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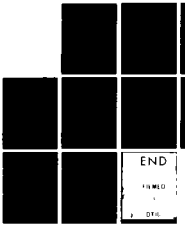

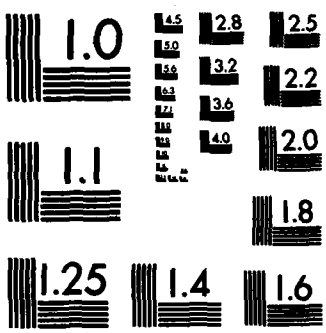

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ROYAL AIRCRAFT ESTABLISHMENT

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Library Translation 2085

April 1982

SWEDISH DEFENCE RESEARCH ABSTRACTS 81/82-1

by

National Defence Research Institute, Stockholm

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FRÖ FÖRSVARS FORSKNINGS REFERAT 81/82-1

by

National Defence Research Institute, Stockholm

Translator
D.P. Barrett

Translation editor
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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 ir English. This volume is the first 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

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A PROTECTION - ATOMIC

A3 Effects of nuclear explosions, and protective measures

(1) FOA report A10003-A3
Radiak 78. Study of a possible review of the organisation for nuclear fallout protection in the Combined Defence System
Kay Edvardson and others August 1981

Measures to be taken by the Combined Defence System for protection against radioactive fallout are based on the report Radiak 55. Certain changes have taken place since then as regards the threat scenario and the technical and organisational situation. It was therefore suggested in Spring 1978 that the FOA in conjunction with the Combined Defence authorities most closely affected would undertake the study under reference.

The study was concentrated on a survey and a critical evaluation of the current organisation for fallout protection, mainly as regards indication, reporting and certain technical aspects. On the other hand, those measures chiefly respecting radioactive fallout were not considered.

The study is devoted mainly to protection from radioactivity. Protection from chemical weapons has been added to the final phase of the study in a limited form. The military organisation for radioactive protection is covered only superficially.

(2) FOA report B40118-A3
Age and dose related carcinogenicity of ^{90}Sr (in English)
A. Nilsson and others March 1981

Three different doses of $^{90}Sr(NO_3)_2$ (29.6, 14.8 and 7.4 kBq/g body weight) were administered as a single peritoneal treatment to four different age groups of CBA mice, aged 25, 75, 150 and 300 days.

Liability to develop bone tumours (osteosarcomas) was irrespective of the dose of ^{90}Sr the greatest in the 75-day groups and lowest in the two oldest groups.

Lymphoreticular tumours were inversely dose-related, with the highest frequency in the lowest dose groups and irrespective of the age at exposure. The frequency of soft-tissue tumours indicates a stronger dependence on age at exposure than on the dose.

Offprint from Acta Radiologica Oncology (1980), 19, Fasc 3, 223-228;
FOA reprints 1980/81:41.

(3) FOA report B40119-A3
Induction of neoplasia by ^{140}Ba in mice (in English)
A. Nilsson and others March 1981

$C_{57}B1$ mice of both sexes were injected with ^{140}Ba nitrate intra-peritoneally in three different doses (55.5, 37.0 and 18.5 kBq/g body weight). Bone tumours (osteosarcomas) were observed in all the groups, of which the osteoblastic type was predominant. Female animals developed more tumours than males at the middle and highest dose levels. Calculated doses in the femur, lumbar vertebrae and sternum varied between 6 and 0.7 Gy.

Offprint from Acta Radiologica Oncology (1980), 19, Fasc 4, 293-297;
FOA reprints 1980/81:42.

(4) FOA report B40120-A3
Effects of ^{90}Sr on ovaries of foetal mice depending on the time for administration during pregnancy (in English)
Curt Rönnbäck March 1981

Pregnant CBA mice were injected with 10 µCi of ^{90}Sr at 8, 11, 13, 16 or 19 days after mating. The effects on the ovaries of individuals treated in utero were examined on their attaining either 28, 56 or 84 days of age. The result consists of a comparison between the number of cells at various stages of development in strontium-contaminated individuals and in untreated control animals.

The reduction in the number of ovary cells was highly correlated with the time of administration of the nuclides. The later contamination occurred during foetal development, the stronger were the effects.

The majority of injurious effects could be noted among oocytes and the early follicle stages, the former being found to be the most sensitive to radiation. The remaining cells in the ovaries are assumed to constitute a numerically reduced pool of functionally normal cells.

FOA reprints 1980/81:43.

(5) FOA report B40121-A3
Effect of syngeneic bone marrow and thymus cell transplantation to ^{90}Sr irradiated mice (in English)
A. Nilsson and others March 1981

CBA mice were exposed to ^{90}Sr (14.8 and 25.9 kBq/g body weight I.P. respectively) and were then transplanted with syngeneic bone marrow and thymus cells and a combination of bone marrow and thymus cells by intravenous injection. At the lower dose of ^{90}Sr the groups of animals treated with cell transplants yielded a higher frequency of lymphoreticular tumours than the corresponding untreated controls. Animals receiving bone marrow transplants exhibited a similar increase at the higher dose. As regards bone tumours (osteosarcomas), there was a tendency to a lower frequency in the cell-transplanted animals, although the picture was difficult to interpret and justifies further investigation.

Offprint from Acta Radiologica Oncology (1980), 19, Fasc. 1, 29-36;

FOA reprints 1980/81:44.

(6) FOA report B40128-A3
Induction of pituitary tumours by combination of oestrogenic hormones and ^{90}Sr
A. Nilsson and others (in English) August 1981

CBA mice treated with ^{90}Sr (0.925, 1.850 and 7.400 kBq/g body weight) in combination with oestrogenic hormones (Estradurin, Leo) exhibited respectively 44, 37 and 30% tumours in the front pituitary lobe (pars distalis). Corresponding animal groups treated with ^{90}Sr alone showed respectively 1, 3 and 2% of tumours, while those treated with oestrogen alone showed 10% tumours. The synergetic effect of ^{90}Sr and oestrogen is attributed chiefly to the growth-stimulating effect of oestrogen on pituitary cells and to their greater sensitivity to radiation from adjacent bone tissue. The histological picture is described at the initial stage of the tumours. The tumours are classified as adenomas and carcinomas, and on the basis of their manner of growth and staining properties are divided into sinusoidal, trabecular and solid types on the one hand, and into acidophilic, basophilic and chromophobic types on the other.

