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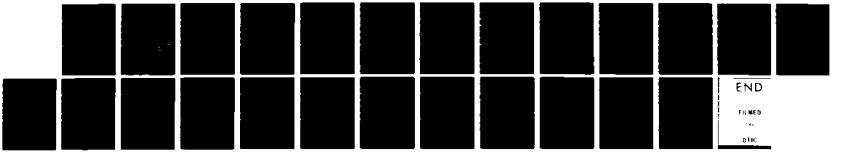

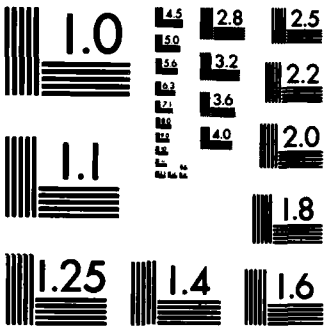

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ROYAL AIRCRAFT ESTABLISHMENT

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July 1982

SWEDISH DEFENCE RESEARCH ABSTRACTS 81/82-2

by

National Defence Research Institute, Stockholm

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SWEDISH DEFENCE RESEARCH ABSTRACTS 81/82-2

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by

National Defence Research Institute, Stockholm

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EDITOR'S SUMMARY

The Swedish National Defence Research Institute issues a quarterly list of unclassified Reports published by the Institute. The titles of these Reports and informative abstracts have been translated in English. This volume is the second issue of 1981/82. Further volumes will be translated in due course. The main topics covered are: protection - atomic, biological, chemical; ammunition and weapons; conduct of war, information and commands; vehicles and spacecraft; reliability and logistics; human factors; associated studies and their solutions; positive methods for limitation and control of armaments; psychology reports.

EDITOR'S NOTE

The Reports are in Swedish unless some other language is indicated (usually English). When requesting Reports it should be appreciated that an English version will not normally be available, and that the prices of the original Swedish documents have not been indicated in this Translation. Reports may be obtained from:

FOA Centralkansliet, S-104 50 Stockholm, Sweden

Index to FRÖ 81/82-2

(80) The Marr-Hildreth model for detecting the edges of an image. Formation of programming system
(81) Report on a visit to Canada and the USA
(82) Report on a visit to Washington DC, 8-16 April 1981
(83) Report on engagements at the Swedish Export Council's Commercial Bureau in Houston, USA
(84) Observations with a 35 GHz radiometer imaging system of terrain at Malmslätt, July 1980
(85) The detection of, and damage to radar aerials by a CO_2 laser

E2 Communications

(86) Radio equipment for investigating wave propagation at 11, 18 and 36 GHz
(87) Variations in the attenuation of propagation at 11, 18 and 36 GHz
(88) A digital radio link; the quality of communication in multi-path propagation

E3 Guidance, navigation and target identification

(89) Report of a conference entitled "Status report and future outlook for defence applications of electro-optical systems, infrared, lasers and related technologies".

E4 Countermeasures, including signal interception and technical intelligence

(90) Effect of the content and type of filler and plasticiser on the properties of a conventional styrene butadiene rubber

H HUMAN ENVIRONMENT

H1 Investigations, future projections

(91) Examination of air samples from the submarine Sjöhund, August 1979
(92) Examination of air samples from the submarine Näcken, August 1980
(93) Is sound a mosquito-repellant?
(94) Emergency medical studies in connection with two Swedish railway accidents in 1980. The train collision in Storsund on 2 June 1980 and the derailment at Upplands Väsby on 24 August 1980
(95) Structure and function of neutrophil leukocytes from patients with the immotile-cilia syndrome
(96) The quantification of neutropuil orientation and migration under agarose - a new method for detecting directed and random movements
(97) The relationship between luminol chemiluminescence and the killing of Staphylococcus aureus by neutrophil granulocytes
(98) Leukotriene B_4 - a stereospecific stimulator for release of lysosomal enzymes from neutrophils
(99) Leukotriene B_4 is a potent and stereospecific stimulator of neutrophil chemotaxis and adherence

H2 Man and technical systems

(100) Identification of target vehicles from the air. A field trial
(101) The development of effective divers' gloves

M INTERDISCIPLINARY STUDIES AND INVESTIGATIONS

M2 Environment and social studies

(102) Fire, buildings and energy
(103) Energy - for what purpose and how much?

M3 Security aspects of environmental studies

(104) Review of the international debate on the nature of the future conventional war in Europe
(105) The effect of increases in crude oil prices on the economy of India
(106) Technological development in the Soviet Union
(107) Soviet policy in the Middle East. A survey

M6 Information systems

(108) Functional keys for *VIDED* on the Volker-Craig 414 terminal

M8 Joint research and study projects

(109) A general approximation method associated with the Bernstein polynomial

T CERTAIN MEASURES FOR LIMITATION AND CONTROL OF ARMAMENTS

T1 Seismological and multiple stations

(110) Seismology 1980. Nuclear test ban verification. Earthquake and earth resource investigation

(111) Common database experiment - progress report on data analysis

A PROTECTION - ATOMIC

A3 Effects of nuclear explosions, and protective measures

(57) FOA report C30242-A3
Report on a study visit to the USA, 20 July to 7 August 1981. Technical studies of the resistance of electronic components to ionising radiation
Lennart Hagström and Sten Jarlén (SAAB-Scania) November 1981

This report is an account of a tour of the USA concerning technical studies of the resistance of electronic components to ionising radiation.

It presents impressions and comments from the annual IEEE Conference on nuclear weapons and the effects of cosmic radiation on electronic equipment, and from visits to industries and laboratories.

