Technique for the Retrospective and predictive Analysis of Cognitive Error in ATM (TRACer)

Submitted by superadmin on Mon, 10/22/2012 - 14:45
HP Activity Categories:
Identification of potential human error and assessment of human error [1]
Resource Type:
Technique
Abstract:

TRACER was developed in 1999 in NATS (National Air Traffic Services, UK), as a means of classifying human errors and their causes in air traffic incident reports.

TRACER? has tried to harmonise active and reactive approaches to Human Error Analyses in the realm of Air Traffic Management (ATM) and Predictive Analysis of Cognitive Errors.

It provides feedback on organisational performance before and after unwanted events. It was realised that for the potential of TRACER to be realised more fully, it had to be simplified and made more accessible to designers, operational incident investigators, trainers, and procedure writers, as well as ergonomists. A reduced scope version was developed, called ?TRACER lite?

References

Developer and source:


Year of development / publication, updates etc:
General Description

Purpose:

TRACEr is based on the human information processing paradigm, but draws extensively from a range of human factors and error causation models. It was based on a task analysis of the controller activities via Hierarchical Task Analysis. TRACEr contains a number of flowcharts to help the analyst determine what errors could occur, what their causes might be, and their relative recovery likelihood. TRACEr lite was created to make core TRACEr techniques accessible to incident investigators and ATC specialists. (Source: GAIN Guide to Methods & Tools for Safety Analysis in Air Traffic Management)

Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.):

Taxonomy

Technical description of method or tool etc

Description of the content/study:

TRACEr can be used both predictively and retrospectively and is based upon a literature review for a number of domains, including experimental and applied psychology, human factors literature and communication theory. TRACEr is represented in a series of decision of flow diagrams and comprises eight taxonomies or error classification schemes: Task error, Information, Performance Shaping Factors (PSFs), External Error Modes (EEMs), Internal Error Modes (IEMs), Psychological Error Mechanism (PEMs), Error detection and Error correction.

A key process in the conversion from TRACEr to TRACEr lite was the simplification of

TRACEr's internal error modes (IEMs) and psychological error mechanisms (PEMs) to create TRACEr lite's internal errors (modes and mechanisms).

TRACEr's procedure and advice (Retrospective Analysis) consists of 6 steps:

1. Analyse incident into ?error events?;
2. Task Error Classification;
3. IEM Classification Information;
4. PEM Classification;
5. PSF Classification;
6. Error detection and Error correction;

Once the analyst has completed step 6, the next error should be analysed. Alternatively, if there are no more ?error events? the analysis is considered finished.

Technical requirements for using the method, tool, etc:

TRACEr analyses can be carried out using pen and paper. PEM, EEM, IEM, PSF taxonomy lists are also required. A HTA for the task under analysis is also required.

Measure/Response Type:
Evaluation

Advantages:

In a small study analysing error incident from the Airprox Reports (Shorrock and Kirwan, 2002) it was reported, via participant questionnaire, that the TRACEr techniques strengths are its comprehensiveness, structure, acceptability of results and usability.

Moderate requirement for resources

Possibility to derive error reduction measures

Used in ATC (HERA) project

Developed specifically for ATC, based upon previous ATC incidents and interviews with Air Traffic Controllers

TRACEr has proved successful in analysing from AIRPROX reports and providing error reduction strategies

TRACEr technique appears to be a very comprehensive approach to error prediction and error analysis, including IEM, PEM, EEM, and PSF analysis.

Disadvantages:

No direct quantification of predicted risk;

No validation evidence or studies using TRACEr;

For complex tasks, analysis will become laborious and large;

Very high resource usage (time)

Training time would be extremely high for such a technique;

Extra work involved if HTA not already available;

Existing techniques using similar EEM taxonomies appear to be far simpler and much quicker (SHERPA, HET, etc.)

Alternative Methods:

SHERPA, SPEAR, CREAM, HET.

Usability (ease of use, efficiency, effectiveness)

Ease of use:
medium

Efficiency:
Effectiveness: medium
Constraints concerning conditions of use: n/a
Reliability: n/a

There are no data available regarding the reliability and validity of the TRACEr method.

Validity: n/a

Required effort (to conduct & to analyse):

The effort to conduct a thorough error analysis is considered as very high to produce valid and reliable results.

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

HF Specialist and ATM Specialist

High: high level of expertise required, only for experts, lots of training required

Other expertise needed (required user qualification):

Incident Investigator and System Designers

**Cost Information**

Cost information not available, copyrights: Shorrock and Kirwan

Experiences of use by SESAR partners (including references):

NATS

Reported and/or published experiences of use (including references):

TRACEr lite RETRO is being used by incident investigators at Manchester Area Control Centre. NATS have developed a post-incident checklist and interview protocol for use at the London Terminal Control Centre and London Area Control Centre to record information based on the structure and simplified content of TRACEr lite.

Applicability to lifecycle phase (E-OCVM):

n/a

Application Area:
TRACEr lite has linked with, and used to populate, a safety model for ATM to analyze future ATM technology impacts. Meanwhile, an adaptation of the original TRACEr is flourishing in European ATM, and being tried in U.S. ATM and has been adapted for potential use in the rail sector in the UK.

Keywords:

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Short Description:

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Links