(7) FOA report B40129-A3
Penetration of substances into tumour tissue - a methodological study of cellular spheroids (in English)
Thore Nederman and others August 1981

The penetration of ^{3}H thymidine, ^{3}H-D leucine, ^{125}I albumin and the drugs ^{3}H-5 fluoro-uracil and ^{3}H vinblastin into human glioma spheroids was studied by a method based on freezing, freeze-drying, steam fixation, embedding in wax, dry sectioning and contact autoradiography. No significant disturbances in the distribution of water-soluble compounds could be observed when using this method. Thymidine and D-leucine penetrated the spheroids quite rapidly, while albumin showed a reduced penetration rate. The concentration of albumin was highest in the periphery of the spheroids, while only small quantities could be detected in deeper regions. A significant difference could be observed in the penetration abilities of the two drugs. Fluoro-uracil penetrated freely, while the penetrating ability of vinblastin was only limited.

(8) FOA report B40130-A3
Effect of different ^{90}Sr doses on the microscopic structure of foetal mouse ovaries (in English)
Curt Rönnbäck

Pregnant CBA mice were intravenously injected with different doses of strontium 90 on the 19th day after conception. The quantity of radio strontium administered was between 11.1 and 370 kBq (0.3 - 10 µCi) per animal.

When the foetuses contaminated in utero had reached 28, 56 or 84 days of age the contents of their ovaries were examined for the number of oocytes and follicles at different stages of development, and the effects were analysed.

The effect of the nuclide was expressed as a reduction of the number (frequency) of the cells at different stages, on a comparison between contaminated and untreated females.

The injury (*ie* reduction in the number of cells) was found to be strongly correlated with the logarithm of the dose. The stage most sensitive to radiation (the 'naked' oocytes) was clearly affected, even at the lowest level of dose.

The ratios of $^{90}Y/^{90}Sr$ for the litters and mothers respectively are discussed.

Offprint from Acta Radiologica Oncology (1980), 19, Fasc. 2, 145-152;
FOA reprints 1981/82:06.

(9) FOA report C40137-A3
Instrument to measure ionising radiation from nuclear weapons
Thomas Ulvsand and Göran Hultén July 1981

A census has been taken of various types of radiation-measuring instruments on the Swedish market which are likely to be used in a military connection. The report gives a comprehensive description and evaluation of different types of instrument, listing the manufacturers and their Swedish representatives.

(10) FOA report C40138-A3
Testing of intensimeter RA 37 used in Switzerland
Thomas Ulvsand and Göran Hultén August 1981

The intensimeter "Control and Alarm Radiation Meter, model RA 73" used by the defence services of France and Switzerland was tested with respect to its measuring accuracy under different external conditions. The intensimeter shows a slight dependence

on the level of energy and rate of exposure. The effects of moisture and different temperatures are small (< about 10%). However there is a strong directional dependence for low energies. The instrument is estimated to have a measuring accuracy of less than ±20%.

The intensimeter is small and easy to hold in the hand. Readout is from a logarithmic display which covers both measuring ranges of the instrument (1 mR/h - 1000 R/h).

The intensimeter has two GM tubes, one for high and one for low rates of exposure.

(11) FOA report C40139-A3
Fodder crops, dairy cows and milk production in a 12-mile radius about the Barsebäck nuclear power station
Marianne Gillberg-Wickman May 1981

A realistic assessment of the overall consequences and possible precautions against a major uncontrolled leakage of radioactive materials (radionuclides) calls for a consideration of the importance of the food chain for the transmission of radionuclides to humans. The food chain fodder crop-cow's milk-human constitutes a very important transmission link. Since feeding-stuffs represent the starting point, special attention was paid to the feed budgets of dairy cows and the crops which form the staple constituent in the fodder. The report also contains a brief summary of the literature on the intake and transport of radionuclides in pasture and cereals. Since the consequences of leakage vary with the season, leakages are discussed for both the period spent in stall and the pasture season.

This report is a continuation and expansion of a previous report, Gillberg-Wickman 1979, which gave a review of the principal components of the production and consumption of foodstuffs within a 3-mile radius of the Barsebäck nuclear power station. The area of investigation has been enlarged to cover a 12-mile radius from Barsebäck. The geographical distribution of dairy cattle and milk production has been mapped and an estimate has been formed of the total quantities of milk and dairy products consumed in the area.

(12) FOA report C40140-A3
A model for calculating the absorbed dose to populations taking local weather statistics into consideration (in English)
Leif Svensson October 1981

A model is described for estimating the absorbed dose for populations which have been exposed to airborne radioactive material. It combines the Gaussian model of atmospheric propagation of radionuclides with the local meteorological statistics. Probability distributions showing the number of individuals who received absorbed doses greater than some specified limits have been calculated. These distributions do not include any estimate of the probability of an uncontrolled leakage of radionuclides, they merely reflect the local weather statistics.

B PROTECTION - BIOLOGICAL

B2 Protective measures

(13) FOA report B40127-B2 (B1)
Long-range transmission of bacteria (in English)
Åke Bovallius and others June 1981

Knowledge as to the existence of mechanisms for the long-range transport of airborne bacteria is very limited. This can be partly explained by the fact that natural formations of large-scale aerosol clouds of micro-organisms have a very complicated composition, which means that criteria such as the generally increased content and the presence of special organisms or other materials such as spores or chemicals have had to be used in order to detect whether long-range transport is taking place.

The size of bacteria means that they can remain in an airborne state for lengthy periods owing to their low rate of precipitation. Mathematical models which take account of meteorological and microbiological factors can be utilised to predict the mode of propagation of aerosols. It can be shown that the survival of bacteria, the strength of the source and meteorological factors are the most important considerations for long-range airborne transport.

Aerosols can be generated on a larger or smaller scale. An example of the smaller scale is the spread of airborne bacteria from sewage plant, where experimental data and extrapolated values of propagation models give relatively good agreement. The spread from larger sources such as towns or agricultural areas can occur under favourable conditions for up to 1000 km. Experimental data from samplings at high altitudes, over the sea and snow-covered areas indicate that the long-range transport of airborne bacteria is a phenomenon of general occurrence. It has been found that the long-range transport of airborne bacteria has taken place from the Black Sea to Sweden, over a distance of 1800 km.

Offprint from Annals of the New York Academy of Sciences (1980), 353, pp 186-200;
FOA reprints 1980/81-45.

