



RTO TECHNICAL REPORT

TR-SAS-087

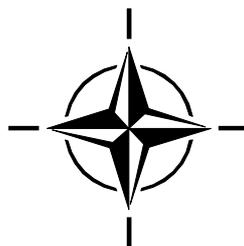
NATO Guide for Judgement-Based Operational Analysis in Defence Decision Making

(Guide OTAN pour l'analyse opérationnelle basée sur
le jugement dans la prise de décision de défense)

Analyst-Oriented Volume:

Code of Best Practice for 'Soft' Operational Analysis

This Report documents the findings of the Task Group TG-034
(System Analysis and Studies Panel) regarding best practices
in judgement-based Operational Analysis.



Published June 2012





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in judgement-based Operational Analysis.

The Research and Technology Organisation (RTO) of NATO

RTO is the single focus in NATO for Defence Research and Technology activities. Its mission is to conduct and promote co-operative 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 co-ordination with other NATO bodies involved in R&T activities.

RTO reports both to the Military Committee of NATO and to the Conference of National Armament Directors. It comprises a Research and Technology Board (RTB) as the highest level of national representation and the Research and Technology Agency (RTA), a dedicated staff with its headquarters in Neuilly, near Paris, France. In order to facilitate contacts with the military users and other NATO activities, a small part of the RTA staff is located in NATO Headquarters in Brussels. The Brussels staff also co-ordinates RTO's co-operation with nations in Middle and Eastern Europe, to which RTO attaches particular importance especially as working together in the field of research is one of the more promising areas of co-operation.

The total spectrum of R&T activities is covered by the following 7 bodies:

- AVT Applied Vehicle Technology Panel
- HFM Human Factors and Medicine Panel
- IST Information Systems Technology Panel
- NMSG NATO Modelling and Simulation Group
- SAS System Analysis and Studies Panel
- SCI Systems Concepts and Integration Panel
- SET Sensors and Electronics Technology Panel

These bodies are made up of national representatives as well as generally recognised 'world class' scientists. They also provide a communication link to military users and other NATO bodies. RTO's scientific and technological work is carried out by Technical Teams, created for specific activities and with a specific duration. Such Technical Teams can organise workshops, symposia, field trials, lecture series and training courses. An important function of these Technical Teams is to ensure the continuity of the expert networks.

RTO builds upon earlier co-operation in defence research and technology as set-up under the Advisory Group for Aerospace Research and Development (AGARD) and the Defence Research Group (DRG). AGARD and the DRG share common roots in that they were both established at the initiative of Dr Theodore von Kármán, a leading aerospace scientist, who early on recognised the importance of scientific support for the Allied Armed Forces. RTO is capitalising on these common roots in order to provide the Alliance and the NATO nations with a strong scientific and technological basis that will guarantee a solid base for the future.

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Glossary of Terms and Acronyms

Alternative	One of two or more possibilities that can be chosen for addressing, improving or (re)solving a problematic situation.
Analysis	A set of activities aimed at decomposing (physical, organisational, social) systems, problems, problematic situations, operations, etc., into their constituent parts, and at investigating their relationships and their meaning.
Analyst	An individual who conducts a study, and in this capacity designs the stages of the process, suggests scientific ways to investigate and model the problematic situation, the methodology(ies) and method(s) to be used, the workshops to be held, and ways to report and interpret the study's outcomes.
Client	<p>This term denotes four specific types of stakeholders:</p> <ul style="list-style-type: none">- The <i>sponsor</i> who actually owns the study;- The <i>customer</i> who pays the bill for the study;- The <i>decision maker</i> who may make decisions regarding the problematic situation or concerning the recommendations by (outcomes of) the study in preparation of decisions by higher authority; and- The <i>end user</i> who is ultimately affected (either positively or negatively) by the study outcomes and related decisions. <p>The various client types together are often referred to as 'client system' in the CoBP.</p>
CoBP	Code of Best Practice
Credibility	The quality of being trusted and believed in or of being convincing or believable (based on The Oxford English Dictionary).
Customer	The individual who pays the bill for the study.
Data	Facts or other pieces of qualitative and/or quantitative information.
Decision	The result of making up one's mind regarding a choice between alternatives.
Decision maker	An individual who makes up his/her mind regarding the problematic situation or concerning the recommendations by (outcomes of) the study in preparation of decisions by a higher authority.
Delphi method	A structured communication technique, originally developed as a systematic, interactive forecasting method which relies on a panel of experts (http://en.wikipedia.org/wiki/Delphi_method ; accessed on 18 October 2011).
Due diligence	An investigation based on agreed standards of the (true) worth of something.

