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**SWEDISH DEFENCE  
RESEARCH ABSTRACTS 77/78-4**

by

Research Institute for National Defence, Stockholm

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Farnborough, Hants

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EDITOR'S SUMMARY

The Swedish Research Institute for National Defence 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 fourth issue of 1977/78. 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 P Rapportredaktion, 104 50 Stockholm 80, Sweden

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A PROTECTION - ATOMICA2 Characteristics of nuclear explosions

(160) FOA report C20236-A2

Time-dependent dose-rate and Compton electron generation from mono-energetic gamma sources in homogeneous air (in English)

Gösta Engström

April 1978

A series of Monte Carlo time-functions have been calculated to determine the gamma dose rates, ion-pair generation and the Compton current in homogeneous air. The Monte Carlo method includes what is termed a 'last flight' estimator for all quantities and a time-dependent treatment of the process of pair formation. Graphic results are presented for photo-energies of the source for 1, 2, 4 and 8 MeV and for penetration distances of up to 1600 m.

A4 Protection against atomic warfare

(161) FOA report B40084-A4

Lack of effect on the chromosomal non-disjunction in aged female mice after low dose X-ray irradiation (in English)

R. Strausmanis and others

11-month old female mice were irradiated with 0.4, 8 and 16 R for five days before being mated with young males. The females were killed 10.5 days after mating, and the mortality of fetuses in utero was determined. The chromosome composition was cytologically investigated for 1064 fetuses. The irradiated female mice had no greater intra-uterine mortality of their fetuses than non-irradiated females, and the observed chromosomal discrepancies (monosomies, trisomies, mosaics and triploids) were no greater in fetuses from the irradiated groups.

Offprint from Mutation Research (1978), 49, pp 269-274;

FOA Reprints 1977/78:36

B PROTECTION - BIOLOGICALB3 Dispersal and propagation

(162) FOA report B40071-B3

In-vitro effect of doxycycline on levels of adenosine triphosphate in bacterial cultures (in English)

H. Højer and others

August 1977

The short-term effects of doxycycline on the survival and levels of intra-cellular adenosine triphosphate (ATP) in bacteria have been studied, the ATP being analysed by a previously developed technique using firefly luciferase. Good correlation was obtained between the two parameters, and experiments were conducted to examine the possibility of using the ATP analyses for the rapid (2 hours) determination of the degree of doxycycline effect in clinical bacterial isolates. On

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comparison with the conventional agar diffusion technique, the results of ATP analyses were found to correlate well with an evaluation of resistance using growth inhibition zones.

- (163) FOA report 40086-B4  
 Enzyme-linked immunosorbent assay, ELISA, for the diagnosis of bacterial infectious diseases (in English)  
 Hans Erik Carlsson and Alf A. Lindberg June 1978

Specific and sensitive measuring methods, which also permit the determination of antibodies belonging to different classes of immunoglobulin, have long been a requirement for the immunological diagnosis of infectious diseases. A quantitative immunological method of measurement which is also capable of automation has become available with the introduction of an enzyme-linked immunological test (ELISA). This technique utilises antigens in the solid phase and measures the primary reaction between an antigen and an antibody by means of enzyme-marked anti-immunoglobulin. The use of enzymes as markers keeps the marked component stable, and the analytical equipment simple.

ELISA has so far proved to be a very suitable method of quantising the antibody response to a number of infectious diseases. It has been used with promising results in bacteriology for diagnosing salmonellosis, infections of the urinary tract and syphilis. Development of the method is continuing for other diseases such as brucellosis, yersiniosis, tularemi and streptococcal infections. The development of a method of detecting antibodies against salmonella O antigens has shown the importance of using defined antigens to obtain a specificity comparable with the sensitivity of the method. Compared with the conventional techniques, ELISA is sensitive, is highly reproducible and requires only small amounts of serum (1 - 10  $\mu$ l per test). Since nearly all types of antigen can be bonded to the solid phase, the method is generally applicable.