C PROTECTION - CHEMICAL

C1 Threat scenario

(14) FOA report B40117-C1
Enzyme therapy in cyanide poisoning; effect of rhodanese and sulphur compounds (in English)
Lars Frankenberg September 1980

Purely prepared rhodanese (thiosulphate: cyanide sulphur transferase, EC 2.8.1.1) from beef liver was tested as an antidote in conjunction with various sulphur compounds for cyanide poisoning in mice. The prophylactic effect as an antidote, when the antidote is given intravenously 1 min before an intraperitoneal injection of cyanide, was dependent on the dose, both of the enzyme and the sulphur compound. An optimum dose of the enzyme was found to be about 2000 international units/kg (3 mg/kg of pure enzyme). This dose together with 2 millimoles/kg of sodium thiosulphate raised LD_{50} for potassium cyanide by a factor of 7.6. When the thiosulphate was replaced by the same molar dose of ethane thiosulphonate or propane thiosulphonate, the increase rose to factors of 10.3

and 9.3 respectively. The maximum antidote effect was reached when the doses of ethane thiosulphonate and propane thiosulphonate were increased to 4 millimoles/kg. LD_{50} for cyanide was then increased by 20.8 and 15.4 times respectively. Ethane and propane thiosulphonates when given without rhodanese were however no better antidotes than thiosulphate. Therapy with rhodanese and a sulphur compound also had a good effect on mice when symptoms of cyanide poisoning had already developed.

The prophylactic antidote effect of rhodanese and thiosulphate fell off rapidly with an increasing time interval between injections of antidote and of cyanide. When rhodanese and thiosulphate were given 20 min before the cyanide, the antidote effect became of the same order as for thiosulphate alone.

The antidote effect of the last-named was not reduced within this time interval.

Enzyme activity in blood plasma fell off rapidly after intravenous injection of rhodanese, and enzyme activity could be detected in the urine. No appreciable inactivation could be detected when the enzyme was incubated with whole blood in vitro, although a strong and rapidly developing inhibition occurred when the enzyme was incubated with fresh mouse urine.

C2 Protective measures

(15) FOA report C40128-C2 (B2, A3)
A meteorological measuring system at FOA 4, Part I
Per Fällman and others January 1981

The report documents the meteorological measuring system constructed under the project "Field measurements and atmospheric propagation models".

The system can be divided into the following main sections: recording of meteorological variables, matching of transducer signals to the data-collecting equipment and the collection and transmission of measuring data to a central computer.

The meteorological input variables are recorded by a transducer mounted at different heights on a mast 39 m high. Signals from the transducer are passed to measurement converters which are responsible for matching them to the data-collection unit. A rational and flexible use of data was made possible by a data-collection unit which performs control of the collection process, formatting and transmission of data to the central computer at FOA 4 for processing. This unit also caters for the display of data at the point of measurement.

The report consists of two parts. The first describes in technical terms the functions outlined above. The second part documents in detail the exact construction of the components which form the measuring system.

D AMMUNITION AND WEAPON TECHNOLOGY

D1 Technology of explosives

(16) FOA report C20420-D1
Electrical igniter M/47B and electrical timed igniter M/51 - investigation of the danger of ignition by static electricity
Ola Listh August 1981

The flashover voltage between an igniting element and its casing and sensitivity to static electricity (MIL STD Tests) were determined for the m/47B electrical igniter and the m/51 electrical timed igniter.

Test results show that the two explosive capsules are considerably more sensitive than the civilian VA capsules (military equivalents are electric blasting cartridges 4 and 5). Between 50 and 90% of the capsules detonated during tests. By way of comparison, no VA capsules detonated.

These older types of explosive capsule should be used only in situations where atmospheric humidity is high, and where it can be guaranteed by adopting safety precautions that the capsules will not come into contact with personnel charged with static electricity. It should also be remembered that these capsules are more sensitive than VA explosive capsules with regard also to the electromagnetic environment, *eg* radio and radar signals.

D2 Gunnery technology and associated ballistics

(17) FOA report C20418-D2
Measurement of stability and scatter testing of projectiles having low-drag nose spikes of different lengths. MALFOM 4.4831 Stage 6.
Sven Nordström July 1981

Stage 6 of the project MALFOM 4.4831 was a test of projectiles with a guide section of 1.0 calibre in the barrel and low-drag nose spikes 3.0 to 4.5 calibres long. Stability measurements at four different velocities were performed on the North Range at FMV-F:AP in Karlsborg. This was followed by testing at long-range at two different velocities to determine scatter.

All four types of projectile were both statically and dynamically stable, with the exception of the shortest type at subsonic speed, when three out of six firings were dynamically unstable, indicating a state of equilibrium with a yaw amplitude of about 3^{o}.

The range obtained increases with increasing length of the spike. Scatter is generally independent of the length of spike, and of the same order of magnitude as for the basic type, 7.5 cm HE shell m/40. The sole exception is the projectile with the next longest spike at the greatest velocity, where probably a large initial yaw in certain firings caused a reduction to the mean range and about 65% greater scatter. It should be possible to gain 15-20% greater range by reducing the guide section and increasing the spike length to 3.5 to 4.0 calibres.

The short guide section did not cause any greater initial yaw than in some tests with earlier types. An increase to about 1.3 calibres was ordered however.

Stability tests yielded a lower static moment and thus a greater static stability factor than theoretical calculations with the *PROBOS* program.

D3 Rocket engine technology and associated ballistics

(18) FOA report C20421-D3
Development of a propellant charge with a fuel-rich propellant at Volvo Flygmotor AB (VFA)
Torsten Liljegren and Bert Anderson September 1981

FOA 27 has developed a charge with a fuel-rich propellant at VFA. This propellant contains 40% ammonium perchlorate and 1.5% iron oxide as the combustion catalyst. The fuel consists of a mixture of hydroxyl-terminated polybutadiene and polystyrene in a 1:1 ratio. The charge is a case bonded tubular cylindrical charge with non-insulated end faces with diameters of 120 mm and 80 mm and length 205 mm.

This charge gives an almost constant pressure-time curve and the desired performance: mass flow about 0.130 kg/s and combustion time about 12 s.

(19) FOA report C20424-D3
Further studies of SOFRAM, Interim report 2
Ralf Eliasson September 1981

These studies are a continuation of previously reported preliminary studies of SOFRAM, a ramjet engine with solid fuel. After describing the water-tunnel studies it shows how the combustion efficiency can be improved by a suitable design of the combustion chamber. Specific impulse and combustion rate for the fuels polyethene and HTPB are compared from tests in a combustion chamber. The internal diameter of the tubular fuel element was then 100 mm.

Performance is described at ground level for different inlet conditions which correspond to flight in the speed range Ma = 1.7 to 2.0. It was possible to use the results as the basis for a worked example for a feasible heavy anti-tank missile.

It is planned to continue studies of SOFRAM, including combustion chamber tests of different types of fuel in a scaled-down test bay using fuel of 46 mm internal diameter.

