

Workload: Measurement and Management

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SHFE GAP 1.1.1.2.1 -

How can measures or tools be developed to unobtrusively measure workload?

Result FY 09: Workload Primer (Casner & Gore, 2009)

Literature Review Selection Criteria

- Principled tool development approach,
- Peer-reviewed articles (NASA, DTIC, HFES, ISAP, IJAP, IEEE),
- Applicable to a range of conditions relevant for space operations
- Field-Ready Tools for Measuring and Evaluating Workload

Compile Toolset of "Best" Tools including...

- NASA TLX
- Bedford
- Cooper-Harper / Modified Cooper-Harper
- Subjective Workload Assessment Technique (SWAT)
- Instantaneous Self Assessment (ISA)
- Physiological measures

Measuring and Evaluating Workload: A Primer (Casner & Gore, 2009)

Annotated Bibliography

225 + Articles Reviewed

Mode		Styles		eference Sort Online Search Find Full Text Open File Quick Search Reference Types	Spelling Attach Figure Open Link Open File	
Groups	A	9	Author	≜ Year Title		
All References	(122)	9	Hill	1992 Comparison of four subjective workload rating scales		
Trash (0)			Hill	1988 Workload assessment of a mobile air defence missile system		
▼ CUSTOM GROUPS ▼ SMART GROUPS ▼ ONLINE SEARCH Library of Congress (0) LISTA (EBSCO) (0) Medline 1997-no (0)	es		Hollnagel	2000 Modeling the orderliness of human action Type	Туре	
			Huey	1993 Workload Transition: Implications for Individual and Team Performs		
			lavecchia	1989 Operator workload in the UH-60A Black Hawk crew results vs. TAW Department/Division	Harry G. Armstrong Aerospace Medical Research Laboratory, Human Systems Division, Air I	
		9	Jex	1981 Measuring aircrew workload: Problems, progress and promises Systems Command		
			Kahneman	1973 Attention and effort Short Title		
		9	Lamoureux	1999 The influence of aircraft proximity data on the subjective mental wor		
		9	Latorella	1999 Investigating Interruptions: Implications for Flightdeck Performance		
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		0	Liu	1993 Mental workload and cognitive task automaticity: an evaluation of s	Report Number	
			Lockett	1990 Crew reduction in armored vehicles ergonomic study (CRAVES) AAMRL-TR-89-023	AAMRL-TR-89-023 DOI Contents Accession Number Call Number	
MEDLINE (TS)			Mallery	1987 The effect of experience on subjective ratings for aircraft and simula		
PsycARTICLES (Mo Mo Mill Mill Mill Mo Mo Mo Mo Mo Na:	Mallery	1987 Comparison of POSWAT ratings for aircraft and simulator workload		
PsycINFO (SP)			McCracken	1984 Analysis of selected LHX mission functions: Implications for operate Contents		
PubMed (NLM) Queens U Stanford U TU Delft U Toronto Web of Science (TS) more ** ENDNOTE WEB configure			Mills	1998 The combination of flight count and control time as a new metric of		
			Mitchell	2003 Trade study: A two-versus three-soldier crew for the mounted comb Accession Number		
			Mitchell	2000 Mental workload and ARL workload modeling tools		
			Moray	1979 Mental workload: Its theory and measurement Call Number		
			Moray	1991 Strategic behavior, workload and performance in task scheduling		
			Moroney	1995 Some Measurement and Methodological Considerations in the Apr		
			Navon	1979 On the economy of the human processing systems		
			North	1989 W/INDEX: A predictive model of operator workload Keywords	Keywords	
		9	O'Donnell	1994 Chapter 42: Workload assessment methodology		
		9	Parasuraman	2005 Workload Modeling and Workload Management: Recent Theoretical	This report is to serve as a user's guide to accompany software Version 3.1 for the Subjective Workload Assessment Technique (SWAT), a bot for measuring mental workload. The guide has been developed as a "how-to" manual for implementing SWAT. Specifically, this report begins with a general overview of workload, describes in featal all all spects of the scale	
			Parks			
		9	Perala	has been developed as a		
		9	Porterfield	1997 Evaluating controller communication time as a measure of workload begins with a general over		
			Raby	finally goes into a step-by	development phase, provides general information relating to the event scoring phase, and finally goes into a step-by-step explanation of each manuli and screen of the program. Various optics are covered including descriptions of the three SWAT dimensions, use of con- Joint measurement and scaling, card sort procedures and analysis, methods of prototyping, event scoring, and data analysis. Each "how-to's exclon that the user will need has been	
		9	Rehman	1983 Subjective pilot workload assessment Various topics are covere		
		0	Reid	event scoring, and data a		
		9	Roscoe	1990 A subjective rating scale for assessing pilot workload in flight: a dec provided in an appendix	so that the appropriate section can be separated from the rest of	
		9	Rouse	1993 Modeling the dynamics of mental workload and human performanc the report for handy reference	ence.	
		9	Sarno	1995 Role of multiple resources in predicting time-sharing efficiency: eva Notes		
		9	See	1997 Computer modeling of operator mental workload during target acqu		
			Stein	1984 The measurement of pilot performance: A master-journeyman appr Research Notes	Research Notes	
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		Reid,	3.B., Potter, S.S., & Bres	.R (1989). Subjective workload assessment technique (SWAT): a user's guide File Attachments	File Attachments	
			(No. AAMRL-TR-89-02	AFB, Ohio: Armstrong Aerospace Medical Research Laboratory.		
				SWAT-UsersGReid-198	0 -46	

Tool Selection

- Research points towards no one, single approach to determine the suitability of workload in various operational contexts
- Different workload evaluations will be needed at different phases of the development cycle
- Workload Primer assists in deciding how and when to use the various tools

Compare / Contrast / Evaluate Tools

- Uni-dimensional and multi-dimensional scales
- Subjective and objective scales
- Thresholds for requirements-related (absolute thresholds) versus design-related (relative) comparisons
- Task suitability / relevance
- Included: NASA TLX, Bedford, Cooper-Harper, Modified Cooper-Harper, SWAT, ISA, DRAWS, TLAP, POSWAT, SWORD, and many others

Future Directions

Research gaps emerged:

- Regularly scheduled repetitive, workload intensive operations
- Dose concept to workload experience is proposed

Augment the FY09 Primer to include workload measurement from the system perspective for space operations:

Aim A. Mission Specialists' Operational Environment and Workload Considerations

Crew member debrief databases will be used to gain insights into events that cause workload levels that exceed or fail to meet the crew member's acceptable workload level

Aim B. Determine the common variables impacting workload when measured at the individual level and workload from the system

Identify individual and system workload parameters needed to attain specific system goals and how operators effectively manage workload to attain system goals for long duration operations

Aim C. Scales, Measurement, & Management Workshop
Gain the most current scales- and management-related
information by organizing, hosting and leading a scales and
management workshop with the goal of answering how workload
has been managed across the system

Aim D. Refine FY 09 Primer with protocol development and workload scale considerations

Refine the considerations that need to be heeded when selecting a workload measurement tool (e.g. NASA TLX, Bedford Scales)

Aim E. Develop a meaningful measure of system workload A system workload algorithm will be created once the system workload parameters are identified from Aims B and C

Acknowledgements

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Casner, S.M., & Gore, B.F. (2009). Measuring and Evaluating Workload: A Primer. FY 09 Final Report, Moffett Field, CA: NASA Ames Research Center