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## Languages and Leadtimes in R&D for Future Generations of C3I

### ABSTRACT

How to conceive, describe and assess a C3I design is not obvious even if standard OR techniques like war gaming, SODA and STRAD are used. Useful conceptual structures appear slowly in a combined learning and design process. It seems as if this conceptual development would have to be some kind of a qualified linguistic elaboration.

In this context the communication between planners and scientists are complicated since the different phases of the R&D process are supposed to be given their instructions with leadtimes of at least a year. One solution to this dilemma, tried in Stockholm, has been to trespass and violate the bureaucracy while applying Total Quality Management principles, closer client relations on all levels that is.

### CONTEXT

A description of the National Defence Research Establishment's military systems department (FOA 1) in OMEGA (Agrell 1985) is still valid. The business is messy problems of planning, strategy and tactics, managed in a close relationship to the clients. Interdisciplinarity is combined with quality ambitions so that methods should have a name and some explicit backing. An ability to combine methods is increasing.

A three year systems analysis project is being done for the Supreme Commander for a new generation of command and control (C3I). The project is lead by a committee of three persons, an officer, an engineer and an analyst (the author of this article). There are about twenty subgroups and two reference groups, one for short and one for long range matters. The Supreme Commander himself is not engaged in the study but instead his "Commander of Operations", as a client and as an ultimate support to the project.

Four kinds of output are produced:

- future C3I structures,
- robust courses of action,
- answers to precise questions from the Ministry and from the Headquarter's Strategy Department,
- control of decided organization developments.

Time and resources for independent thinking according to the first two items had a tendency to be squeezed out by urgencies in the latter two. Still, the present

paper is about the efforts in the project towards an independent future thinking.

A dead-line for the project is given to September 1st 1995, but after that of course then there will be other continuations of the C3I development.

### METHODS

The major methods of analysis applied in the project are Systems Analysis in a classical Churchman sense (1968), Colin Eden's SODA methodology (1990) and war-gaming (Brewer and Shubik 1979).

The SODA sessions formulated some objectives and alternatives necessary for the systems analysis, but this setup is no direct affair. John Friends programme STRAD will be used to schedule robust courses of action in the R&D process.

Levels of abstraction had to shift during the course of the project as we shall see in the next paragraph.

War gaming was mainly for the discovery of important issues and factors. It was partly supported by computerized modelling. It gave some overview of relations between budgets and military abilities.

Systems methodology was less of a problem than the factual and scientific basis for the design of alternatives and options. The competences were there quite well, but they were tied up in long range projects of their own. Informal relations and trespassing the bureaucracy were necessary for the factual scientific base in the studies.<sup>1</sup>

### SLICINGS

The basic concepts for describing matter and values had to be questioned several times. Economists and officers of different levels all had a need for different conceptual frameworks. There was no obvious or clearly objective way to see the world of future C3I.

In the beginning of the project in Sept-Oct 1992, as a result of the SODA sessions, some key issues were formulated for a systematic generation of alternatives and options (tables 1). Degrees of decentralization and computerization for example were selected as two major issues. Criteria for evaluation were formulated on a kind of micro level with an effort to have both relevance and some measurability (table 2). Cognitive comfort and a comprehensive timeaspect were two of those criteria. Strategic issues at that stage were mere frameworks for cost-effectiveness studies.

Confronted with the regular perspective planning unit in the Headquarters Strategy Division we found that effects had to be expressed in strategic terms in order to impress and influence. A few major threat stories (scenario) were written. The earlier more technical elaborations were of use for the strategic evaluations, but in an intuitive way. Estimates became very approximative.

Measurability and strategic relevance could not be combined. In an effort to concile the different stands the strategic criteria were reformulated

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<sup>1</sup> Useful discussions with the NACISA office and with the consultants of Ba & Sema about the overall approach should also be mentioned.

in a more precise, functional language. Certain operational abilities were surfaced (table 3). Ken Bowens "System-based interviewing" came to good use in these negotiations (1983). His recommended exchange of notations could be done in spite of tensions about other issues.

The project suffered from obstacles in the generation of alternatives, first by a lack of qualified manpower, and the few able to elaborate our systematic abstractions were subject to competing influences. In the perspective planning a special attention to the dimension "degree of coordination" was ordered and of course also to *cost levels*. For a detailed costing still another categorization was asked for, a categorization not quite identical to the one appearing in the standard accounts of the armed forces.

In the long range research planning for C3I two different slicings compete, the one following the academic disciplines, the other following visible matter and techniques.

The obvious slicing of the subject: "command, control, communication and intelligence" never came to any real use. James Millers "Living Systems" language may come to use with some of the researchers attached to the project

I am convinced that prototyping and teaching in the C3I area are needing still other slicings of the world, a matter which will complicate the efforts of building general software libraries.