B PROTECTION - BIOLOGICAL

B2 Protective measures

(58) FOA report C40146-B2, C2
Test of the filtering efficiency of mouth masks as a function of particle size
Ingrid Fängmark and Mats Ahlberg October 1981

Under the direction of the SPRI (Institute for Planning and Rationalisation in the Medical Services) a method has been devised for testing filtering efficiency as a function of particle size.

The method was tested on 17 different mouth masks for hospital staff. The object was to simulate the ability of the filter to separate bacteria from exhaled air. For each filter the penetration of quartz particles through the filter was determined for five different size-gradings, using an optical particle counter.

The results indicate a widely varying filtering effect for the mouth masks under test.

C PROTECTION - CHEMICAL

C1 Threat scenario

(59) FOA report C40142-C1
Measurements of changes in mass and conductivity of certain oximes. An investigation of their usefulness to indicate chemical warfare agents
Göran Olofsson November 1981

The object of this study was to find a substance which will adsorb organic phosphorus compounds. The substance is also required either to be of low volatility or to form a chemical bond with a metal or glass surface. The oxime group includes a number of compounds which meet the first requirement. By studying various oximes in the manner adopted here it is hoped to find one or more suitable oximes which can be modified so that they become attached to a substrate to be used for indicating chemical warfare agents.

An account is given of the ability of 11 oximes to adsorb the insecticide dimethyl-(2,2 dichlorvinyl) phosphate (DDVP), which inhibits cholinesterase. Changes were also studied in electrical conductivity on adsorption. The results demonstrate wide differences in adsorption power. For some of the oximes adsorption is so significant that from this point of view they could be used as indicators. Electrical conductivity is not always affected by adsorption.

C2 Protective measures

(60) FOA report A40035-C2
Chemical warfare protection for the civil population - a summary of the OCC study
P.G. Jönsson and others October 1981

The effectiveness was studied of various protective measures to limit side effects on the civil population from representative types of chemical attack against targets of military importance. Acceptable protection can be achieved in most cases by a combination of remaining indoors with reduced ventilation, "light breathing protection", early warning and effective all-clear signalling.

D AMMUNITION AND WEAPON TECHNOLOGY

(61) FOA report C30254-D, E
Study visit to West Germany on the subjects of optical sensors and missile guidance systems, and missile simulation, June 1981
Thomas Gundmark and Hans Strengnell December 1981

A study visit was paid to firms and institutes in West Germany during the first week of June 1981. The purpose of the visit was to study and discuss the current situation in the fields of missile guidance and the simulation of missile guidance systems, and target-seeking by missiles including their sensor systems, principally using optical-electronic techniques.

Places visited included:

Messerschmidt Bölkow Blohm (MBB), Ottobrunn,

Dornier GmbH, Friedrichshafen,

Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt (DFVLR), Oberpfaffenhofen,

Industrieanlagen Betriebsgesellschaft (IABG), Ottobrunn.

A very positive reception was enjoyed at all the places visited, with many participants who gave an account of their activities. Our chosen fields of discussion were thus more than well covered, and the outcome of the visit can be considered to have been very good.

D1 Technology of explosives.

(62) FOA report C20430-D1
Tests with a new prototype of microcalorimeter from Messrs LKB (in German)
Max Frey (W. Germany) and Jan Hansson November 1981

A new microcalorimeter was purchased and studied with a view to its operation and the accuracy and stability of its measurements. The heat developed by several propellants at elevated temperatures was also determined.

(63) FOA report C20432-D1
Fuel-rich propellants containing magnesium
Torsten Liljegren November 1981

Magnesium has a moderate heat of combustion, lower for instance than boron or aluminium. It has a low ignition temperature, and thereafter burns in the gaseous phase at a high rate. Its favourable combustion properties mean that magnesium propellants are of interest for use both in air-breathing rocket motors, ramjet rocket motors, and for projectiles with external combustion.

The report includes comprehensive results of calculations for energy and performance, leading to a discussion of the choice of propellant composition.

The manufacture and test combustion of HTPB propellants with a high magnesium content were recently begun. Results are reported from these introductory studies.

D4 Technical aspects of warheads

(64) FOA report C20428-D4
A study of dislocation density and phase elongation as a function of deformation in sintered tungsten composites
Ulf Lindegren October 1981

Tungsten composites (heavy metals) are used as a material in armour-piercing projectiles. The present report is a continuation of the studies of the mechanical properties of these composites, reported previously.

The tungsten composite studied here is an alloy, DXI, which is manufactured in France by Le Carbone. This composite contains about 90% W, 6% Ni and 4% Fe, and in the sintered state it consists of grains of tungsten in a softer matrix.

The report contains a method for producing thin films by electrolytic polishing and ion etching.

It also discusses experiments to explain, from dislocation densities in the tungsten grains and the binding phase, the behaviour of both these phases on deformation. The dislocation density has been determined with the electron microscope in thin films of the composite.

This work was done as an examination project at the KTH.

(65) FOA report C20435-D4
Study of the penetration of buildings by conventional weapons and the distribution of the point of explosion
Lennart Götherskjöld December 1981

When conventional weapons are deployed against targets in or near to buildings, the projectiles are often equipped with delay fuzes to achieve penetration of the target before exploding.

Knowledge of the penetration by projectiles into buildings is limited. There does exist some information of penetration at a vertical angle of impact. On the other hand, less attention has been devoted to penetration and the probable position of the point of explosion when the angle of impact is oblique with respect to the building. This study, which should be regarded as a pilot study, deals principally with the latter alternative.

A special computer model was devised for the study. Its mathematical method is generalised for different types of building and choice of attack.