- (164) FOA report B40086-B6  
 Effect of amphotericin B on levels of adenine nucleotides in *Candida albicans* (in English)  
 A. Lundin and others January 1977

Amphotericin B is a polyene antibiotic used in the therapy of generalised fungal diseases. The function of polyene antibiotics is to cause a membrane leakage of important cell components. In this research the effect of Amphotericin B on the levels of adenine nucleotides in *Candida albicans* has been studied. Incubation of the yeast cells having low contents of Amphotericin B resulted in a swift and drastic drop in the level of ATP in the cells, while the total pool of adenine nucleotides (ATP + ADP + AMP) was less affected. The effect was dependent on the pH of the incubation medium, and could be counteracted by large contents of  $K^+$  and

sterols. The effect of polyenes on levels of adenine nucleotides can supply information as to the working mechanism of this type of antibiotic and on the energy metabolism and its regulation. Experiments have been started to utilise the effect as a rapid and sensitive method of determining polyenes in clinical tests.

D AMMUNITION AND WEAPON TECHNOLOGY

D1 Technology of explosives

- (165) FOA report A20027-D1  
 A study of organic substances in proximity to ammunition, with harmful effects on the ammunition and its packaging  
 Göran Åqvist and Jan Hansson May 1978

The results are reported of an analysis commissioned by the Swedish Defence Materials Test Laboratories, A:AS, to assess which chemical substances under different environmental conditions are likely to occur, causing undesirable modifications to ammunition and its packaging.

- (166) FOA report C20239-D1(A2)  
 Detonation waves in Lagrange coordinates (in English)  
 Nils Hörnqvist and Tommie Sundel May 1978

The properties of detonation waves are derived from a Lagrange formulation of the hydrodynamic equations. A similarity transform is used to obtain a system of ordinary differential equations, which are then solved numerically. The result is presented for TNT.

- (167) FOA report C20247-D1  
 Rheological properties of a composite propellant having hydroxyl-terminated polybutadiene (HTPB) as the binding agent  
 Roland Sandén June 1978

Some missile propellants having HTPB of the type R-45 HT as the binding agent and ammonium perchlorate as the oxidising agent have been made and tensile-tested. The results are presented in the form of what are termed principal curves. The propellant is hardened with di-isocyanate, DDI 1410 and IPDI. Propellants having about the same strength have been obtained with these two hardening agents. By increasing the content of hardening agent from  $\frac{NCO}{OH} = 0.7$  to  $\frac{NCO}{OH} = 0.8$ , the elongation is greatly reduced. The addition of 1% powdered iron oxide as a combustion catalyst to a propellant caused a slight improvement in its strength properties. The majority of propellants contain a bonding agent, and these propellants possess strength properties resembling those of CTPB-based composite propellants previously produced at the FOA.

D2 Gunnery technology and associated ballistics

(168) FOA report C20238-D2  
 Wind measurement tests using parachutes  
 Sven Nordström and Sture Wickerts

May 1978

The subject of possible means of simplifying and improving methods of determining the wind has been considered by the committee on ballistic meteorology at the request of several military authorities. Given the importance of this subject for artillery fire, the committee arranged a trial between 15-19 August 1977 at FMV-A:AP. This involved both a study of means of wind measurement using falling parachutes, and testing various apparatus for measuring the path of a parachute.

The tests were designed and directed by Sven Nordstrom. Assistance was supplied by FOA, FMV, MVC and Messrs Bofors.

The parachutes which were used for the wind-measuring tests had been previously fired into the air by rockets for other purposes. For the wind tests some of them had been specially prepared to give a radar and laser return.

The method of determining the wind by tracking a falling parachute was found to be quite usable. However the possibilities of locating a parachute by radar above cloud were not examined.

The results show that the parachutes used in this test did not always follow the wind. In some cases independent movement of the parachute was caused by swaying. For any future use of this method it is thought likely that parachutes can be produced which accurately follow the wind. The measures adopted afforded good reflection both for radar and for laser radiation.

D4 Technology of war and effect on the combatants

(169) FOA report C20233-D4  
 Investigation of the sensitivity of coaxial cables to shock waves in water, 1975  
 Paul Ström

April 1978

In the event of problems with the supply of antimicrophonic cable of previously known manufacture and properties, it has been necessary to look for cables having the same properties and easier to obtain. A previously unused anti-microphonic cable, Suhner G 03130 HT was compared with two other known types of cable, Dätwyler's RG-58 C/U and Telcon PTIGM. The Suhner cable proved largely to satisfy the necessary requirements for a cable which is exposed to shock waves in water during its use.

D6 Protection against the effects on the combatants

(170) FOA report A20029-D6  
 Proposal for methods of ballistic testing of personal shielding  
 Bo Janzon and others

June 1978

Swedish activities concerning personal protection consist mainly of keeping abreast of international developments of protective materials and designs,

and of devising and applying methods of evaluating these designs. The requirements include standardised methods for testing the capability for protection against splinters and small-arms ammunition.