End user	An individual who is ultimately affected (either positively or negatively) by the study outcomes and related decisions.
Expert (subject-matter expert)	An individual who has considerable relevant knowledge in a particular area without necessarily owning or otherwise being part of the problematic situation.
Facilitated modelling	A process where the analyst actively engages the client (group) to participate in all stages of a 'soft' OA study and thus acts as an facilitating analyst (often with the help of a supporting facilitator).
Facilitator	An individual who helps (i.e. supports, enables and encourages) individuals or a group or groups of stakeholders, clients, subject matter experts, and analysts work together through the stages of a study by managing procedure (the way the problem is tackled) and process (the way participants interact), whilst adopting an impartial attitude.
'Hard' Operational Analysis	OA based on well understood, standard science and mathematics.
Input	Data needed for setting up or running a model or influencing a process with the aim of affecting the results of that model or process.
Judgement	The result of the process of forming an opinion.
MA	Morphological Analysis
MC(D)A	Multiple Criteria (Decision) Analysis
Mess	Any problematic situation that requires or seems to require (re)solutions involving some action, although it is unclear initially what the issues are, what actions are required and/or who is or should be involved.
Method	A structured set of guidelines or rules to achieve some clear well-defined purpose.
Methodology	A particular combination of methods that possess a common set of characteristics and assumptions and are used in a study to achieve a purpose.
Model	A representation of (a part of) reality (i.e. a problematic situation) as seen by a number of people who wish to use the model to understand, manage, or improve that reality.
Morphological Analysis	A method for exploring all the possible solutions to a multi-dimensional, non-quantified problem complex (http://en.wikipedia.org/wiki/Morphological_analysis , accessed on 17 October 2011).
Multi-methodology	A combination of methods from possibly different methodologies.
Multiple Criteria (Decision) Analysis	A sub-discipline of OA that explicitly considers multiple criteria in decision-making environments (http://en.wikipedia.org/wiki/Multi-criteria_decision_analysis , accessed on 17 October 2011).

NATO	North-Atlantic Treaty Organisation
OA	Operational Analysis
Objective	<p><i>(adjective in connection with data)</i> Based on agreed, established, consensually observed facts.</p> <p><i>(adjective in connection with an activity or process)</i> Based on rules grounded in theory or established practice and characterised by recorded argumentation and rationale and following an agreed and sound process accepted by all involved;</p> <p><i>(noun)</i> Aim, purpose or goal.</p>
Operational Analysis	The interdisciplinary science that focuses on how appropriate actions can be designed to change (i.e. towards improvement) or even (re)solve problematic situations.
Option	One of two or more possibilities that can be chosen for (re)solving a problematic situation.
OR	Operational Research (equal to Operational Analysis)
Outcome	This denotes what has been achieved by the study ('effect' or 'impact'), based on specific results and their analytic interpretation.
Primary client	The term 'primary client' refers to the single individual or (small) group of individuals who belong to the client system and who acts or are acting as a partner (first point of contact) to the analyst throughout the conduct of the study.
Problem	Any situation where there is a perceived gap between its current state and its desired or required state, which needs or seems to need a (re)solution involving some action, although it may often be unclear what (re)solution and what action are most appropriate.
Problem (proper)	A problematic situation in which it is not very clear initially what the issue is and how a solution can be found; could be positioned between 'Puzzle' and 'Mess' (ref. Chapter 2).
Problem structuring	The process of analysing a problematic situation in order to identify the issue(s) to be resolved.
Problem Structuring Methods	Methods developed for dealing with unstructured problematic situations that are characterised by multiple actors, their multiple perspectives and conflicts of interest, uncertain and unquantifiable factors, and designed to support groups in their decision making.
Problematic situation	Any situation that is characterised by the existence of one or more problems and requires or seems to require (re)solutions involving some action, although it may often be unclear initially what action.
Puzzle	A problematic situation in which it is fairly clear what the issue is and how a solution can be found.
Qualitative	Based on distinctions or descriptions in terms of characteristics, gradation or order.