The report describes the present state of knowledge and the mathematical computer model, and presents the results of preliminary investigations and computations. These latter concern two multi-occupation buildings of differing construction. Among other things the results indicate the importance which building design and the direction of impact may have for the penetration by a projectile into a building.

D8 System studies

(66) FOA report C20429-D8 (E1, E3)
Model of visibility in combat (Initial study).
Staffan Höijer October 1981

At the review of visibility in combat on 1 September 1981 a presentation was given of a method of constructing a model of combat visibility with reference to a concrete instance (armoured attack against a centre of resistance). The report set out here should be regarded as supplementary to that of 1 September 1981. Combat visibility is discussed more generally here, together with some opinions as to how such a model should be designed. The main intention of this report is to afford a basis for further work on a model of combat visibility, and should therefore be seen as a pilot study. Some of the ideas should be discussed further and expressed in a concrete form in connection with some future continuation of this work.

(67) FOA report C20433-D8
Comparisons among some irregular interpolation methods for the plotting of contour curves.
Anders Widman November 1981

This project is to compare several methods of interpolating irregular data for the subsequent generation of contour curves. Four methods were compared. One of the methods is due to Hiroshi Akima and the other three to Richard Franke.

These methods are:

Akima's irregular method,

the Nielson-Franke method,

quadratic Shephard,

thin-plate splines.

They were compared in terms of time of execution, standard deviation and image quality. Akima's irregular method was found to be the most rapid, while giving the poorest image quality. Quadratic Shephard and Thin-plate splines produced the best image quality.

Comparisons were also made with the Marlow-Powell regular method from the Harwell Subroutine Library. This method was coupled with a graphic routine, which draws a polygonal line between given co-ordinates.

The other methods require a graphic routine for generating contour curves for regularly given data. In all cases the *GPGS-F* graphic package and its extensions *Graphisto* and *Surrender* were used for the graphic output.

E CONDUCT OF WAR - INFORMATION AND COMMAND TECHNIQUE

(68) FOA report C30231-E
A simple inversion method for determining aerosol size distribution (in English)
Thomas Kaijser September 1981

This report discusses integral equations which describe the attenuation of light in an aerosol composed of spherical particles. This is a fundamental equation for determining the distribution of particle size in an aerosol by measurements of the attenuation of light. A simple method is described for determining a physically realistic solution to the integral equation. The method is based on an assumption that the solution can be written as a linear combination of log-normal functions.

(69) FOA report C30239-E
Protection from lightning in FOA3
K.G. Lövstrand and Berndt Backlund October 1981

In order to remove or to reduce drastically the risk of damage by lightning strikes on installations in FOA3, a review was conducted of the measures which should be adopted for lightning protection. The institution of a standard system of lightning protection would entail some very costly precautions. Instead, the existing portions of the installations have been utilised to a large extent to arrange for the lightning current to be conducted to earth. The report describes a number of measures which connect different metal roof structures to form a collecting and discharging system. A further suggestion is for the installation of surge protection for the electronic systems and a triggered discharging system for the power supply. The telephone exchange equipment is considered to be already sufficiently protected by the precautions at present being adopted. The measures proposed are felt to afford an acceptable level of protection at a reasonable cost.

This study was initiated by the Safety Committee in FOA3.

(70) FOA report C30241-E
Implementation of a display program for coded map databases.
Tomas Claesson September 1981

The report presents the implementation of a display program for coded map databases. This is an examination project carried out in the Image-processing branch of the FOA. The Display program is a decoder for the Display RC code (1). This code permits the efficient coding of binary images, and it combines efficiency of storage with ease of access.

(71) FOA report C30246-E
7th European Conference on Optical Communication
Hans Ekblom November 1981

Visit to Denmark, 8-11 September 1981.

Object: The purpose of the visit was to attend a conference on communication by optical fibres, in order to gain an overall impression of the present state of the art.

Object of the visit and organisational information: The conference was organised by the Electromagnetics Institute, Technical University of Denmark in conjunction with a number of institutes both in Denmark and other countries. The official title of the conference - 7th European Conference on Optical Communication shows that this is the seventh conference of its kind.

(72) FOA report C30247-E
Microwave tubes. 2nd Review of the literature, covering 1980
Herbert Stevskal November 1981

Trends in development for microwave tubes are analysed year by year, supported by a comprehensive review of the literature. As regards conventional microwave tubes, the greatest activity was found to concern travelling-wave tubes. Among recent high-powered oscillators the gyrotron has reached the stage where individual models are commercially available. Other new types of amplifiers and oscillators are at the R&D stage. Some of them for example produce very high power at UHF frequencies, while

others produce moderate or even very high power at millimetre wavelengths. This field is felt to be in a state of very active development, partly due to the availability of relativistic electron beams which permit extremely high power, *eg* a 3 GW pulse power in the X-band using a relativistic positive-grid oscillator (reflex triode).

(73) FOA report C30248-E
The design of FET amplifiers for 9.4 GHz
Carl-Gustaf Svensson November 1981

This report describes the development of a 9.4 GHz GaAs FET amplifier. It is intended for use as a pre-amplifier in a radar receiver at present under development in FOA360.

(74) FOA report C30252-E
A method of calculating cascade-coupled two-part networks, with applied examples drawn from filtering and aerial techniques
Åke Bergquist December 1981

A method has been developed for simplifying the calculation of cascade-coupled two-part networks, which is illustrated by the analysis of bandpass filters. A simplified method of synthesising them is also demonstrated which, together with the method of analysis, will permit the synthesis of aerials with Chebyshev- or Butterworth-type radiation patterns with a controllable zero direction. The possibility of synthesising quarter-wave transformers by repeated analysis is also discussed as one likely field of application.