D4 Technical aspects of warheads

(20) FOA report B20032-D4
Dislocation generation in pure aluminium at quasi-static and shock loading (in English)
Torbjörn Svensson

The effect of a frontal shock collision on pure aluminium (99.99%) was studied and compared with the quasi-static deformation ($\dot{\varepsilon} = 10^{-3} s^{-1}$). Impact pressure was varied between 0.5 and 10 GPa. Most of the experiments were made with impacts of 2 μs duration. No clear effect was observed when the duration was increased to 4 μs. The density and structure of dislocations and the yield stress were measured after impact at eight pressures. The pressures were converted to accumulated plastic elongation to permit comparison with quasi-static deformation. By plotting yield stress against the square root of the dislocation density ρ a friction stress was revealed in the impact-stressed material. The effect of the disloaction structure on yield stress is discussed. A quasi-phenomenological model of dislocation generation, $d\rho/d\varepsilon = U - \Omega\rho$, which was found to be applicable to a number of single-phase metals, was tested on both impact-stressed and quasi-statically deformed aluminium. The rate of generation U was found to exceed the typical rate for quasi-static deformation, while the recovery rate Ω is of secondary importance for the actual impact pressure.

Offprint from Shock Waves and High-Strain Phenomena in Metals, Chapter 32, pp 547-560, 1981;
FOA reprints 1981/82:07.

(21) FOA report C20422-D4
The effect of a slurry-type explosive in underwater detonations
Staffan Berglund and others September 1981

The report presents the results of comparative tests between five civilian explosives from different manufacturers, ANFO with varying aluminium contents.

Corresponding parameters are also reported for comparison for the conventional military explosives TNT, Hexotol and Hexotonal.

The charges were detonated at a depth of 21.5 m and pressure-time curves were recorded at four different distances from the charges.

The results reported include maximum pressures, impulse densities and energy densities on the pressure-time curves as functions of distance from the charge and weight of charge for charges consisting of different slurry-type explosives, and the bubble-impulse energy for the respective explosives.

(22) FOA report C20423-D4
Fragmentation data for the M58, HE-RFL-60N and PRB-103 rifle grenades.
Anders Andersson and Fritiof Lithén September 1981

Object: To determine the fragmentation of the above projectiles, with the rate of ejection of splinters and their direction.

Method: Fragmentation data for the M58 and HE-RFL-60N were obtained experimentally, while those for the PRB-103 were calculated mainly on the basis of data from the manufacturer's brochure.

Result: Fragmentation data are tabulated.

D6 Protection from exploding warheads

(23) FOA report C20426-D6
Inward ventilation of combustion gases into shelters
Rolf Jansson and others September 1981

This was an investigation into the inward ventilation of combustion gases into shelters in the event of a fire near to an air intake. The principal danger was considered to be from carbon monoxide. Fires in rubble close to the air intake were studied as likely serious cases.

The gas/air temperature and CO concentration both at the air intake and inside the shelter are reported from five experiments with two different types of rubble. In this connection some different ways of observing the inward ventilation of combustion gases were studied, using components of combustion gases other than odourless and colourless carbon monoxide. The results of CO measurements showed unequivocally that it is necessary to cut off ventilation rapidly when fire breaks out close to an air intake.

D8 System studies

(24) FOA report C20425-D8 (E1, E3)
Visibility in combat. Survey made at FOA, 1 September 1981
Ylva Lindgren September 1981

The report contains the pictorial material presented in the survey on 1 September 1981 concerning combat visibility with a brief text, and a summary of the content of the subsequent discussion.

E CONDUCT OF WAR - INFORMATION AND COMMAND TECHNIQUE

(25) FOA report A30029-E
Information techniques 1981: basic techniques. Technical developments of importance to the activities of FOA in information processing
Bengt Kleman and Sören Palmgren July 1981

Reviews are presented of the state of technical development in the following fields:

Microwave and millimetric wave techniques.

Optronics.

Micro-electronics and micro-computers.

Data processing.

The reviews describe the current situation and trends in development. The latte. are based chiefly on the picture obtained from the direction of research and technical and economic investment in different parts of the world. Information is mainly derived from perusal of the technical literature.

The object of these reviews is to lay a basis for the prediction of developments in military technology and for the long-term direction of technical activities in FOA 3.

E1 Reconnaissance, target location and fire control

(26) FOA report B30045-E1
On image restoration and noise reduction with respect to subjective criteria (in English)
Sten Nyberg

The report deals with the problem of designing methods of image restoration using subjective criteria of image quality. Measures of image quality are reviewed. One problem with many measures is that they require a knowledge which is not always available concerning the scene or the imaging system. Some methods are proposed for estimating definition and signal/noise ratio. These methods are automatic in the sense that they do not call for the designation of edges, homogeneous fields or the like. The application of knowledge about the visual system in restoration generally means that simple closed solutions are not obtained. A new filter is described, with reference to some simple facts concerning the visual system. The criterion has been for the noise level in the resultant image to have a given value. An optimum Wiener filter often reduces noise to an unnecessary extent at the expense of definition.

Iterative methods of image restoration as a rule permit a greater interaction than other methods. One such method investigated is the projection method. After each iteration the image can be analysed automatically in terms of definition and noise. Given a description of the way in which image quality depends on definition and noise, it is possible to discontinue the restoration process at the right iteration.

It is often an advantage to combine the operation of overall restoration with a system of noise reduction which allows for the local properties of the image, *eg* edges etc. A suitable method for the image field has been investigated and extended to two dimensions. Two other methods were also investigated for comparison.

FOA reports, (1981), 15, 1, 1-36.

(27) FOA report B30049-E1
Relaxation: evaluation and applications (in English)
György Fekete and others

The stochastic relaxation method is an iterative method for utilising contextual information in the classification of objects and elements in pictures. The convergent behaviour of the method can be studied empirically by investigating the stepwise changes in the probabilities that a given object belongs to a certain class,

and also the entropy of the corresponding variables. Some examples are quoted which compare three different algorithms for different applications to images.

Offprint from IEEE Transactions on Pattern Analysis and Machine Intelligence (1981), Vol Pami-3, 4, 460-469;

FOA reprints 1981/82-08.

(28) FOA report C20417-E1
A seismic study on cracks in crystalline rock (in English)
Hans Israelson July 1981

The report contains the results from field research with seismic measurements *in situ* in crystalline rock. What is termed the inter-hole method is probably the best qualified for charting cracks. By this method the region between two boreholes is systematically scanned by seismic beams. Seismic signals are generated in one hole by micro-explosions and recorded in the other for different combinations of depths. Test measurements also demonstrated large variations in the velocity (5-6 km/s) of the seismic longitudinal waves. A tomographic image of the collected measurements was tested to illustrate the type of mapping which can be performed by inter-hole measurements.