This Report contains a proposal for methods of testing chiefly military bullet-proof vests, helmets etc, based on a brief description of the pattern of risks. The test methods include 5 spherical steel and heavy metal balls to simulate splinters, and 4 typical small-arms projectiles of differing penetration power. The proposal is related to test methods which have long been in use, so that to a large extent the information already accumulated can be used in the future.

- (171) FOA report C20235-D6 (A3)  
 The heat radiation from celluloid fires (in English)  
 Bengt Hägglund and Sven Gunnar Hansson April 1978

An investigation was conducted into the heat radiation from celluloid fires and its relation to the temperature and extent of the conflagration. The width of the square fire varied from 0.5 to 6 m. The radiation intensity from the flame zone increased as the depth of flame, reaching a maximum of  $24 \text{ W.cm}^{-2}$  for flame widths greater than 2 m. This radiation intensity corresponds to that of a black body at  $1160^\circ\text{C}$ , which was also the maximum flame temperature as measured by a thermo-element. Simultaneous values for the distribution of radiation over the flame zone were obtained by means of an IR camera. Finally the values obtained were compared with those from previous investigations of thermal radiation from timber and petroleum fires.

- (172) FOA report C20237-D6  
 The ignition of combustible material by hot splinters  
 Lars-Erik Altvall April 1978

The purpose of the investigation was to prepare documents by which to evaluate the risks of ignition from projectile fragments. The first part of the investigation was an experimental study of the relation between the temperature of splinters and their ability to ignite various easily combustible materials. The second part concerned the relation between the velocity of a splinter and its temperature after impact.

Results of the first part indicated that ignition into flame occurred at splinter temperatures between  $700$  and  $850^\circ\text{C}$  for the materials under examination and for splinter sizes of 9 g. Ignition to smouldering was obtained at temperatures down to  $500^\circ\text{C}$ . At suitable wind speeds, smouldering could turn into flame. Final calculations showed that ignition of combustible material was not obtained at splinter velocities less than  $700 \text{ ms}^{-1}$ , but was obtained with high probability at velocities greater than  $1000 \text{ ms}^{-1}$ .

- (173) FOA report C20240-D6  
 Equilibrium phases in the systems B-C, B-Si and B-C-Si  
 A study of the literature  
 Fredrik Hopfgarten and Bo Holmberg May 1978

Based on a perusal of the literature, an evaluation is given of the phase relations in the systems B-C, B-Si and B-C-Si.

The system B-C includes several phases, though they have only narrow regions of existence. Only one phase is congruently fusing, that is  $B_{13}C_2$  (rhombohedral boron carbide). The boron carbide with the highest carbon content has the composition  $B_{13}C_3$ . At least two further phases exist in the boron-rich part of the system.

In the system B-Si there exist  $B_6Si$  and a rhombohedral boron silicide having a definite stoichiometry, somewhere in the region of composition  $B_3Si - B_4Si$ . At least one boron silicide richer in boron exists.

The system B-C-Si is lacking in ternary compounds.

D8 System studies

- (174) FOA report C20246-D8 (D4, E1)  
 User's guide to AUTODOK a computer program for analysing Fortran routines on an IBM 370  
 Gunnar Holm June 1978

The program analyses Fortran routines written for the IBM 370, supplementing the information so acquired with certain information from print-outs of the H extended-compiler. The result is a list of all the quantities contained in the routine with all their attributes. The user has the freedom to choose which tables he wishes to be printed-out and in what order, and to supply them with a textual commentary. In addition there is a facility for incorporating one's own routines which eg take account of information from the commentary card.

E CONDUCT OF WAR - INFORMATION AND COMMAND TECHNIQUE

E1 Reconnaissance and location

- (175) FOA report B30023-E1  
 Forest inventory and land use mapping by automatic classification of digital MSS data from satellite and aircraft (in English)  
 T. Orhaug and others

The report describes computer-based studies of processing and interpretation of digital multi-spectral visual data from satellite-borne and airborne sensors for forest inventory and land use mapping. A district in Dalsland was examined with a view to forest mapping from Landsat data, and an area in Alanas was mapped from airborne MSS data. The Linkoping area was also mapped for purposes of land use. The report provides a brief description of the method of processing.