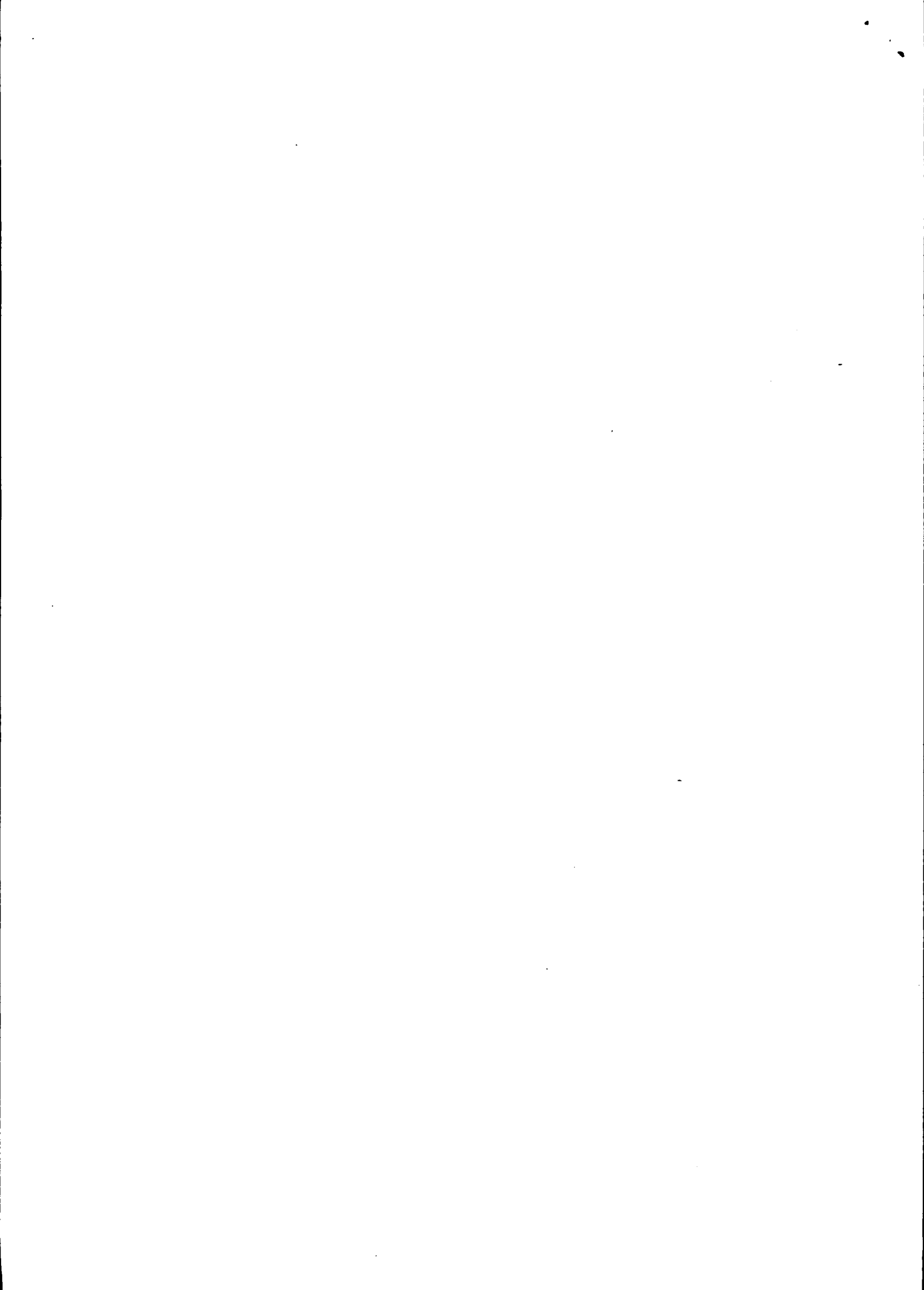
This frequent change of perspectives in the project was induced by and endurable for the military clients and for the top management of the project. It was a problem however in the relations to the numerous scientific and technical specialists also egaged. Short notice and changing perspectives is a threat to their professional honour.

## REFLECTIONS

The need in the project to have a rapid response to different questions in different appearing perspectives clashed with the research planning system requiring leadtimes of more than a year. Good informal contacts with courage and confidence were vital to have a reasonable flow of information between research and planning. Research plans had to take some deviations. Total Quality Management (Townsend & Gebhardt 1990) had to fight bureaucracy.

Some good old OR methodology came into use in the project and it was very satisfactory to be able to lean on some items of definable methodological work. Less well founded, but necessary, linguistics and semantic reflections was a heavy supplement to the ORmethodology. Efforts to read specialists in applied semantics like Christian Schmidt (1985) and Jacques Derrida (1976) made us realize that our semantic efforts were defendable. From the field of C3I research we can testify that Christian Schmidt is right when he more generally claims that semantics is a non obvious and quite decisive supplement to syntax and modelling. We felt happily relaxed when learning from Derrida that no language is perfect or free from contradictions and that words, without a method, could be chosen with a purpose in mind.

It would certainly be worthwhile to elaborate some of a verifiable (and falsifiable) methodology on the borderline between linguistics and OR. At least we feel a need for that in the Swedish C3I studies.