(29) FOA report C30165-E1
Adaptive passive hydrophone systems
Lars Götherström and others July 1981

The principles of adaptive signal processing in passive hydrophone systems is discussed, and various criteria of adaptivity are assessed. The properties of systems, such as signal/noise ratio, array-gain etc, are illustrated and different methods of calculation are studied in a mainly textbook style. The report is an edited version of indications and calculations made in connection with internal discussions in Branch 350 under what is broadly a continuing review of the literature during the period 1976-78.

(30) FOA report C30224-E1
On data security in a distributed office computer system (in English)
Rolf Blom (LiTH) and others August 1981

Problems of data security are becoming increasingly acute. This is a documentation of a study of some important problems in this field. It was undertaken in conjunction with members of the Institute of Systems Engineering at the College of Technology, Linköping and FOA 3.

The situation which is considered is an office-type environment with individual workplaces equipped with desk-top computers. These are in mutual communication and use a larger-capacity central computer, including special input-output equipment.

The questions under discussion included: problems concerning the protection of databases; the ease with which one can dial addressees and delegate authority to access data and communications; the distribution and protection of keys and general requirements for the equipment in an environment with this type of local network.

No attempt has been made to forecast when some such distributed office computer networks will become available on a full scale. It was evident however that they are at least technically possible today, and certainly within the next decade.

(31) FOA report C30225-E1
Acoustic image-sensors for underwater use. Situation report 30 April 1981. Field tests of an acoustic camera, type Thorn-EMI
Ludvig Mossberg August 1981

Field testing was performed on a hydro-acoustic TV equipment from Thorn-EMI, England. Sections of the programme are included under Part C, FOA-STU framework agreement, Marine Technology II.

A very large number of images were recorded on video tape. The subjective impression of an acoustic image is considered to be equally as important as a quantitative analysis of detectability, range, resolution, sound contrasts in the target as received by the camera etc. A great many interesting evaluations could be carried out although the laboratory conditions were not adequate. The results demonstrate that the specifications supplied by EMI have been satisfied.

A result of the tests is that clearer guidelines can be set for the development of the system.

The conclusion is that, when the improved Thorn-EMI acoustic imaging system becomes available, it will be considered for procurement.

(32) FOA report C30227-E1
Detection of obstacles to low-flying aircraft. Reflection models and measurements of power lines, wires and latticework with a CO_2 laser
Dietmar Letalick August 1981

A CO_2 laser of 10.6 µm wavelength can be used in an obstacle-indication system for low-flying aircraft and helicopters. For this purpose it is necessary to know how various obstacles reflect laser beams. A model is presented in this report for calculating the return from obstacles with a cylindrical surface. Measurements of returns of 10.6 µm radiation from different objects are also reported. The targets used were various types of wires, cables and latticework. Measurements were taken on a laboratory scale with a CO_2 laser and direct detection, with the target a few metres away. Detection was also performed at distances of 500 and 1100 m with a coherent CO_2 laser. Calculation of the ranges for some typical situations shows that the detection of obstacles such as wires and latticework at kilometre ranges is possible with a CO_2 laser radar. This supports some recently published results.

E2 Communications

(33) FOA report C30226-E2
Data communication for small computers
Rolf Mellberg August 1981

Owing to the rapidly increasing use of small (personal-type) computers and their geographical spread, a greatly increased need arises for data communication for such computers. In the field of data communication an intensive development is now proceeding which will eventually result in communication functions which are both general-purpose and simple to use. However it is likely to be only in the latter part of the 1980s before conditions exist for a standard of network communication to have gained general acceptance and dissemination. In the short term therefore there is a need to find some simpler means of communication for small computers. The report deals with the software aspects, and the solutions which are discussed are based on well-tried techniques and equipment.

E3 Guidance, navigation and target identification

(34) FOA report C20419-E3
NYCOND, a modification of *CONDIS*
Thord Righard August 1981

NYCOND is a modification of *CONDIS*. This report describes the changes in *NYCOND* as compared with *CONDIS*.

CONDIS, which was described in an earlier FOA report, is a simulation package based on *COMBINED SIMULATION* (Keld Helsgaun, Roskilde University, Denmark).

The principal differences between *NYCOND* and *CONDIS* are:

NYCOND is based on a later version of *COMBINED SIMULATION* than *CONDIS*.

This later version includes *inter alia* an integration method for non-rigid/ ordinary differential equations.

NYCOND contains a method for numerically solving rigid differential equations.

The program structure and dialogue section is partly varied in *NYCOND* compared with *CONDIS*.

A sub-class of *NYCOND*, *CLASS vekon*, is described in the report. This incorporates facilities for the user to use vectors and vector formulae directly to define the system.

Like *CONDIS*, *NYCOND* is intended for use on the DEC-10 system at the Stockholm Computing Centre, QZ.

F VEHICULAR AND SPACECRAFT TECHNOLOGY

(35) FOA report C30218-F4
Salyut-6 space station during the period 1 July 1980 to 23 March 1981
Astrid Rundkwist May 1981

This report is a continuation of "Salyut-6 space station during the period 19 August 1979 to 30 June 1980" (FOA report C30206-F4, November 1980), and was written for the same purpose, namely to reproduce information supplied by the Soviet press on the latest record-duration space voyage on board Salyut-6, 185 days, and Soviet comments on it. Also reported is information on events connected with Salyut-6 up to 23 March 1981 inclusive.

H HUMAN ENVIRONMENT

H1 Investigations, future projections

(36) FOA report C55049-H1
Collective behaviour in hostile environments. Introduction to catastrophe research in terms of behavioural science
Sven-Jacob Andersson June 1981

This report is the result of collaboration between the Civil Defence Authority and FOA concerning studies of human behaviour in threat situations and emergency environments.

It is introduced by a review of definitions of a catastrophe as used by different investigators.

Two different principles are discussed for the analysis of emergencies. The first is based on the geophysical nature of the incident, and the second on social tensions. The latter is recommended for those engaged on the planning and organisation of the rescue services.

It stresses the need for a research dimension in planning and training for emergency work (rescue services), and concludes with a glossary of suggested terminology.