Quantitative	Based on measurement in terms of numbers expressed on a numerical scale.
Repeatability	The quality of a phenomenon to occur again, possibly in different places and times, and observed by different people.
Requisite	The characteristic of something when relevant people have agreed on its adequateness and sufficiency for use.
Result	This denotes what has been produced by applying a model, method or methodology, or merely following a process.
Rigour	Quality achieved through strict enforcement of logical rules and doctrine.
Robustness	The quality of withstanding or overcoming adverse conditions (based on The Oxford English Dictionary).
SAS	System Analysis and Studies
Satisficing	A decision or strategy or (re)solution is satisficing if it is good enough ('adequate'), but not necessarily optimal.
Scrutineer	An individual who provides an independent review of the study.
SME	Subject-Matter Expert (see under Expert)
SODA	Strategic Options Development and Analysis
'Soft' Operational Analysis	Operational Analysis exploiting methodologies and methods that are predominantly based on the rational (i.e. not intuitive) use of human judgement.
Soft Systems Methodology	An approach using 'real world' descriptions and systems engineering terms to structure messy problems where there may be divergent views about the nature and definition of the problem.
Sponsor	The individual who actually owns the study
SSM	Soft Systems Methodology
Stakeholder	An individual who can affect or can be affected by the (resolution of the) problematic situation.
Strategic Options Development and Analysis	An approach using diagram-based visualisations to explore messy problems and capture individual and group views with the aim of reaching a shared understanding of the problem.
Study phase	A coherent and distinguishable part of a sequence or cycle of activities over time.
Subjective	Based on personal feelings or intuition or expertise.
System	A collection of organised things constituting a whole and the relationships between its constituent parts.

Technique	Denotes each of the specific algorithms or interviewing modes (etc.) which are part of a method.
TG	Task Group
Tool	Either a 'Technique' or the agent of a technique (e.g. a software program).
Transparency	The quality of being easy to perceive or detect, or open to public scrutiny (based on The Oxford English Dictionary).
Triangulation	The use and critical synthesis of different sources or perspectives or methods regarding a (usually) single issue.
Uncertainty	The absence of knowledge and the inherent variability of phenomena, both in varying degrees.
Validation	The activity of proving or demonstrating or supporting the truth or accuracy or value of something (based on The Oxford English Dictionary).
Validity	The quality of being logically or factually sound ('cogent') (based on The Oxford English Dictionary); fitness for purpose.
Wicked problem	<p>A problem that is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognise. (http://en.wikipedia.org/wiki/wicked_problem; accessed on 2 November 2011).</p> <p>See 'Mess'; this CoBP uses 'mess' rather than 'wicked problem'.</p>

Preface

The Task Group (TG-034, SAS Activity 087) was commissioned by the System Analysis and Studies (SAS) Panel to produce a code of best practice for judgement-based Operational Analysis. After an exploratory phase in 2009 which addressed, at the Panel's request, the issues surrounding use of judgement in Operational Analysis (OA), the TG formally started its work Spring 2010 and finalised the code at the end of 2011.

The TG began by identifying a number of topics that would have to be addressed and considering what the specific boundaries of a code of best practice would be. This included its readership. Inspired and informed by discussions at two academic conferences¹ about a number of challenging propositions regarding the subject proposed by the TG, the TG went on to identify and (re-)read relevant literature.

The TG decided to write a Guide consisting of three volumes: an analyst-oriented document (the "Code of Best Practice for 'Soft' Operational Analysis"), a client-oriented document, and a brief summarising brochure for high-level, 'executive' decision makers. The TG also decided to write the analyst-oriented document first, not only in view of the crucial role of the analyst, but also because the TG Members considering their background generally felt more comfortable with an analyst's perspective. The client-oriented volume was developed after a first full draft of the analyst-oriented volume and saw an addition of specific topics relevant to clients keeping mutual consistency in mind. The summary brochure was derived from the client-oriented volume.

The design and writing of the Guide's volumes was assigned individually to the following participating nations/agencies: NATO/ACT, Australia, Canada, Germany, Netherlands, Sweden, and the United Kingdom. The final set of volumes was submitted to the Panel in December 2011. Their common main title is "NATO Guide for Judgement-Based Operational Analysis in Defence Decision Making", referred to as 'the Guide'. The analyst-oriented volume however is the Code of Best Practice (CoBP) proper. The other two volumes have a more explanatory nature: one is directed to clients and is organised around seven key questions that clients are likely to ask, the other is a short summary of a few key aspects of (using) judgement-based OA and is written for executive decision makers explaining and promoting key aspects.