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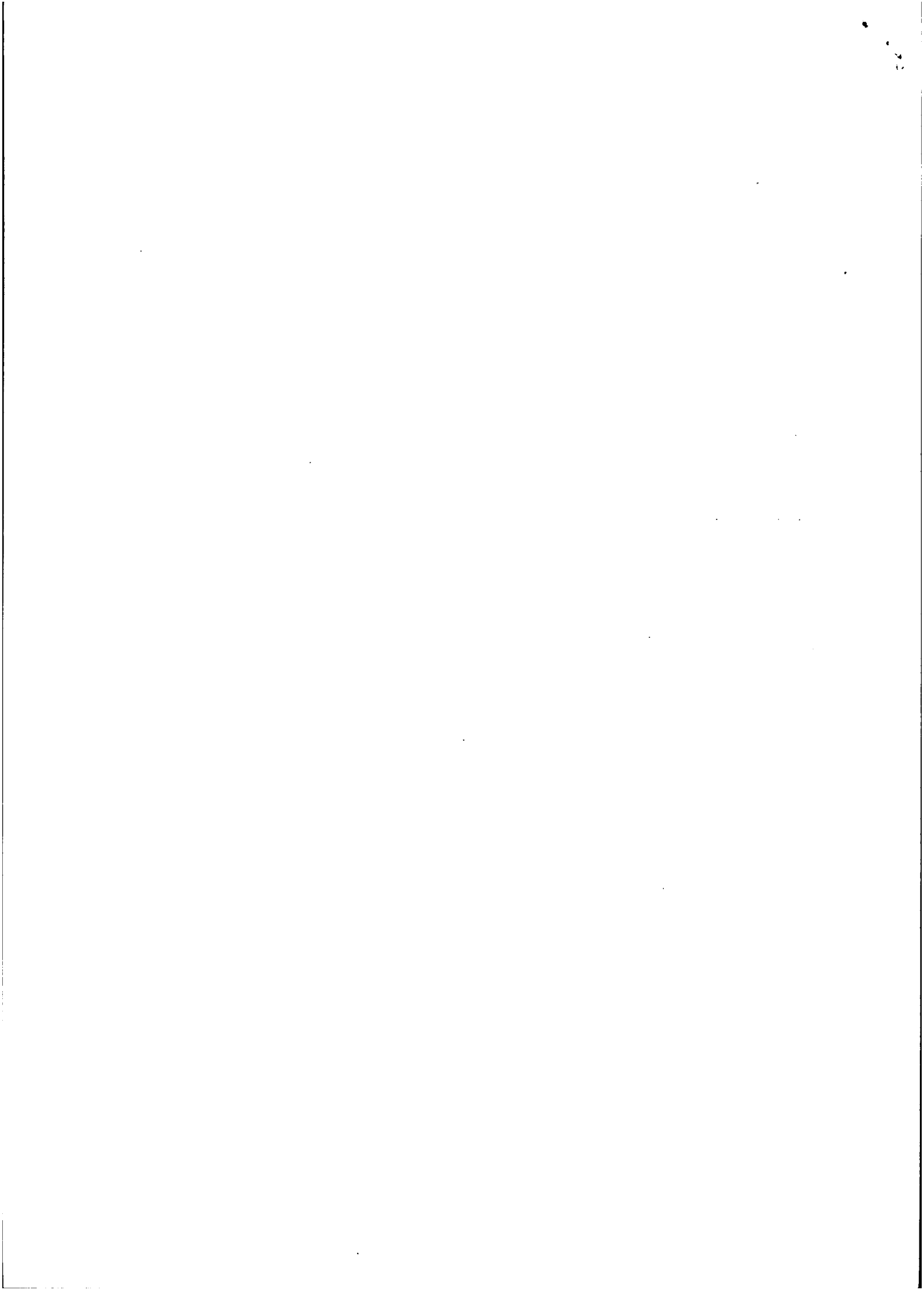


Table 1

MAJOR THEORETICAL OPTIONS

AUTONOMY - CONTROL  
MILITARY RESSOURCES - CIVILIAN  
LONG RANGES - PRESENCE  
PROTECTION - INVISIBILITY  
TELECONFERENCING - MEETING  
MULTIMEDIA - RATIONAL CONTENT  
MESSAGES - DATABASES

Table 2

VALUES

RESILIENCE  
RAPIDITY  
MOBILITY  
ABILITIES OF CONCENTRATION  
PREPAREDNES  
"TOTAL QUALITY", CHARISMATICS  
COMFORT  
OVERVIEW  
COGNITIVE FLEXIBILITY  
LOCAL INITIATIVES  
NON MIL ASPECTS  
COSTS LCC  
ADAPTIVITY

Table 3

OPERATIONAL ABILITIES

CLAIM NATIONAL ITEGRITY  
DISCOVER HOSTILE PREPARATIONS  
PROTECT POPULATIONA AND SOCIETY  
MILITARY INITIAL ABILITIES  
PREVENT ENEMY PROLIFERATION  
MILITARY CONTINUED ABILITIES AND GROTH  
REGAINS  
MILITARY SUSTAINABILITY