Assessing the Impact on Mental Workload (AIM)

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HP Activity Categories:
Assessment of workload [1]
Resource Type:
Tool
Abstract:

The AIM questionnaire serves to assess the effect of automation on controller mental workload.

AIM was designed to provide assessments of the impact on controller mental workload (MWL) due to ATM system changes. It was developed as part of the ?Solutions for Human-Automation Partnerships in European ATM (SHAPE)? Project conducted within the Human Factors Sub-Programme (HSP) of the EATM Human Resources Programme (HRS). The complete AIM Tool Set is available within the SHAPE Toolkit (to assess the effect of automation on controller workload, situation awareness, teamwork and trust in the system.)

AIM is based on a definition put forward by Hilburn and Jorna [2001] which defines mental workload as the controller?s subjective experience of the demand imposed by the ATC task. The items used in the questionnaire refer to specific ATC control tasks which have been formulated on the basis of an integrated task and job analysis of air traffic controllers [EATCHIP, 1999]

References

Developer and source:
Eurocontrol
Doris M. Dehn; Assessing the Impact of Automation on the Air Traffic Controller: The SHAPE Questionnaires; Air Traffic Control Quarterly , Vol. 16(2) 127-146 (2008)
http://www.eurocontrol.int/humanfactors/public/standard_page/SHAPE_Quest... [2]

Eurocontrol (draft). The new SHAPE questionnaire: a user guide.
http://www.eurocontrol.int/humanfactors/gallery/content/public/docs/SHAP... [3]

Year of development / publication, updates etc:
2003/2007

http://www.eurocontrol.int/humanfactors/public/standard_page/SHAPE_Quest... [2].

http://www.eurocontrol.int/humanfactors/gallery/content/public/docs/DELI... [4](HRS-HSP-005-REP-03)%20Released-withsig.pdf
General Description

Purpose:

AIM as a tool was designed to be:

A. Multi-dimensional: Ability to evaluate different dimensions of MWL. AIM allows the analyst to determine the MWL due to:
   - Different cognitive functions,
   - The demands on different mental resource types.

It also partitions the MWL assessment according to mental effort required and task difficulty. Mental workload impact due to differences in mental effort required may have different design implications from MWL impact due to task difficulty.

B. Multi-scaled and diagnostic: AIM consists of measurement sub-scales for each dimension of MWL. These scales are:
   1. Building and Maintaining Situation Awareness
   2. Monitoring of Information Sources
   3. Memory Management
   4. Managing the Controller Working Position
   5. Diagnosing and Problem Detection
   6. Decision Making and Problem Solving
   7. Resource Management and Multi-Tasking
   8. Team Awareness

This will enable a profile of mental workload impact to be produced, that is a profile of MWL due to:
   - Different cognitive function groups, e.g. multitasking workload, memory management workload, planning workload or decision-making workload;
   - The demands on different mental resource types, e.g. visual mental resources, spatial mental resource or verbal mental resources.

C. Practical and usable: For easy and convenient application during real-time simulations of ATM and in a typical human factors laboratory. AIM was designed to require minimal resources to administer. There is no special training required to administer AIM. The AIM Tool Set contains guidelines for users to decide which version of AIM to use and how to score and interpret the different versions of AIM. The tool set also includes a computer-based tool which will automate the scoring of AIM.

D. Situation/design sensitive: Distinguishing mental workload as per situational conditions or design of automated tools.

E. Impact on spare processing capacity: With ATM system change or implementation of automation resulting in increased sector capacity and traffic density, the time and mental capacity available to formulate a response to problems and emergencies is reduced. It is therefore important that AIM includes a capability to indicate if the ATM system change may have a potential impact on the spare mental processing capacity of the controller and thereby increasing the risk of overload.

There is a short version and a long version of the AIM, referred to as AIM-s and AIM-l respectively. The AIM-l consists of 32 items which fall into eight subtests with four items each. The AIM-s consists of 16 items which are not further divided into subtests.

Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.):
Measurement instrument? Paper and pencil questionnaire

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**Technical description of method or tool etc**

**Description of the content/study:**

This is a pencil and paper self report tool. Available in a short version AIM-s consisting of 16 items and a long version. AIM-l consisting 32 items AIM-l is broken down into eight sub-scales of four items each. Responses are collected following completion of a task on a seven point Likert type scale ranging from none to extreme. This provides a simple numeric indicator of MWL across the 8 sub-scales in the long version or a simple measure of overall MWL in the short version.

**Technical requirements for using the method, tool, etc:**

None.

**Measure/Response Type:**

Responses are collected on a seven-point Likert scale ranging from none to extreme that is scored with the aid of a scoring key.

**Results obtained and interpretation:**

The result is an average of all scores on the short measure. In the long version eight subscale scores are also obtained.

**Evaluation**

**Advantages:**

Simple to administer. Specifically designed for measuring ATCO mental workload.

**Disadvantages:**

None described

**Alternative Methods:**

Cooper Harper Scale adapted for ATC, Air Traffic Workload Input Technique (ATWIT), Instantaneous Self Assessment Technique (ISA)

**Usability (ease of use, efficiency, effectiveness)**

**Ease of use:**

high

**Efficiency:**

high

**Effectiveness:**
high
Constraints concerning conditions of use:
None

Reliability:
The overall Cronbach’s alpha obtained was 0.97 long version (0.95 short version) with the eight sub-scales in the long version having and Cronbach’s alpha of 0.68 or above. See Air Traffic Control Quarterly, Vol. 16, No. 2, pp. 127-146.

Validity:
None reported

Required effort (to conduct & to analyse):
Low effort

**Level of HF expertise needed (required user qualification)**

High: high level of expertise required, only for experts, lots of training required
Other expertise needed (required user qualification):
Describe other necessary competence needed for using the tool, etc.

**Cost Information**

The tool is available from Eurcontrol and is free of charge.

Very low: (<100 €) low costs to purchase or free license, no special devices necessary
Experiences of use by SESAR partners (including references):
None reported

Reported and/or published experiences of use (including references):
See Air Traffic Control Quarterly, Vol. 16, No. 2, pp. 127-146.

Applicability to lifecycle phase (E-OCVM):
Can be used to assess mental workload in existing job roles.

Application Area:
Is suitable for assessing mental workload following shifts, Real-Time Simulation, in group sessions and in model-based simulations.

Keywords:
Workload assessment

Short Description:
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[1] http://webprisme.cfmu.eurocontrol.int/ehp/?q=taxonomy/term/100