Offprint from 4th Canadian Symposium on Remote Sensing, Quebec, 16-18 May 1977

FOA reprints 1977/78:32

- (176) FOA report B30024 E1  
Landsat digital data for water pollution and water quality studies in  
Southern Scandinavia (in English)  
Ulf Helldén (Lund U) and Ingvar Åkersten

A diagram to illustrate the spectral characteristics of various types of water has been constructed by means of simple statistical analysis of the different reflectance properties for water-covered areas in southern Scandinavia, as recorded by Landsat-1. Indications exist that water whose reflection spectra are dominated by material containing chlorophyll (phytoplankton) can be distinguished from that dominated by material devoid of chlorophyll. Differences among lakes, as well as patchiness in particular lakes, with respect to the visible depth could be illustrated after a simple parallelepiped classification and black-and-white print-out and in colour, by means of a radar recorder and Calcomp plotter (cathode-ray tube) and a 3-colour ink plotter respectively.

Offprint from Proc 11th Int Symposium on Remote Sensing of Environment  
Ann Arbor, 25-29 April 1977 FOA reprints 1877/78:33

- (177) FOA Training activity, compendium No 43  
Lasers: theory, technique, applications, safety.  
Ove Steinwall and Britt Hartmann March 1978

E3 Fire control

- (178) FOA report A20026-E3  
Navigation and position-finding  
Sylve Arnzén April 1978

This Report is a contribution to FOA/STU studies in Marine Technology, and includes a general survey - plus some evaluation - of basic principles, practical technique together with the leading data for navigation aids in general use, mainly concerning radio navigation, while other methods (of an optical, magnetic, inertial etc nature) are covered in less detail.

The assembly of factual data is intended mainly as a basis for selecting suitable systems for measurement and position-finding for use as a geodetic reference above the surface in association with surface and subsurface activities at sea, though it can probably be used also for different types of activity (land and airborne navigation etc).

The corresponding submarine technique is reported in a separate parallel study<sup>1</sup> by T. Pentelius, FOA 3.

- (179) FOA report C20244-E3  
Hydraulic servosystem with pulse-modulated valves  
Anders Sjöquist June 1978

This is an interim report under the project 'Pulsed control of valve-operated pneumatic and hydraulic servosystems', financed by STU, STAL-LAVAL, SAAB-SCANIA and FOA.

The project is 50% funded by STU pursuant to letters of authority 735066 U, 74-7621 and 75-5875.

The report deals first with some general properties of various kinds of modulation principle in pulsed control. This is followed by a detailed theoretical account of the 'bang-bang with dead zone' (BBDZ) control principle, based on the properties of valves. This principle can be used in positional servosystems, in which motor dynamics can be neglected. In terms of control engineering such systems can be regarded as trivial, but since many hydraulic positional servos are of this type there is some justification for analysing this control principle.

As an example of the BBDZ principle, tests have been run with a hydraulic motor at present being used by STAL-LAVAL to control a steam regulator valve for a 100 MW generator turbine, in which the motor is controlled by a conventional servo valve.

Tests with this hydraulic motor indicate that it is quite possible to replace the conventional analogue servo valve by two 2-positional magnetic valves while still retaining the required control capabilities.

(180) FOA report C20245-E3  
Investigation of positional and speed ripple in a fluid servo with pulse-modulated poppet valves  
Anders Sjöquist

June 1978

This Report covers part of the project 'Pulsed control of valve-operated pneumatic and hydraulic control systems', financed by STU, STAL-LAVAL TURBIN AB, SAAB-SCANIA and FOA.

The project has been 50% funded by STU pursuant to letters of authority 735066 U, 74-7621 and 75-5875.

The report deals first with computer simulations of a 3rd-order system, in which the input signal is a pulse train. Ripple in the position and the speed arising from the principle of pulsed control is plotted and is reported both in tabular form and as a special diagram to illustrate which combinations of pulse widths and pulse repetition rates should be avoided with respect to ripple. The diagram can therefore serve as a basis in choosing a modulation principle (pulse frequency modulation, pulse width modulation or combinations of these).

The computer simulations have been checked by test runs with a pulse-modulated pneumatic and a hydraulic servo. The result, as reported at the end of the report, shows a rather inferior agreement between the simulated and measured values for ripple in the pneumatic servo. However, the agreement between these values for the hydraulic servo is very good.

