NORTH ATLANTIC TREATY ORGANISATION

RESEARCH AND TECHNOLOGY ORGANISATION

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RTO TECHNICAL REPORT **TR-IST-051**

Characterising the Ionosphere

(La caractérisation de l'ionosphère)

Final Report of Task Group IST-051.

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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.

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- 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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14. Abstract

This report is a compilation of papers from academic and other research institutes that describe ionospheric phenomena and parameters that affect electromagnetic propagation. The report addresses both mid-latitude and high-latitude effects. The first chapter describes the morphology of the ionosphere, briefly covers the neutral atmosphere and expands on the influence of the geomagnetic field, ionospheric electric field and currents, and particle precipitation at high latitudes. Chapter 2 looks at the instrumentation for obtaining the relevant data. An analysis of the mapping of total electron content in geographic co-ordinates is presented in Chapter 3 with an aim of providing timely information to the users. Chapter 4 addresses spontaneous emissions observed during ground-based and rocket-borne experiments. The final chapter considers the specific effects of space weather on the ionosphere during severe geomagnetic and ionospheric storms, the impact on technology including communication and navigation systems, and emphasises the need for a global perspective of the system. Extensive references are provided for each subject. For completeness, the proceedings of a Specialists' Meeting held in conjunction with the study are added as an appendix.

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