



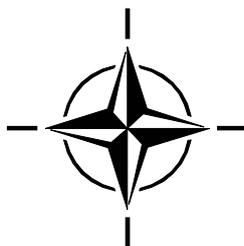
RTO TECHNICAL REPORT

TR-IST-031

# Speech Processing in Realistic Battlefield Environments

(Le traitement de la parole  
en environnement de  
combat réaliste)

This Technical Report has been prepared as a result of a project on  
“Speech Processing Using Realistic Battlefield Data” for the RTO  
Information Systems Technology Panel (IST) by Task Group 013.



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- 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

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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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## Preface

Communications, command and control, intelligence, and training systems are more and more making use of speech technology components: i.e., speech coders, voice controlled C<sup>2</sup> systems, speaker and language recognition, and automated training suites. Interoperability of these systems is not a simple standardization problem as the speech of each individual user is an uncontrolled variable such as non-native speakers using, in addition to their own language, an official NATO language. For multi-national military operations, this may cause a reduced performance or even cause malfunction of an action. Standardized assessment methods and specifications both for commercial-off-the-shelf (COTS) and for development of new technology are required. The work was separated into four tasks:

- 1) Collect native and non-native unclassified and classified speech communications from training exercises and actual operations;
- 2) Produce annotated database(s) that might be used beyond the confines of the Task Group;
- 3) Assess effects on performance of recognisers and communication equipment; and
- 4) Relate derived results to military applications.

In this report the results of the study are presented.

## Foreword

Efficient speech communication is recognized as a critical and instrumental capability in many military applications such as command and control, aircraft and vehicle operations, military communication, translation, intelligence, and training. The former NATO research study group on speech processing (AC243 (Panel 3) RSG10) conducted since its establishment in 1978 experiments and surveys focused on military applications of language processing. Guided by its mandate, the former RSG10 initiated in the past the publication of overviews on potential applications of speech technology for military use and also organized several workshops and lecture series on military-relevant speech technology topics. Recently the group continued under the IST Panel as AC232/IST/TG001.

In recent years, the speech R&D community has developed or enhanced many technologies which can now be integrated into a wide-range of military applications and systems:

- Speech coding algorithms are used in very low bit-rate military voice communication systems. These state-of-the-art coding systems increase the resistance against jamming;
- Speech input and output systems can be used in control and command environments to substantially reduce the workload of operators. In many situations operators have busy eyes and hands, and must use other media such as speech to control functions and receive feedback messages;
- Large vocabulary speech recognition and speech understanding systems are useful as training aid and to prepare for missions;
- Speech processing techniques are available to identify talkers, languages, and keywords and can be integrated into military intelligence systems; and
- Automatic training systems combining automatic speech recognition and synthesis technologies can be utilized to train personnel with minimum or no instructor participation (e.g., Air traffic controllers).

This report is the result of a project on “Speech Processing Using Realistic Battlefield Data” with contributions of all Task Group members, which represent nine NATO countries (Belgium, Canada, France, Germany, Netherlands, Spain, Turkey, the United Kingdom, and the United States). Because speech technologies are constantly improving and adapting to new requirements, it is the intention of the Task Group to initiate projects on military applications of speech technology. Therefore the group appreciates any comment and feedback on this report.

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<b>14. Abstract</b>	<p>This report summarizes the results of research conducted by IST RTG-013 to better understand, detect, and mitigate the effects of native and non-native speech produced in military battlefield environments. Speech data was collected in three representative conditions to foster this and future research. Descriptions of the databases are included in the report. In addition, experimental plans on how to use these databases to measure the performance of speech processing systems are provided. Results using several state-of-the-art speech recognition systems from various IST RTG-013 member countries are presented. Finally recommendations and impact on current and future multi-national operations are presented.</p>		





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