- (181) FOA report C20248-E3  
Pulsed control of valve-operated pneumatic and hydraulic servo systems;  
summary and results  
Thorvald Persson June 1978

This Report deals with the background, organisation and results of a project undertaken under the direction of FOA, concerning 'Pulsed control of valve-operated pneumatic and hydraulic servosystems'. FOA has collaborated in the project with SAAB-SCANIA AB Jonkoping, STAL-LAVAL Turbin AB Finspang, and - to some extent - MECMAN AB Stockholm. The Technical Development Board has funded the project to 50% pursuant to letters of authority 735066 U, 74-7621 (735066) and 75-5875 (735066, 74-7621). Activity on the project extended over four years, its purpose being to serve civilian, mainly industrial, requirements. A fruitful exchange of information took place with a defence-oriented project undertaken by FOA and SAAB-SCANIA having somewhat similar objectives.

F VEHICULAR AND SPACECRAFT TECHNOLOGY

F2 Ships and hovercraft

- (182) FOA report C20241-F2 (F3)  
A method of determining small shifts in X-ray reflections detected by  
parallel scanning  
Eva Elvers and others May 1978

The report describes a method for measuring small shifts in the position of x-ray reflections. The reflection for a reference material is recorded by a position-sensitive sensor and is stored in a multi-channel analyser. The reflection from the material under investigation is subtracted from the stored reflection. Changes in the appearance of the reflection are then calculated from difference curves. Changes in position are determined to an accuracy of  $\sim \sqrt{t/A}$ , where  $t$  is the width of the reflection and  $A$  is the pulse count at the peak. A typical measuring time is about 2 min. The method is illustrated by experiments using test rods of aluminium and carbon-fibre reinforced laminated plastic.

- (183) FOA report C20242-F2 (F3)  
Non-destructive measurement of fibre stress in aramide fibre laminates  
by an x-ray diffraction method (in English)  
Mats Larsson and others May 1978

The crystal structure in aramide fibres (Kevlar) is sufficiently well-ordered to enable the distance between crystal planes to be measured perpendicularly to the longitudinal direction of the fibre.

Using a position-sensitive detector for scanning the position of the x-ray reflection, elongations can be determined to an accuracy of  $\pm 50 \cdot 10^{-6}$  lattice spacing. The equivalent sensitivity in tensile measurement will be  $\pm 17$  MPa in a fibre tension which corresponds to  $\pm 10$  MPa for a normal laminate laid in one direction.

H HUMAN FACTORSH1 Summaries, forecasts and system studies

- (184) FOA report C60002-H1  
 Analysis of problems concerning human attitudes to threats, catastrophes  
 and the future up to AD 2000  
 Jan Agrell June 1978

This report, which concerns methodology, is part of project H1 38 ('Investigation into future catastrophes'), the object of which is to study human ability to withstand mental and bodily stresses caused by catastrophes up to AD 2000. It begins with a survey of the general area of research, followed by an account of the requirement and basic conditions for an empirical examination of human attitudes to future threats and disasters, and their relation with the will to counteract them. Various disaster situations are specified and a general model of the problem is presented. A number of human attitudes towards threats in some important future problem situations are then analysed in more detail. This is followed by a deeper analysis of different classes and species of threats and disasters as a basis for designing models of human behaviour in the presence of disasters etc. Finally an account and a model are given for an empirical investigation of human reactions to future threats.

H5 Injuries and treatment, rehabilitation and associated activity

- (185) FOA report C54022-H5  
 Catalase and peroxidase - studies of simple enzyme tests in urine  
 diagnosis  
 W. Thorsell and others June 1978

The object of the study is to try to devise some reliable, sensitive, rapid, simple, and inexpensive methods for diagnostic use in urine analysis. There is in fact a lack of such methods at present to a large extent.

Catalase is an enzyme which can be expected to increase in concentration when an increase of eg erythrocytes, kidney cells and certain bacteria - aerobic in particular - occurs. The search for methods for indicating changes in the concentration of catalase in urine resulted in a gas-volumetric method, referred to as a modified ring test.

Peroxidase occurs eg in erythrocytes, leucocytes and certain bacteria, and can therefore modify its concentration in urine when pathological changes arise. The determination of peroxidase can thus be used as a supplement to that of catalase in urine analysis. Reagent dyes are used for this purpose. One of these, based on otolidin, can be used to advantage, assuming that any disturbing components in the urine are eliminated, eg by means of an ion exchanger.