E1 Reconnaissance, target location and fire control

(75) FOA report C30221-E1
Experience from tests with a CO_2 laser radar
Kai Gullberg and Anders Widén September 1981

The report describes some practical optical problems connected with beam patterns and components which arose during work on CO_2 laser radars at the FOA. It discusses heterodyne detection with acoustic-optical modulation and Doppler laser radars. This work led to the laser radar reported on in FOA report C30220-E1 1981, Studies of Target Signatures with a Coherent Laser Radar, by G. Bolander, K. Gullberg, I. Renhorn, O. Steinvall and A. Widén.

(76) FOA report C30223-E1
Detection of periodically fluctuating noise
A. Gjärdman and L. Götherström June 1981

Noise and interference from vessels are often modulated in the high-frequency range by periodic cavitation from the vessel's propeller. This makes it possible to distinguish two vessels by analysing the demodulated high-frequency noise. The report demonstrates that the s/n ratio after demodulation is directly proportional to the ratio between the bandwidths of the pre- and post-detector filters, multiplied by the square of the depth of modulation for a small s/n ratio at the detector input.

(77) FOA report C30228-E1
IMIO - a routine library for input-output of image data on the DEC-10
A user's guide
Gunilla Lönnemark September 1981

IMIO is a collection of routines intended for the input and output of image or other data in matrix form, stored either on disc or magnetic tape.

(78) FOA report C30229-E1
Stochastic relaxation
Tommy Elfving and Jan-Olof Eklundh June 1981

What is termed the stochastic relaxation method is a technique which can be applied to the automatic classification of the elements of images or sections of images. The method is described in the report as an optimisation problem. A first-order Kuhn-Tucker condition is derived for the model. The fixed points are further characterised by a well-known algorithm proposed by Rosenfeld, Hummel and Zucker by means of these conditions. Finally a local convergence result is demonstrated, and the applicability of the statement of optimisation is discussed.

(79) FOA report C30232-E1
Design of a LSI circuit containing an IR detector array with electronic multiplexing
Rolf Helgodt and others September 1981

This report describes the design of a LSI circuit containing, among other things, an array having four IR detectors. This circuit forms part of a Multi-Project Chip which was designed in the Spring of 1981. The project was organised by the LSI Design Center at Linköping College of Technology.

(80) FOA report C30235-E1
The Marr-Hildreth model for detecting the edges of an image. Formation of a programming system
Kristina Ernstsson and others October 1981

The report describes the model proposed by D. Marr and E. Hildreth for the detection of edges, and various methods of treating such edges. A programming system has been devised for a number of methods, *eg* such that the edge should not be indefinitely faint and that adjacent edge points should lie in approximately the same direction and be of similar definition in order to be regarded as 'good' edge points. Results are also compared from various sizes of operator.

Results gained from the different methods are presented in the form of diagrams and discussions in the report.

(81) FOA report C30236-E1
Report on a visit to Canada and the USA
Håkan Klevebrant and others October 1981

A project under the co-operation agreement between FOA and STU in the field of marine technology deals with the application of technical practice under Arctic conditions. The project consists of investigating possibilities of developing new techniques for better coping with hostile environmental conditions in off-shore oil and gas operations. As part of this project a visit to Canada was planned in order to study how problems are tackled involving severe cold, sea ice and icebergs in off-shore activities. A number of research institutes and firms in Canada were visited for this purpose, and the outcome of these visits was altogether satisfactory.

In connection with this visit under the project, a number of other visits were also paid to institutes and firms in the USA as well as Canada in order to acquire information on activities concerning advanced remote-controlled underwater vessels and laser bathymetry.

(82) FOA report C30237-E1
Report on a visit to Washington DC, 8-16 April 1981
Jörgen Lexander October 1981

In connection with an engagement at the Swedish Export Council's Commercial Bureau in Houston, a visit was paid to Washington in order to gather information on the regulations for inspection and maintenance of underwater-based installations for off-shore oil and gas production. It was also hoped to gather information on current developments in free-swimming remote-controlled submarine vehicles, and on the technique for clearing oil spillage at sea. With the support obtained from the US Geological Survey in arranging the visits, the visit proved to be very productive.

(83) FOA report C30238-E1
Report on engagements at the Swedish Export Council's Commercial Bureau in Houston, USA
Jörgen Lexander October 1981

The report concerns the participation by one member of FOA in activities at the Swedish Export Council's Commercial Bureau in Houston, USA, over a 5 month period 1 February to 1 July 1981. The object of this engagement was to gain information and experience of the market in the USA involved in the exploitation of off-shore oil and gas, and in particular of the marine techniques connected with them. The visit was supported by funds under the programme for joint investment by FOA and STU in the development of civil marine technology. The experience gained from serving with the Commercial Bureau was very good.

(84) FOA report C30240-E1, E3
Observations with a 35 GHz radiometer imaging system of terrain at Malmslätt, July 1980
Gunnar Stenström and Ain Sume October 1981

The report presents measurements made with a 35 GHz radiometer imaging system in July 1980, of the terrain round the flight-control tower at F13M in Malmslätt near to Linköping. A Dicke radiometer was used with a 60 cm parabolic Cassegrain antenna, controlled by an on-board computer, which also took care of data-collection and storage. The radiometer images were colour-coded and displayed on-line on a TV screen, and are reproduced in the report. A selected area of ground was recorded about once an hour during a period of 16½ hours in order to observe variations over time in measured antenna temperatures and their correlations with diurnal changes and meteorological changes. The importance of the reflection of cold sky radiation on smooth surfaces (metals, plastics and roads) was demonstrated, which leads to a contrast with their poorer reflecting surroundings.