(37) FOA report C58009-H1
Report by participants at the VII Annual Congress of the European Undersea Biomedical Society and Symposium on compression sickness, Cambridge 21-24 July 1981
Hans Örnhagen September 1981

The European Undersea Biomedical Society was formed in 1973. Its first scientific meeting was held at the KI (Royal Institute) in the same summer. Every year since then scientific meetings have been arranged at different places in Europe except for those years when the Undersea Medical Society in the USA arranges its international conferences. The 1981 meeting was held in Cambridge, England from 21-24 July. About 160 scientists had assembled including 11 from Sweden. More than 52 papers were read to the Congress on various aspects of diving. Three of them were based on the results of Swedish research activities. Personnel from the North Sea Medical Centre, Great Yarmouth, had undertaken to organise a day's lecture on decompression sickness in the central nervous system and means of treating it.

In connection with the Congress, study visits were also paid to the British Antarctic Survey and the North Sea Medical Centre.

(38) FOA report C58010-H1
Research requirements in underwater activities in the 1980s
Bo Cassel October 1981

This report concerns international forecasts of developments in underwater activities in the 1980s and research projects which are being implemented. A list is given of those projects being initiated or planned by FOA which have a bearing on international developments.

In this context, proposals are advanced for the conduct of underwater research by the FOA during the 1980s.

(39) Report XLIV, 1981, KAMEDO (H1)
Emergency medicine studies in the North Sea. Loss of the accommodation platform Alexander L. Kielland on 27 March 1980
Helge Bryne and Henry Lorin

In response to an invitation from Norway to participate in a Symposium on 21-22 April 1980 in Bergen, at which questions concerning rescue services and medical problems associated with oil activities in the North Sea would be discussed, it was decided to send two doctors from Sweden. One of them was a senior anaesthetist at the Central Hospital, Uddevalla, named Göran Bengtsson, who is also a naval surgeon trained in submarine activity. The other was a senior Air Force medical officer, Henry Lorin of the Air Force Centre for Medical Investigation and secretary of KAMEDO.

The symposium suddenly acquired great topical interest when, after the invitations had been issued, the accident occurred to the oil platform in the North Sea, as described below. Questions concerning this accident were naturally in considerable evidence at the symposium.

Although Sweden is not engaged at present on a large scale in the extraction of oil, nevertheless many items of interest for emergency medicine arose from the rescue

operations and medical aid with a more general application, particularly as regards serious accidents at sea and under hostile conditions. Therefore after the symposium H. Lorin contacted H. Bryne of the Rogaland Central Hospital, Stavanger who, as head of the hospital emergency centre, was able to form a good idea of the services deployed. We have compiled this report together. The account is based on Dr Bryne's own experience, on lectures and reports and on interviews with some of those taking part in the rescue operations and medical work. Certain information has also been derived from written reports.

H2 Hostile environments, closed units, field hygiene

(40) FOA report B20031-H213
Permeation of solvents through plastic materials studied by mass spectrometry (in English)
Allan Linnarson

Chemicals are often handled in solvents containing several constituents. It is usual to wear protective gloves for protection against the materials in question. In its pure state a given constituent has a sufficiently long permeation time for whatever material is used for a particular glove. However permeation times may be greatly reduced in combination with other constituents, and the gloves may lose their protective ability. In order to investigate the phenomenon of permeation it is an advantage to be able to detect and measure low concentrations of gases which are evolved on the rear side of a membrane in contact with a solution on its front side. Gases from various constituents need to be detected simultaneously and selectively, and the mass spectrometer has proved to be an excellent instrument for such investigation.

Offprint from Advances in Mass Spectrometry (1980), 8A, pp 1959-1961;
FOA reprints 1981/82:03

(41) FOA report C40135-H2 (C2)
Analytical methods for substances in Groups A and B, Industrial Safety Board Instruction No.100. Stage I. Results of literature search.
Birgitta Olofsson and Stellan Marklund June 1981

The availability of methods of testing and analysis in air for 40 carcinogenic substances in Groups A and B, under Industrial Safety Board Instruction No.100, was investigated by means of a search for data in the literature.

Information collected in the computer, which is listed in tabular form, contains mainly methods in which air samples of gases are taken up on to solid adsorbents or in liquids. Membranes and filters are used for the sampling of aerosols, particles and particle-borne substances. A special study was devoted to access via direct-display instruments.

(42) FOA report C53005-H2
Man/computer communication: from artificial intelligence and behavioural science perspectives (in English)
Lena Linde October 1981

The report discusses research into problems of communication between man and computer. A distinction is drawn between two tendencies: the design of computer models of human dialogues (artificial intelligence) and psychological studies of man/computer interaction. Studies related to these various aspects of man/computer communication are

located in journals in the fields of software engineering, artificial intelligence, man-machine interaction, and to a small extent in the psychological literature. The purpose of the present report is to present some typical theories on the problems of man/computer communication and to discuss such problems within a psychological frame of reference. References will be given to the following types of study:

(a) computer models of human dialogue,

(b) experimental psychological studies of interaction with a database (computerised information search),

(c) cognitive models of computerised tasks, such as textual editing,

(d) statement of user's requirements, based on practical experience and common sense.

(43) FOA report C56026-H2
The role of biotechnology in the development of technical systems; a frame of reference
Hans Furustig July 1981

Modern civilisation is to a large extent based on the operation of manned technical systems, in which people spend a large part of their time. It is important to study problems of systems development and the experience gained from it. The objectives are scientific, ethical and pragmatic. As a background to a study, the subjects discussed here include systems theory, ergonomics, manned systems and systems development.

Manpower and technical aids constitute the hardware core of manned technical systems. This core performs a system function through combination with working procedures, knowledge and software. Systems theory emphasises the importance of non-separable multivariate relations. In concrete terms this means that relationships and the operational environment are important for the implementation of a system function. This entails consequences for the type of knowledge which is relevant to systems development. The philosophical theory of systems involves a constructive questioning as to whether the conditions are reasonable, necessary or desirable. This entails value judgments in the process of systems development. Conflicts of value which may arise are both instrumental and categorical.

The aspects of ergonomics and biotechnology are dependent on advances in their applications. The most important application is the development of manned systems. A knowledge of ergonomics must therefore be valid for problems in a concrete systems context, and not merely in a general experimental context. It is difficult in theory to attest the advances in ergonomics, and the good arguments in ergonomics convey an element of a-priorism. One of the tasks of ergonomics is to provide decision-makers with a basis for decision such that the value and cost of the ergonomic contribution can be compared with those of the alternatives. Critical ergonomics involves the evaluation and testing of ergonomic activities for constructive purposes. The need for composite assessments in connection with systems development suggests a systems approach.

The process of systems development can be analysed as though it were a process of problem-solving. Here it should be remembered that some of these problems are of a special nature, being unique, incapable of unequivocal formulation, the solution lacks any limiting criterion etc. Systems development can also be analysed as though it were

mainly a process of decision-making. Technical systems development in principle is a rational and end-serving process. It may however involve some irrational elements. Decisions may be based on deadlock, may be inadequately based or idiosyncratic etc.

