigms / tasks are available to researchers?
- What real world, collaborative domains have been studied in-depth?
- What are some of the socio-cultural factors that affect crew performance?
- How can collaborative task analysis be useful for complex systems design?

These questions (and many more) can be answered by perusing author's papers. In this sense, the proceedings provide a kind of exploratorium for those who will come into contact with the themes of collaboration and complexity. The intent has been to provide a nexus of thought and direction with respect to *collaborative crew performance in complex operational systems*.

L'efficacité du travail en équipage dans des systèmes opérationnels complexes

(RTO MP-4)

Synthèse

Le premier symposium organisé par la Commission facteurs humains et médecine de l'Organisation pour la recherche et la technologie (RTO) a eu pour thème *l'efficacité du travail en équipage dans des systèmes opérationnels complexes*. Ce thème dénote deux grandes tendances communes à la recherche, à la conception et à l'ingénierie des systèmes à savoir: a) la collaboration et b) la complexité.

Avec la réalisation et la mise en service de nouveaux systèmes au prochain millénaire, les différents aspects de cette question devront être traités de façon constructive afin d'assurer la réussite des missions. Ce symposium a eu pour objectif d'identifier d'abord les problèmes multidimensionnels et les défis auxquels les scientifiques et ingénieurs sont confrontés lorsqu'il s'agit d'intégrer des équipages dans des systèmes complexes; et ensuite de procéder à l'examen de l'ensemble des solutions novatrices proposées.

Les problèmes, défis et solutions dégagées, qui concernent de nombreux pays, ont fait l'objet d'un nombre pléthorique de théories, de philosophies, de technologies, d'études, d'approches, de contextes, et de mesures. Ils sont la pierre angulaire de la connaissance des nombreuses contraintes propres aux activités des équipages. Les communications, la contribution d'un rassemblement d'éminents spécialistes et chercheurs dans ce domaine, permettent de répondre à un certain nombre de questions telles que:

- comment établir des programmes de recherche en matière de travail collectif en équipage?
- quelles sont les influences des différences des individus lors des opérations en équipage?
- dans quelle mesure les données équipage sont-elles différentes des données individuelles?
- quelles sont les applications de l'ingénierie cognitive pour la conception de systèmes coopératifs?
- quelles sont les théories de groupes applicables à l'étude du comportement des équipages en environnement complexe?
- comment mettre en oeuvre une approche ethnographique de la conception des interfaces homme/machine?
- quelles sont les technologies coopératives proposées pour l'amélioration des performances des équipages?
- quels sont les paradigmes/tâches coopératifs à la disposition des chercheurs?
- quels sont les domaines coopératifs concrets ayant fait l'objet d'études approfondies?
- quels sont les principaux facteurs socioculturels agissant sur les performances des équipages?
- l'analyse coopérative des tâches, peut-elle servir à la conception de systèmes complexes?

Une lecture attentive des communications du symposium fournira les réponses à ces questions et à bien d'autres encore. Ainsi, le compte rendu de la réunion est en quelque sorte un *exploratorium* pour tous ceux concernés par les sujets du travail en équipage et de la complexité. L'idée directrice du symposium a été de présenter une série de réflexions sur *l'efficacité du travail en équipage dans des systèmes opérationnels complexes*.

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Preface

Specialists within the human factors and medical community are now frequently coming into contact with real world settings that demand collaborative crew interaction. These settings are complex, contain distributed - highly technological - systems, and require joint interdependence to establish meaningful operations. Yet the research and design data to support these demands has not been well developed, is poorly organized, and is typically not generated for complex operational domains. Given these states, the purpose of this symposium was to congeal and organize topics that address both the theoretical and practical concerns of those specialists who are now engaged with some element of collaborative crew performance in complex operational systems. Hence, these proceedings enact a repository for those currently addressing this area and for those who will advance this area in the future. The topics within are wide-ranging and should be edifying for differing quests for knowledge in this area. It is the hope of the organizers that this symposium has laid down (1) a foundation for potential contributions to collaborative crew performance and (2) a spirit of congenial aspiration that will sustain research and development to new levels of maturity and advancement.

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Flight crews	Workloads																		
Group dynamics	Performance evaluation																		
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Task analysis	Systems engineering																		
14. Abstract	Contains the proceedings of the first RTO Human Factors and Medical Panel (HFM) Symposium, held in Edinburgh, Scotland, April 20-22, 1998, including the Technical Evaluation Report and Keynote Addresses. Research and applications in human factors has frequently only considered individual operator interfaces, for limited work domains in well-defined scenarios, as evaluated by unitary measures. As we progress towards the next millennium, complex operations will increasingly require consideration and integration of the collaborative element wherein crew performance becomes a critical factor for success. The goal of this symposium has been to bring together a global perspective on issues and factors that need to be understood when systems design is focused on the crew operating in a complex environment. Hence, the papers contained in these proceedings give the reader a broad, multidisciplinary view of needs, requirements, ongoing research and development projects, and various research agendas that will bring about new technologies, approaches, and measures with regard to collaborative crew performance. The papers and multiple perspectives contained in these proceedings provide a baseline for understanding many elements of crew performance and in that sense will be valuable for the human factors specialist that must now design for the collaborative element and be concerned with the broad bandwidth of complexities within the operational setting. Additionally, the volume provides information for researchers, scientists, and engineers in many different areas who find themselves immersed in collaborative systems design.																		



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