(85) FOA report C30244-E1
The detection of, and damage to radar aerials by a CO_2 laser
K. Gullberg and D. Letalick November 1981

In order to assess the possibility of detecting a radar aerial by its reflection of a laser beam, the target surface of a radar was calculated. A rough estimate was also made of the beam power required of a CO_2 laser in order to produce an effect on a radar aerial. No conclusions were drawn from the calculated information. The calculations were made on a LME Spira aerial.

E2 Communications

(86) FOA report A30027-E2
Radio equipment for investigating wave propagation at 11, 18 and 36 GHz
Bernt Danielsson and Lennart Nilsson May 1981

The present report contains a description of radio equipment forming part of a measuring system for studying atmospheric effects on the propagation of radio waves at frequencies above 10 GHz. In order to give some idea of the scope of the measurements, the report also contains a brief description of the station sites and measuring paths.

The investigations were performed in co-operation between FOA and the Swedish Telecommunications Authority under a European joint research project entitled "Influence of atmospheric conditions on electromagnetic wave propagation at frequencies above 10 GHz, Project Cost 25/4".

Swedish contributions cover the frequency bands 11, 18 and 36 GHz and measuring paths of 5, 15 and 41 km. Besides variations in the attenuation of propagation, the depolarising effect of the atmosphere was also studied over certain paths.

The transmitters usually operate with horizontal polarisation. The table below shows link designators, frequency bands, measuring paths and the polarisation as received.

Path	11 GHz band	18 GHz band	36 GHz band
5 km	-	F 3 (HP)	F 6 (HP + VP)
15 km	F 1 (HP)	F 4 (HP + VP)	F 7 (HP + VP)
41 km	F 2 (HP)	F 5 (HP + VP)	-

As the table shows, the activity covered a total of seven transmitters and eleven receivers.

Data was collected by a computer system based on a PDP 11/10. In parallel with the computer-based data collection, similar recordings on all the measuring channels were also made for control and monitoring purposes.

The measurements are expected to continue over a minimum period of 3 years, their object being to create a body of data which will be representative of conditions in Sweden, and may form a basis for the dimensioning of systems and the optimisation of performance, both for established and new fields of application of radio communication systems at frequencies above 10 GHz.

This report is one of a series containing the results from the Swedish COST Project 25/4: Investigations of wave propagation at frequencies above 10 GHz.

(87) FOA report A30028-E2
Variations in the attenuation of propagation at 11, 18 and 36 GHz
Bernt Danielsson and Lennart Nilsson May 1981

This is a report on the results of 1 year's measurements of field strength at 11, 18 and 36 GHz over a line-of-sight path 15 km long. The depolarising effect of the atmosphere was also studied at 18 and 36 GHz. Attenuation and depolarisation due to atmospheric anomalies and precipitation were investigated.

The measurements formed part of a joint European research project entitled "Influence of atmospheric conditions on electromagnetic wave propagation at frequencies above 10 GHz, project Cost 25/4".

The Swedish contributions made in co-operation between FOA and the Swedish Telecommunications Authority altogether cover paths of 5, 15 and 41 km, and frequencies of 11, 18 and 36 GHz.

The result of the field-strength measurements shows that both atmospheric anomalies and precipitation cause serious disturbance to propagation, while both cases present characteristic differences in their effects. Atmospheric anomalies cause multi-path propagation which in turn produces a widely varying attenuation of propagation, on which is superimposed a rapid and deep fading, whereas signal variations due to precipitation exhibit a slower pattern as a rule. In both cases the effects are a function of frequency, in that the effect increases with increasing frequency.

The distribution curves for propagation attenuation between July 1976 and June 1977 are presented for the three cases of rain, snow and atmospheric anomalies.

The measurements show that depolarisation occurs in connection with serious disturbances of propagation. The greatest depolarising effect was caused by atmospheric anomalies (multi-path propagation).

This report is one of a series which reports the results of the Swedish COST Project 25/4: Investigations of wave propagation at frequencies above 10 GHz.

(88) FOA report C30253-E2
A digital radio link; the quality of communication in multi-path propagation
Charlie Yeh December 1981

This report deals with digital radio links liable to multi-path propagation, with special reference to selective fading. The effect of selective fading is analysed, starting from two interfering components, one direct and one reflected component, which are rotated against each other. An estimate is given of the maximum rotation for a mirror-image reflection. This is important, since inter-symbol interference increases with rotation.

A model is also discussed for predicting non-availability for a digital radio link in multi-path propagation, as a function of the parameters of the system and those which figure in wave propagation. The model shows that non-availability varies with distance by a power of 6 law, which makes distance an important parameter in the design of radio links.

Finally some effective measures are described for improving availability, such as adaptive smoothing of the received signal spectrum, and diversity reception.

E3 Guidance, navigation and target identification

(89) FOA report C30233-E3
Report of a conference entitled "Status report and future outlook for defence applications of electro-optical systems, infra-red, lasers and related technologies".
Björn Nilsson September 1981

On 9-10 March 1981 the author attended a conference in London on the subject of "Status report and future outlook for defence applications of electro-optical systems, infra-red, lasers and related technologies". The visit was funded by FMV-M under the heading of a feasibility study of end-phase guided projectiles against naval targets. The arrangers were TMSA and TTS (The Technical Marketing Society of America and the Technology Transfer Society). The conference was chaired by the then director of the

US Army Night Vision and Electro-optical Laboratory, Dr Edward Sheehan. The subject headings which led to our attendance were "Focal Plane Technology", "Impact of Image and Signal Processing Advances", "Impact of Smoke/Haze/Water on E-O" and "Battlefield Applications". This report concerns only the conference with respect to end-phase guidance of projectiles, and thus constitutes an account under the heading of the above feasibility study. The conference has also been generally reported within FOA as a brief visit report.