Projects may be abandoned or may survive for indefinite reasons. There are some good reasons for studying failed projects, and the circumstances under which manned systems fail to work. There are also good reasons for studying the origins of manned systems. For example there are both organisational control factors (sediment etc) and scientific control factors (paradigms), which will materialise during technical systems development.

From discussions which were held and from references in the literature the following problem areas were identified for further study:

(1) problems in the nature, propagation and adaptation of ergonomic knowledge,

(2) the need for a constructive appraisal of ergonomic activity, including questions of criteria and methods, and

(3) a review of concrete experience in technical/ergonomic systems development.

H6 Individual and group efficiency

(44) FOA report C54033-H6
Report of the FOA workshop on current research into physiology and behavioural science on sleep and interrupted sleep, 17 September 1980
Mats Gillberg June 1981

The idea behind the FOA workshop, and hence the present report, was to provide a fairly representative picture of research into sleep and interrupted sleep being conducted in Sweden. With a few exceptions, most of the laboratories or institutes associated with sleep research were represented. The participants were encouraged to provide examples of their current research. Contributions covered questions of method, problems of a more fundamental nature and some applications to the workplace. The author's papers have been collected in an unchanged and unedited form.

On the same date as the above workshop, another was held on psychophysiology. This will be reported elsewhere (FOA report C54034-H6).

(45) FOA report C54034-H6
Report of the FOA workshop on psychophysiology, 17 September 1980
Mats Gillberg June 1981

With the object of giving a current picture of psychophysiological research in Sweden, a representative selection of scientists was collected from universities, university hospitals and other research institutes. The participants were encouraged to give some examples of their current research. Contributions covered psychophysiology in its psychoendocrinal, cardiovascular and neurophysiological aspects respectively, as well as more theoretical arguments. The authors' papers have been collected in an unchanged and unedited form.

On the same date as the above workshop, another was also held on sleep and interrupted sleep. This is presented in another report (FOA report C54033-H6).

H9 Man and machine systems

(46) FOA report A56003-H9
Human factors in system development: experience and trends. A symposium held in FOA 56, Biotechnology, at Karlstad, 24-25 September 1980
Bengt Bergström and others June 1981

The object of the symposium was to assess the role of applied and research-oriented biotechnology in current and future technical systems development. Representatives from industry, universities, military research institutes and public bodies were invited to read papers.

M INTERDISCIPLINARY STUDIES AND INVESTIGATIONS

M1 Defence operational analysis organisation

(47) FOA report C10193-M1, M2
The translation of information on the course of a war to different parts of the overall defence system - a family of models based on a basic model
Tore Isaacson September 1981

When organising the different parts of an overall defence system, the conception of the nature of a future war is of decisive importance. Knowledge of developments in the war environment is mainly in the possession of the defence services. Unfortunately there are serious difficulties in conveying such knowledge to other departments of the overall defence system in a form suitable for their requirements.

This report describes an experiment in using a number of computer models for assessing and translating certain relevant information from studies conducted by the defence services on the course of war, into studies by the social and civil defence services. Some models have also been designed in support of studies of supply operations in the defence services.

An advantage of this approach is that data can be translated rapidly and probably with fairly close precision, without any need for representatives of the various authorities to become absorbed in detail in other studies. This is also an advantage from the security aspect.

The family of models has not yet been applied in practice, and therefore a need for experimentation exists. This will indicate whether it is possible and appropriate to continue this activity. If the choice is made to go ahead with the indicated course, models and methods of decision-making will need to be co-ordinated within the overall defence system to a considerably greater extent than at present. Among other things, this will mean a greater co-operation among the Operation Analysis groups in the relevant questions of method.

M3 Security aspects of environmental studies

(48) FOA report C10118-M3
Review of the international debate on the future nature of a conventional European war
Lars B. Wallin June 1981

Studies of the international debate on the military problems of NATO and the Warsaw Pact, on arms developments and on their consequences for the nature of future wars in Europe are a useful aid when endeavouring to imagine our future environment in terms of security policy and military operations.

This report is a review of that part of the debate dealing with the problems of a conventional war.

Part I describes the NATO and WP alliances, the structure of their military formations, their deployment and presumed actions in war, and it discusses some characteristics of the possible battlefield.

Part II refers to the views of defence commentators on the military situation in Europe and developments in weapons technology and their consequences.

Part III takes up the debate on some important problems - electronic warfare, air forces and air defence, the possibilities for helicopters, the urban terrain etc.

Part I was in fact intended as a background to the two following parts, although all three, including the separate sections, are self-contained and can be read independently of one another.

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

(49) FOA report C10183-M3
The Chinese doctrine on foreign policy in the future
Torbjörn Lodén July 1981

The report gives a review of the foreign policy doctrine of the People's Republic of China in the context of the older Chinese history of ideas and in the framework of China's confrontation with the outside world during the last 150 years. It distinguishes a few constant features of this doctrine: an anxiety for China's national dignity in the international system, together with efforts to unite all conceivable forces in the world against some arch-enemy. The report shows how this doctrine has been modified as regards *eg* China's view of the USA, the Soviet Union, Europe and foreign countries, and it relates the evolution of this doctrine to various tendencies in domestic politics. It also discusses some possible clashes among the leadership on different questions of foreign policy: the assessment of the Soviet Union and the USA; attitudes to left- and right-wing forces in Western politics; and the attitude to the tasks of military defence. The report indicates that the foreign policy doctrine is now being modified so that concern for the national dignity is not seen as precluding a close economic and technical co-operation with the capitalist countries. In conclusion some factors are discussed which may lead to a thaw in Sino-Soviet relations.

(50) FOA report C10 84-M3
Europe - continuity in change? (in English)
Nils Andrén September 1981

This report delineates some alternative future European developments, broadly speaking in a framework of the dominant characteristics of the current power system. The developments here described are treated in terms of their significance for European stability. To a large extent the report is an expanded version of Chapters 5, 7 and 8 of the author's book "International Developments and Swedish Defence Doctrine", 1978.

(51) FOA report C10189-M3
Sweden, the North and Nuclear Weapons
Gunnar Jervas September 1981

Recent events have brought into prominence the subject of nuclear weapons. In these circumstances it was thought appropriate to take a critical look at Swedish policy in this field.

This study contains three main sections: the first deals with Swedish policy on nuclear weapons in historical terms. Section 2 attempts to identify the current policy, as it emerges from the present thinking of the Committee on Defence. Section 3 contains a critical evaluation of the views of the Committee, and an attempt to carry the analysis further, especially as regards the perception of the threat. The subject of possible defensive planning continues to be an object of investigation.

