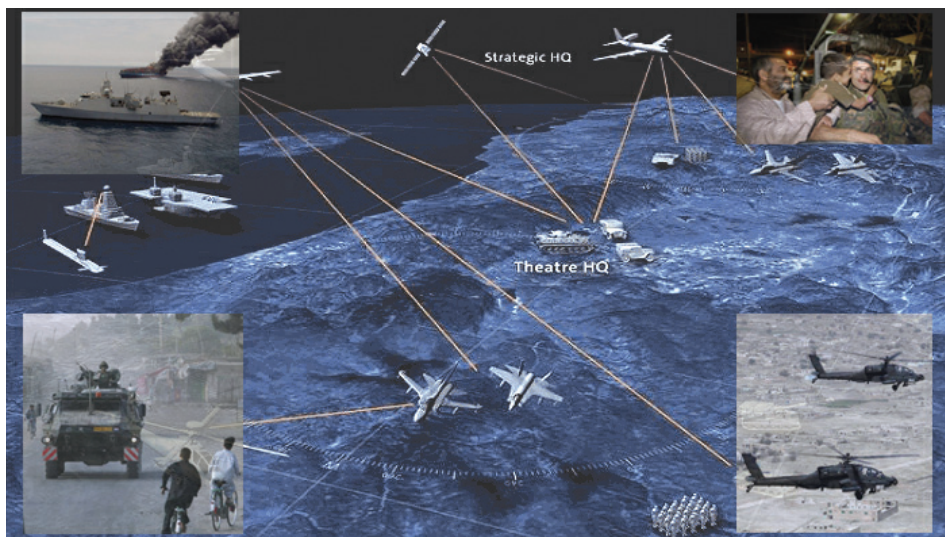


# C4I

TNO and Defence:  
working together on the solutions for tomorrow



### Introduction

Military force is just one of many instruments that are applied in reaching international security objectives, which are often formulated globally or in rather abstract terms. While this (international) military force is applied amidst a civilian population, interaction with the population and its government is one of the essential means to contribute to the intended effect. Due to the asymmetric nature of military missions and the omnipresent media, local actions or incidents at a tactical level can easily have strategic implications.

In this complex context, reach-back or distributed collaboration concepts must often be applied due to limitations in the number of personnel to be deployed. These limitations are often not only related to financial means, but also to the scarcity of relevant expertise required for various contemporary missions. Given this typification of military missions, the Dutch

Defence organisation is transforming into an expeditionary force, constituted of versatile, modular and interoperable units. In this transformation process the Dutch MoD is confronted with a number of complex issues. Typical questions raised in this context include: How to optimally align the Concepts of Operation, the Command & Control Organisations and the Communication and Information Infrastructures? How to establish and maintain the required interoperability levels within 'hastily formed' networks of military and non-military players? How to establish and support the required level of shared situational awareness within this complex and adaptive force?

### Objectives

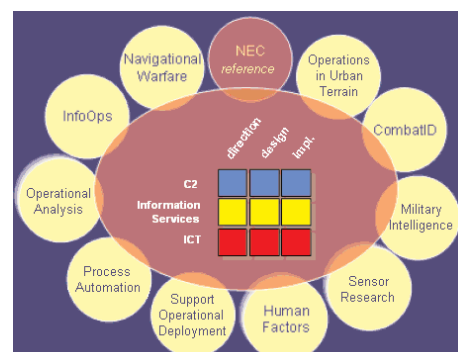
The C4I research programme contributes to solving command & control solutions in the complex context described above. The requirements of future command & control will be studied from four perspectives: organisational, information, ICT

infrastructure, and an integrating operational perspective. The research aims at a deep understanding of the impact of network-enabled operations for operational concepts. From this understanding, new concepts for the organisation of command, information management and network technologies will be developed, tested and demonstrated. The programme aims at integrated development and experimentation.

### Themes/Projects

The research questions related to the projects within the programme are subdivided into a three-tiered structure, where each layer represents a different aspect of C4I:

- *C2 structures and processes*, dealing with the increase of operational value with the optimal organisation and structure of command, information needs and human capabilities. Typical questions to be addressed are: under what operational conditions is decentralised Command & Control, with a minimal amount of explicit direction and guidance, effective and efficient? How to establish and maintain



Scope of the C4I Programme

shared situational awareness in a highly distributed force?

- *Information services*, in which the necessary C2 systems, functionalities, services and characteristics are investigated that can lead to an increased operational value. Typical issues to be addressed are: how to ensure that the right information is available at the right time in the right format to the right person to the right use, without causing information overload? How to ensure semantic interoperability in a distributed collaborative situation while the set of players is not fixed and the interaction patterns will be likely to vary frequently?
- *ICT infrastructures and supporting services*, focusing on the technical services needed to achieve the objectives. Examples of these services include transmission and network systems and (NATO) standardisation, functional and security concepts for ICT-services and insight in how they can be implemented safely and efficiently in the defense infrastructure. This also involves investigations into the possibilities and restrictions of the integral robust infrastructure and recommendations and contributions to its enhancement, integration and realisation.

The operational perspective provides the integration of these layers with integral experimentation using realistic scenarios, operational measurement techniques and experimental facilities for experimentation and demonstration.

In the figure below, for each layer the three steps in concept development are shown: direction, design and implementation. Also shown is the C4I programme as central to the development of the NEC concept, and related to a broad range of other defense research programmes within TNO.

#### Application

The results of the C4I programme will support the Netherlands defense organisation in the development and evaluation of new policies and solutions for high value command and control, based on effective, agile organisational concepts. The results can be applied across the full range of defence tasks, including the defence role in supporting national and international civil authorities in upholding the law, providing disaster and humanitarian relief. With the research, concept development and experimentation in the C4I programme, TNO and the Dutch Defence organisation work together on the solutions of tomorrow's complex command and control domain.

#### TNO Defence, Security and Safety

TNO Defence, Security and Safety provides innovative contributions to the advance of comprehensive security and is a strategic partner of the Dutch Ministry of Defence to build up the defence knowledge-base. We employ our acquired knowledge for and together with contractors.

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#### Programme

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##### Title

C4I

##### Programme number

V507

##### Time schedule

1-1-2006 - kick-off

31-12-2010 - completion

##### Budget

13.344 kEURO