E4 Countermeasures, including signal interception and technical intelligence

(90) FOA report C20434-E4
Effect of the content and type of filler and plasticiser on the properties of a conventional styrene butadiene rubber
Tord Åredal December 1981

Fourteen different rubbers were investigated, based on copolymers of 24% styrene and the rest butadiene. The materials are different as regards the type and content of filler (SAF, HAF and graphite) and plasticiser (Nylsolvex 125 and DOS). Their static mechanical properties, temperature of vitrification and complex moduli of elasticity (3.5 to 110 Hz, -50, +50°C) were determined. Master curves were plotted for modulus of elasticity, modulus of loss and loss factor. The constants were determined in a mean WLF equation for all the materials. The effect of the amplitude of vibration on the modulus of elasticity was studied. A comparison was made between the modulus of elasticity and the elastic shear modulus for six of the materials. Finally the morphology of three of the materials was studied.

The experimental work was mostly carried out by the author under a project contracted out by FOA to the KTH Department of Polymer Technology. The manuscript of the report was drafted by the author on a consultancy basis on completion of the contract.

H HUMAN ENVIRONMENT

H1 Investigations, future projections

(91) FOA report C54035-H1
Examination of air samples from the submarine Sjöhund, August 1979
L.H. Andersson and others October 1981

At the direction of FMV-M:FU the occurrence of pollution in the submarine Sjöhund, type Sea Serpent during a dive was examined for the total concentration of carbon dioxide, the concentration of aerosols (dust particles and liquid droplets) and the occurrence of inorganic components in airborne dust. The presence of oil particles and gaseous carbon dioxide, owing to an unintentional oil leak, and of galley fumes was observed.

A list of recommendations and precautions for improving the quality of air on board ship was drawn up.

(92) FOA report C 54036-H1
Examination of air samples from the submarine Näcken, August 1980
Åsa Bränd-Persson and others October 1981

At the instance of FMV-M:FU the presence of pollution of the atmosphere on board the submarine Näcken was investigated for the particle count (aerosols) and content of carbon dioxide.

A comparison was drawn with results from the corresponding investigation in 1979 on board the submarine Sjöhund, type Sea Serpent.

(93) FOA report C54037-H1
Is sound a mosquito-repellant?
W. Thorsell and others October 1981

A number of commercially available "acoustic mosquito repellants", some of them recommended for use in the Defence services, were tested for their mosquito-repellant effect, both in the laboratory and in the field. The studies barely confirmed the alleged repellant effects.

(94) Report XLV. KAMEDO. H1
Emergency medical studies in connection with two Swedish railway accidents in 1980. The train collision in Storsund on 2 June 1980 and the derailment at Upplands Väsby on 24 August 1980
Henry Lorin

Several serious railway accidents occurred in Sweden in 1980. It was therefore felt to be of interest for KAMEDO to study the rescue operations and medical activities at two of them, since many people had been killed or seriously injured in them. One of them occurred at Storsund near Borlänge and the other at Upplands Väsby north of Stockholm.

Information was therefore collected, processed and co-ordinated. In some cases KAMEDO observers were responsible for reporting, and in others it was people who took a direct part in the rescue operations who provided the information. Information was also supplied from various bodies who assisted with the emergency work, *eg* LAC on the lines in question, the Falu hospital and the fire brigade at Borlänge. In addition a psychiatrist, in the course of several months' service with FOA 5, studied the special mental problems arising out of the serious accident at Storsund.

I hope that the experience reported in this account will afford an additional contribution to the knowledge of emergency medicine.

(95) H1
Structure and function of neutrophil leukocytes from patients with the immotile-cilia syndrome (in English)
Björn Afzelius and others

Acta med Scand. (1980), 208, 145-154; FOA5.

(96) H1
The quantification of neutrophil orientation and migration under agarose - a new method for detecting directed and random movements (in English)
Jan Palmblad and others

Journal of Immunological Methods (1981), 44, 37-53; FOA5.

(97) H1
The relationship between luminol chemiluminescence and killing of staphylococcus aureus by neutrophil granulocytes (in English)
L. Ewetz and others

Blut (1981) 446: 1-9; FOA5.

(98) H1
Leukotriene B_4 - a stereospecific stimulator for release of lysosomal enzymes from neutrophils (in English)
Ingiäld Hafstrom and others

FEBS Letters (1981), 130, 1 July; FOA5.

(99) Concise Report: H1
Leukotriene B_4 is a potent and stereospecific stimulator of neutrophil chemotaxis and adherence (in English)
Jan Palmblad and others

Bloot (1981), 58, 3, September; FOA5

H2 Man and technical systems

(100) FOA report C56027-H2
Identification of target vehicles from the air. A field trial.
Björn Norlin November 1981

Airborne weapon systems with equipment for automatic target spotting enable the pilot to identify targets at greater ranges than before. In order to investigate the distance at which targets can be identified when once spotted, a field experiment was conducted using light aircraft (Type 61). Six test subjects with no previous experience of identification from the air identified five vehicle targets at known locations on the ground. A total of 180 overflights were made.

Most of them gave their answers from about 2.5 km distance from the target. Throughout the range of distances at which the subjects themselves opted to give an answer (1 to 4.5 km), the proportion of correct identifications was practically constant (70%). This shows that factors other than distance from the target itself affected identification performance. Another interpretation of the result is that the subjects made use of a constant decision-making criterion.