In view of the current argument about nuclear-free zones, this subject is also discussed.

This study forms part of the "Trend Project".

M5 Economic studies

(52) FOA report C10185-M5
The economic cost to society of industrial fires
Christina Haig and others August 1981

During the 1980/81 financial year a research project has been undertaken at the Institute of Defence Research, entitled "The overall costs to society of major industrial fires". The project was financed by the Swedish Fire Research Authority. It is reported on in this and in one other report, G. Karlsson, T. Sonesson: "Cost-benefit analysis of technical precautions against industrial fires".

The project is covered in two reports, since they deal with two somewhat different problems.

The project was by way of being a pilot study. One important element was to investigate the suitability of different types of conceivable methods for attacking the problems under study.

Chapter 2 of this report was written by Göran Karlsson and Thomas Sonesson. The other parts were written by Christina Haig.

(53) FOA report C10186-M5
Cost-benefit analysis of technical precautions against industrial fires
Göran Karlsson and Thomas Sonesson (both Linköping U) August 1981

During the 1980/81 financial year a research project has been undertaken at the Institute of Defence Research, entitled "The overall costs to society of major industrial fires, and a cost-benefit analysis of precautions against such fires". The project was financed by the Swedish Fire Research Authority. It is reported on in this and in one other report: C. Haig, G. Karlsson and T. Sonesson: "The economic cost to society of industrial fires".

The project is covered in two reports, since they deal with two somewhat different problems.

The project is by way of being a pilot study. One important element was to investigate the suitability of different types of conceivable methods for attacking the problems under study.

(54) FOA report C10187-M5
Follow-up to changes in the peacetime organisation of the Army - case studies Lv 5 and Lv 4 - P 7/Fo 11
Catarina Hertelius and Peter Nordlund July 1981

Changes in the organisation of the peacetime army have been, and will be carried out further in the future for reasons of economy.

Two case studies are reported, the disbandment of Lv 5 at Sundsvall and the transfer of Lv 4 from Malmö to Ystad and of parts of P 7/Fo 11 from Ystad to Revingehed.

The object of the case studies was to examine the actual economic result of the changes and to improve the basis of accounting under the peacetime organisational budget.

It can be established that both changes will generate considerable savings during 1978-1998. Everything indicates that the savings will be greater than those assumed in the preliminary calculations.

Otherwise the study shows that the method used for preliminary budgeting is broadly consistent with its objectives. On the other hand it is desirable for the assumptions for preliminary budgeting to be presented in greater detail than hitherto. In addition the routines for the continuous monitoring and ex post facto accounting of any future changes in the peacetime organisation should be further developed.

(55) FOA report C10190-M5
Productivity in the Defence Services. An analysis of possible means of assessing changes in Defence productivity.
Guido Gentili and Curt Wells September 1981

In the debate on the allocation of funds to Defence the question often arises as to what is a reasonable requirement for the development of productivity in the Defence services. For various reasons it is very difficult to give a well-supported answer to this question. It is difficult just to give a meaningful definition of the concept. It is still more difficult to measure any improved productivity which is actually achieved. The most difficult of all is to state what improvement in productivity the Defence services should be capable of achieving.

The report first discusses the implication of the notion of improved productivity in Defence. The possibilities are also discussed of measuring such improvement. Possible means of arriving at what is a reasonable requirement are also dealt with by analogies with other activities in the economy.

The question of what is a reasonable requirement for improved productivity in Defence was previously discussed in EPAF (Expert study of cost control in Defence tasking, Ds 1975:2) and in a response to this study compiled at FOA (Bergendorff *et al* - Developments in productivity, prices and pay in Defence, FOA report C10057-M3, October 1976). Both these articles lack any discussion of concepts, which should be necessary for a rigorous treatment of the subject. This is provided in the present study. In greater detail than the publications referred to above, it also discusses possible means of measuring improved productivity in Defence.

The conclusions of the report are in the main negative. In order to measure the amount of improved productivity achieved, or to arrive at the amount of improvement which the Defence services should be able to achieve, it is necessary to conduct an argument based on a chain of unsound assumptions. The uncertainties in all of them are then cumulative in the final figure.

The conclusion is that requirements for rationalisation in Defence should be stated as concretely as possible, and that the debate should be conducted in conjunction with actual plans. If the requirement is stated merely as an annual percentage, arrived at *eg* by analogy with some other sector in the economy, no one can ever be convinced that the figure actually expresses an improvement in productivity which Defence has any reasonable chance of achieving.

M7 Follow-up and monitoring of scientific research outside FOA

(56) FOA report B60002-M7
Remote sensing techniques suitable for exploration and navigation in and under sea ice (in English)
Ragnar Thorén

In an introductory Chapter (1) the author describes the noteworthy development in remote sensing techniques during recent decades. In Chapter 2 he gives an account of satellite navigation etc on board the Swedish state-owned icebreaker YMER during her interdisciplinary expedition to high Arctic latitudes in June-September 1980. The next chapter (3) deals with the pioneering voyage by the Soviet atomic icebreaker ARKTIKA to the North Pole in August 1977. mentioning the fact that despite frequency fog the vessel's position was maintained with very high accuracy owing to an advanced system of satellite navigation.

The author goes on to describe briefly the advanced technology of the Swedish Space Corporation and its collaboration with France (Centre National d'Etudes Spatiales, CNES) in developing a new remote-sensing satellite (SPOT) and a new generation of Landsat satellites, and a new satellite system planned by NASA for sea monitoring etc (Chapter 4). The development of LORAN C into a more worldwide navigational system is described in Chapter 5. The importance of visual ice reconnaissance in combination with optical reconnaissance systems in Arctic waters all year round is considered in Chapter 6 under the heading "Night Vision Systems" with sections on field experiments, both on board the Swedish Arctic bulk carrier m/s Thuleland in the winter of 1979-80, and on board YMER in August-September 1980, together with a section under the headings "Some other well-known instruments" which likewise includes laser rangefinders, and "Passive Image-intensifier Goggles".

Finally in Chapter (7) the author gives an account of UNDERWATER TECHNOLOGY with the sub-headings "Hydro-acoustics and navigation", "Hydro-optics", "Laser depth-sounding in the Baltic Sea", "Remote-controlled research vehicle, FOA-SUB" etc, "Underwater communication", "Acoustic underwater locating systems", "Acoustic speed log" and "Subsea exploratory drilling platforms, habitats etc, and satellite laser communications".

FOA reports (1981), 15, 2.


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DT