The TG used existing publications, including textbooks, edited collections (proceedings) and reviewed papers, in order to attempt to produce useful guidance, based on each TG Member's personal knowledge and experience. The TG did not always try to reconcile differing academic views but rather made an effort to synthesise all useful ingredients where possible and made informed choices where a synthesis appeared to be infeasible. This has all been done with the Guide's general and the CoBP's specific purpose in mind and creating, along the way, clarity and focus in the vast and rapidly further developing world of 'soft' OA.

In order to illustrate issues, the TG used a number of unclassified descriptions of case studies and derived short pieces of text from them each addressing a particular issue. They appear as illustrative text boxes in the main text of this volume. The TG decided on which issues would require clarification by text boxes and which aspects from the available case summaries would be appropriate. In addition, there are some clarifying text boxes that are not based on cases and text boxes at the start of most chapters, summarising their main points both as statements and as recommendations to the analyst. Different colouring is used to denote the three different text box types.

The TG has restricted itself in referencing the material in the main text in order to not distract the reader too much from the content. By its nature, the CoBP (in fact the entire Guide) is a work of review and representation

¹ ISMOR (30 August – 3 September 2010, New Place, Hampshire, UK): 27th International Symposium on Military Operational Research, with special theme 'The use of 'soft' methods in OR'.

OR52 (7 – 9 September 2010, Royal Holloway University of London, Egham, UK): 52nd Annual International Conference on Operational Research of the O.R. Society.

of relevant ideas. If a particular method for approaching a problem or issue was identified in an academic paper or book and adapted for use in the CoBP, a reference to the source is given. So, references are given where appropriate and are not designed to be exhaustive, or even comprehensive. Some chapters contain a short list of recommended publications for further reading. The references and the lists of publications for further reading encompass the literature that the TG have used for the CoBP and serve as a tribute to our major sources.

The TG very much appreciates the efforts made by external reviewers to review the documents. A draft version of the analyst-oriented volume was reviewed by two associate professors², amended based on this review and then finalised. A draft of the client-oriented volume was reviewed by three individuals³ who belong to the Defence community, and finalised using their commentary. The TG acknowledges this support and thanks all reviewers for their most valuable advice. The Chair would like to thank all contributing nations and agencies for their effort in writing these documents which will be of benefit to all NATO Nations, PFP and Contact Nations, other Nations and organisations, and individuals.

Although the authors expect that the Guide will be useful as it is written, this work will clearly gain value from practical experience in working with it. The TG therefore recommends to the Panel that, in due course, an activity should be set up to see if the Guide, and especially the CoBP, needs adjustment based on the feedback that, hopefully, would have been brought to the Panel's or the authors' attention. That would be good practice.

² Dr. L.A. Franco (University of Hull, United Kingdom); Dr. E.A.J.A. Rouwette (Radboud University of Nijmegen, Netherlands).

³ Dr. R.A Forder (formerly at Defence Science & Technology Laboratory, United Kingdom); Lt.Col. J-H. Pay (Norwegian Defence Research Establishment FFI, Norway); Cpt.Cdr. F.S. Ordean and Lt.Col. I. Psomas (Joint Assessment Branch, Joint Force Command Brunssum, NATO).

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14. Abstract	<p>Judgment plays an important role in all Operational Analysis (OA). NATO practitioners have determined that approaches in OA that are based on human judgement are increasingly critical to defence decision making. The purpose of the NATO Guide for Judgement-Based OA in Defence Decision Making is to create an understanding of what judgement-based OA is; to clarify what this type of analysis can do to help address problematic situations, and what people can expect from it in that respect; and, to provide guidance on how a judgement-based OA study should be carried out to maximise the validity, credibility and acceptance of such a study and its outcomes.</p> <p>The Guide is published as three volumes: 1) An analyst-oriented document (the Code of Best Practice for 'Soft' OA, setting 'rules of the road' for analysts); 2) A client-oriented document; and 3) A brief summarising brochure for high-level, 'executive' decision makers explaining key aspects.</p>														





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