(101) FOA report C58011-H2
The development of effective divers' gloves
John Adolfson and others November 1981

A functional study of a new glove system for divers was carried out with 10 test subjects at 5 m depth in a diving tank. The system consisted of a moulded five-finger outer glove of 1.1mm thick latex rubber shaped to the natural hand, and a knitted inner glove of synthetic fibre which did not absorb moisture and fitted the hand so that movements of air in the micro-climate were prevented. The average water temperature was +0.1°C, and diving periods varied between 30 and 45 minutes. Rectal temperatures and 14 skin temperatures were continuously recorded. Manual strength, motor ability and tactile discrimination were tested. A conventional deep-sea diving glove was tested at the same time for comparison, and the diving costume used was the constant-volume Unisuit.

Regardless of which glove system was used, mean body temperature during the last 30 minutes of a dive fell at 1.6°C/hour. Mean hand temperatures were lower throughout with the thin glove than with the thick deep-sea diving glove, and fell faster initially, while towards the end of the dive tending to stabilise at about 10°C. The lowest hand temperatures were measured with the thin glove, in some subjects being about 10°C at the thumb and about 9°C at the forefinger. Three subjects exhibited signs of cold-induced blood-vessel dilation (Lewis reaction).

In a normal dry environment maximum manual strength fell by 20% when working with the thin glove compared with bare-hand performance. The corresponding figure with the thick deep-sea diving glove was 40%. After about 40 minutes in cold water the maximum strength developed with the thin glove was 50% lower, and with the thick deep-sea diving glove 70% lower.

With the thin glove the ability to assemble bolts was practically unaffected both when dry and after about 30 minutes in cold water. With the thick deep-sea diving glove the loss of performance was about 50%, both when dry and after 30 minutes in cold water.

Tactile discriminating ability with the thin glove was only slightly affected in the normal dry environment (loss of performance was about 2%). With the thick deep-sea diving glove it was seriously affected (loss of performance was about 39%). The thickness of the glove is thus very important for sensitivity in the hand and fingers. Hand temperature was also important. For a mean hand temperature of 17-18°C, tactile discriminating ability was reduced by an average of 5.6%, and with a mean hand temperature of 12.0 to 12.5°C by about 12.5% with the thin glove. For one subject with a mean hand temperature of 9.7°C, his tactile discriminating ability was reduced by 83%.

A comparative study should be made of both glove systems in a wet, cold environment at increased pressure, when the neoprene glove is compressed, which is not the case with the latex rubber glove.

The thin glove system being tested is colder than the conventional deep-sea diving glove under the conditions as reported for this experiment, though appreciably better functionally. Continued experiments should be performed with a glove system designed on the same principle, but of a thicker material.

M INTERDISCIPLINARY STUDIES AND INVESTIGATIONS

M2 Environment and social studies

(102) FOA report C10192-M2
Fire, buildings and energy
Nils-Olov Norlander October 1981

Two main areas, those of housing and energy systems, were studied with a view to future fire risks. Risks from different trends in development are identified in order for them to be countered in good time.

(103) DFE report No.39. M2
Energy - for what purpose and how much?
Peter Steen and others

Could Sweden manage on half of its current power consumption in 20 or 30 years?

Is this possible despite the increased consumption of goods and services?

Could it be done without heavy extra costs or capital investments?

The large increases in oil prices of the 70's and technical developments have meant that economic techniques now exist which are much more efficient in energy than those in use today.

These new techniques do not require any extra great capital investment if they are progressively introduced in the general course of continual renewal in society.

A deliberate choice of techniques may permit some radical reductions in overall energy use, even with an increased consumption of goods and services.

Energy - for what purpose and how much? is a self-contained continuation of a future projection, "Solar power or uranium, energy choice of the future" (M. Lönnroth, T. Johansson, P. Steen), which dealt with various possibilities for supplying energy and the factors which affect the development of the energy system.

M3 Security aspects of environmental studies

(104) FOA report C10118-M3
Review of the international debate on the nature of the future conventional war in Europe
Lars B. Wallin June 1981

Studies of the international debate on the military problems of NATO and the Warsaw Pact, on the development of weapons and their consequences for the nature of a future war in Europe are of some assistance when we try to visualise our future environment in military terms and those of security policy.

This report gives a review of that part of the debate dealing with problems of conventional warfare.

Part I describes the NATO and Warsaw Pact alliances, the aspect of their military formations, their disposition and presumed performance in war, and it discusses some features of the possible battlefield.

Part II summarises the views of a number of defence commentators on the military situation in Europe, developments in weapons technology and their consequences.

Part III takes up the debate on some important problem subjects - electronic warfare, air forces and air defence, the possibilities of helicopters, urban terrains etc.

Part I was actually conceived as a background to the two following parts, though all three, and also the individual sections are self-contained, and can be read independently.

The manuscript of the main text is dated December 1979, while the foreward was written in September 1980, at the same time as the introduction and the review were being revised and expanded.

(105) FOA report C10188-M3
The effect of increases in crude oil prices on the economy of India
Erik Moberg August 1981

The price of crude oil was increased during the 1970s, mainly in 1973-74 and 1979-80. It is mainly the increases of 1973-74 which are dealt with here. These did not have any serious negative effect on the Indian economy, and it may in fact have been slightly positive because of some indirect positive effects, such as increased demands from the oil-producers for Indian manpower and Indian exports, and the high rate of world inflation, which reduced the Indian debt-servicing ratio (the ratio between the annual cost of loans and export earnings). The most important single factor was transfers from Indian immigrant labour in Western Asia. There is no sign of the long-term conditions for growth having been impaired by increased oil prices, in fact the reverse. However as regards the increases of 1979-80, the overall effect on the Indian economy may have been negative. The additional price increases do not seem to have involved any corresponding further demand from the oil producers for goods and services from the rest of the world.

