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# Preface

The application of human performance modelling within the early phases of the design life-cycle can play an important part in optimising the allocation of function and interaction between the human and machine. It will enable human limitations to be considered before commitment to complex system design solutions that are costly to modify at later stages of the design life-cycle. Working Group 22 was convened in 1995 to address the issues associated with using and developing human performance models. The principal target audience for the Report and its related expert system (HOMER) is all military and industrial organisations involved in the specification, procurement, design, qualification and certification of military systems where the human contribution impacts on mission effectiveness. Model developers within commercial and research organisations should also benefit from the chapters that deal with model limitations and implementation issues.

It is important to recognise previous approaches to performance modelling to ensure that the proposed output is not duplicating work that has been carried out already. During the inaugural meeting of the Working Group (WG) in Belgium (April 1995), the various activities known to the working group were identified. These included:

- Defence Research Group (DRG) Panel 8, Research Study Group (RSG)-9 1982-1990 (Ref 1)
- AGARD Aerospace Medical Panel (AMP) Working Group 12: Human Performance Assessment Methods 1987-1989 (Ref 2)
- National Research Council 1986-1989 (Ref 3)
- The Technical Co-ordination Programme (TTCP) Human Factors in Aircraft Environments (UTCP-7) 1992 - Current
- Air Standardisation Co-ordinating Committee (ASCC) WP61 1993-1995
- SAE Human Modelling System Users Survey 1994 - Current

It was apparent that there is considerable variation in the capabilities of the models and tools and the WG agreed that the system designer would need guidance in the selection of the appropriate model. The approach taken was to establish a set of attributes that characterised all types of models and to determine the extent to which each model or tool satisfied the attribute constraint. A set of thirteen models, which were representative of the type and range of performance models, was chosen to carry out this classification activity.

At the second meeting in the US (October 1995) a review was conducted of the models under evaluation. The model characteristics were further developed into a form that would be compatible with an expert system. The application of models within the system design process was considered in more detail, particularly their potential use within the qualification process. The WG was given a demonstration of the MIDAS integrated modelling environment at NASA-Ames Research Center.

The third meeting was in the Czech Republic in April 1996. A demonstration of most of the tools under evaluation was provided to enable the WG to achieve a greater appreciation of their capabilities. The WG then focused on developing the expert system (Human Operator Modelling Expert Review [HOMER]) and examined all the different criteria a system designer might consider important in terms of his problem domain, his knowledge and experience, the available resources, and so on. A set of 22 questions was drawn up and a score for each of the thirteen models against each of the 80 possible answers was allocated, based upon the capability of the model to answer the specific question. The questions intended to discriminate among competing models were also weighted in terms of their importance to the system designer (e.g., budget) so that inappropriate models/tools are not offered. The WG agreed that another form of 'educating' designers in the use of models was by means of walkthroughs that would provide graphical representations of the use of the tools to solve a specific problem. In this way the system designer could gain a greater insight into the complexity or otherwise of the process by which

1. A Directory of Human Performance Models for System Design (1991)
   DRG AC/243 Panel 8 TR/1
2. Human Performance Assessment Methods (1989)
   AGARDograph 308
3. Human Performance Models for Computer-Aided Engineering (1989)
   NRC Elkind, Card, Hockberg, and Messick-Huey

the required measure of human performance could be obtained. Representative case studies were selected for inclusion in the Report and the overall format of the final report was agreed at this meeting.

The fourth meeting was held in the UK in October 1996. The prototype expert system containing about 80 rules was reviewed by the group. The questions and answers were further developed and the weighting system was refined to ensure that the system dealt with 'show-stoppers' to prevent the system designer being offered unsuitable models. A set of candidate models for inclusion in the final version was identified and a questionnaire was designed to send out to all model developers. The WG was given a demonstration of IPME at the DERA Centre for Human Sciences, Farnborough.

The fifth meeting was held in the Netherlands in April 1997. The meeting concentrated upon completing the chapters of the Report and carrying out further validation of HOMER.

The final meeting was held in the US in October 1997, and included a final review of the Report and HOMER. The commercial aspects associated with maintenance of the expert system is beyond the scope of the Working Group but Micro Analysis and Design is currently hosting the expert system at its web site (WWW.MAAD.COM/AGARD).

Human performance modelling is a key technology that is needed to enable the cost-effective procurement of military systems. Therefore it is important to ensure that the potential users are aware of all the considerations that should be taken into account in the application and use of performance models when applied to their problem domains. The development of the selection criteria and their associated weightings formed an important output of the working group.

# Acknowledgements

The authors wish to thank the following personnel who contributed in the provision of presentations of the human performance modelling environments in the UK and US:

| | |
|---|---|
| Dr. Andy Belyavin | DERA, CHS, Farnborough, Hants, UK |
| Mr Barry Smith | NASA-Ames Research Center, Moffett Field, California, USA |
| Mr Sherman Tyler | NASA-Ames Research Center, Moffett Field, California, USA |
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# List Of Acronyms

| | |
|---|---|
| ANSI | American National Standards Institution |
| ATM | Air Traffic Management |
| BAe | British Aerospace |
| CAD | Computer Aided Design |
| FAIT | Function Allocation Issues and Trade-offs |
| GOMS | Goals, Operators, Methods, and Selection rules |
| HOS | Human Operator Simulator |
| HOMER | Human Operator Modelling Expert Review |
| HRA | Human Reliability Analysis |
| HPM(s) | Human performance model(s) |
| IPME | Integrated Performance Modelling Environment |
| MHP | Model Human Processor |
| MIDAS | Man-Machine Integrated Design and Analysis System |
| MS HOS | Micro Saint Human Operator Simulator |
| NASA | National Aeronautical and Space Administration |
| OCM | Optimal Control Model |
| POP | Prediction of Operator Performance |
| PROCRU | Procedure Oriented Crew Model |
| PSF | Performance Shaping Factor |
| PUMA | Performance and Usability Modelling in ATM |
| SA | Situation Awareness |
| SAFOR | Safe All-Weather Operations for Rotorcraft |
| SRC | Sowerby Research Centre (part of BAe) |
| TAWL/TOSS | Task Analysis WorkLoad/TAWL Operator Simulation System |
| V&V | Verification and Validation |
| WAS | Aircrew Workload Assessment System |
| WC Fielde | Workload Consultant for Field Evaluation |

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