(106) FOA report C10194-M3
Technological development in the Soviet Union
Jan Åke Dellenbrant and Adam Perlowski September 1981

The present article contains an assessment of the technological level in the Soviet Union and the importance of technological development for the community, in particular the economy. The study is based largely on current Soviet material.

It is introduced by a review of the Soviet system of R&D, with special attention to the effectiveness of research. This is followed by a discussion of technological development in a number of fields such as machine tools and computers, the use of metals and the employment of manpower.

The July Reform of 1979 is also considered, with its importance for the development of technology. Foreign trade and the import of technology is given detailed treatment, and military technology is covered in a separate section.

The study forms part of the "Eastern Project".

(107) FOA report C10196-M3
Soviet policy in the Middle East. A survey.
Mette Skak November 1981

One of the most important observations in this report is that the Middle East policy of the USSR does not appear to be based on any overriding strategy, but is ultimately opportunistic.

Even though hitherto military support has been the most effective means of advancing Soviet influence among the Arabs, there is much to suggest that traditional diplomatic methods are at present being upgraded.

In a context of a conspicuously increased Soviet interest in Western Europe and the possibility of a weakening of the cohesion of NATO, it would seem reasonable to assume that the USSR will tone down the military initiative throughout the Middle East.

The study forms part of the "Trend Project".

M6 Information systems

(108) FOA report C10177-M6
Functional keys for *VIDED* on the Volker-Craig 414 terminal
Tord Beckman October 1981

The report describes how special keys on the Volker-Craig 414 terminal can be used for executing some of the commonest commands in the *VIDED* textual editing program.

M8 Joint research and study projects

(109) FOA report C10170-M8
A general approximation method associated with the Bernstein polynomial
Staffan Wrigge December 1981

Let $f(x)$ be continuous and real in the range $[0,1]$. It is found that $\lim_{n=\infty} B_n(x,f) = f(x)$ uniformly in the range $[0,1]$, where $B_n(x,f)$ is defined as

$$B_n(x,f) = \sum_{k=0}^{n} (k^n) f\left(\frac{k}{n}\right) x^k (1-x)^{n-k} \quad .$$

The corresponding Bernstein approximation of degree n with respect to the function f and the norm N are defined as

$$B_n(x,f,N) = \sum_{k=0}^{n} a_k(n)x^k(1-x)^{n-k}$$

in which the coefficients $a_k(n)$ are chosen such that

$$N\left[f(x) - \sum_{k=0}^{n} a_k(n)x^k(1-x)^{n-k}\right]$$

assumes its minimum value.

We study in particular $\min D^2(w)$, where $D^2(w)$ is defined as

$$D^2(w) = \int_0^1 \left(f(x) - \sum_{k=0}^{n} a_k(n)\, x^k(1-x)^{n-k}\right)^2 x^m(1-x)^m dx ,$$

with $m\varepsilon\{0,1,2,\ldots\}$.

It is proved that the approximations studied in an earlier report (C10158-M8) are the special cases

(i) $f(\frac{1}{2} + x) = f(\frac{1}{2} - x)$

(ii) $f(0) = f(1) = 0$

(iii) $f(x)$ is analytic and real when x is real,

or

(j) $f(\frac{1}{2} + x) = -f(\frac{1}{2} - x)$

(jj) $f(0) = (f(\frac{1}{2})) = f(1) = 0$

(jjj) $f(x)$ is analytic and real when x is real.

T CERTAIN MEASURES FOR LIMITATION AND CONTROL OF ARMAMENTS

T1 Seismological multiple stations

(110) FOA report C20427-T1
Seismology 1980. Nuclear test ban verification. Earthquake and earth resource investigation (in English)
Brittmarie Tygård October 1981

This annual report for 1980, which is the first in a planned series, gives a general account of seismological activities at the Swedish Defence Research Establishment (FOA).

The principal activity by the FOA seismological unit concerns the seismological detection and monitoring of underground nuclear explosions. In the course of the year a special study was made of the way in which International Data Centres should be organised as part of a worldwide seismological monitoring system.

A long-term study is also being conducted at the FOA concerning the risks of earthquake damage to Swedish nuclear power stations. As part of this project a special network of seismological stations is being operated in southern and central Sweden.

Two seismic prospecting projects are also being studied at the FOA. One of them concerns the development of seismic methods of oil exploration, while the other involves studies of crystalline rock by means of seismic measurements between boreholes.

(111) FOA report C20431-T1
Common database experiment - progress report on data analysis (in English)
Gunnel Barkeby and others November 1981

The object of a Common Data Base Experiment (CDBE) was to create a seismic database of high quality from a large number of stations distributed worldwide. The database is to be used for studying various problems connected with the construction of an international verification system for a CTB, and in particular with the functions of international data centres. This report summarises the results obtained so far at the temporary data centre installation at the FOA in Stockholm. The data which were analysed were collected during a 2-week period in October 1980. Bulletins, known as Level I data, were obtained from 59 stations in 21 countries, and wave-form data, known as Level II data, from 58 stations in 13 countries. The results presented are far from being complete, and should be regarded as preliminary. This report, which was submitted to the meeting of the seismic experts' group of the Committee on Disarmament in Geneva in August 1981, summarises the experience gained, and draws some preliminary conclusions.