H6 Efficiency and conduct including group factors and leadership, particularly in fighting conditions

- (186) FOA report B57005-H6  
Changes in male exercise performance and anthropometric variables between the ages of 19 and 30 (in English)  
Bill Ny Lind and others

55 men from the Stockholm area were examined in connection with military enlistment, and were re-examined 11 years later. The most conspicuous changes to be registered were increases in body weight (11%), waist measurement (19%) and thickness of folds in the skin (reflecting changes in the layer of subcutaneous fat) (25-41%). Intensity of effort at a pulse rate of 170 ( $W_{170}$ ) had risen by 5%, while the ratio  $W_{170}$ /body weight had decreased by 5%. The changes were still greater in a sub-group who were physically inactive, both at age 19 and age 30. Body length had increased by 13 mm, of which 70% was due to growth of the tibia.

(Offprint from Europ. J. Appl. Physiol, (1978), 38, 145-150; FOA reprints 1977/78:35)

- (187) FOA report C52001-H6  
Task complexity and 24-hr performance patterns in morning and evening active subjects (in English)  
Jan Fröberg

Two groups of test subjects active in the morning and evening respectively were subjected to loss of sleep for 72 hours. Performance of a task which varied in complexity, and with a reward or deterrent, was measured every three hours. The complexity of the task failed to affect the 24-hour rhythm, while the two last conditions improved the level of performance, especially in the 'morning' group.

H8 Training procedures

- (188) FOA report C55017-H8  
Some observations on the psychology of leadership  
Christer Jeffmar (Psych. Inst. Lund U) April 1978

The article gives (1) a historical background of the advance of present-day psychology of leadership, (2) some views on the concept of the style of leadership, (3) a presentation of F.E. Fiedler's leadership model, (4) a survey of the role of motivation in the leadership process, and (5) a proposal for an integrated theoretical model of the process of leadership.

- (189) FOA report C57003-H8  
Mental and physical analysis of effects of a cross-country march, August 1977: Platoon Leaders' School (PBS), I 22, Kiruna  
Monica Cedermark and others June 1978

The cross-country march in August 1977 at the PBS, I 22, Kiruna was studied in its mental and physical aspects. Analyses of the maximum oxygen intake and various muscular functions were made in laboratory tests in Stockholm in order

to describe the performance profile of the PBS trainees taking part, and to derive from this a profile of required activities which could be applied to the training of platoon leaders at I 22, Kiruna.

It is typical of a PBS trainee that he is larger and heavier than the average soldier. He has a high maximum oxygen intake and is strong in muscle. In this respect he is largely comparable with a male GIH trainee. The PBS trainee has muscle fibres of a composition indicating a rather higher proportion of slow muscular fibres than in the normal population and GIH trainees, tending to indicate that the PBS trainee is somewhat tougher.

The PBS trainees consumed on average 40-50% of their maximum oxygen intake during the cross-country march. Stress for short periods however was as high as 65-75%, which means that an intensity of effort was chosen which was about optimum for performing a hard physical task for the least possible accumulation of lactic acid in the active muscles and the bloodstream.

The average calorie consumption varied from 4000 to 6000 kcal/day, depending on the duration and strenuousness of the day's programme.

Analyses of muscular glycogen showed that a large part of the 'fuel' consisted of carbohydrates in the form of muscular glycogen, resulting in an almost complete exhaustion of glycogen reserves at the end of a day's work. This exhaustion was most pronounced after days of strenuous effort. In muscular biopsies taken after more than 24 hours it was found that an insufficient formation of glycogen had occurred. This indicates that the food had failed to contain enough carbohydrates to reach the levels considered to be normal.

Physical stress had a very moderate effect on the performance of a routine mental test. Subjective effort, fatigue and 'stress' generally followed the secretion of the 'stress hormone' adrenalin, which was at its highest during days of most strenuous marching.

(190) FOA report D55006-H8  
 Problems in the work situation of commanding officers (in English)  
 Alise Weibull June 1978

This account is a summary of certain experience gained from a study project now in progress concerning 'The motivation of commanders' (FOA Project No 18), related to the themes of the symposium of 'Leadership' and 'Crises of authority in the defence services and society'. Data have been acquired from interviews with about 30 commanders at field force level in the army. The report concentrates on the requirements or expectations of commanders for guidance and organisation. The topics covered are chiefly the administration of personnel such as postings and transfers of commanders, the consequences of the career system for cooperation and continuity, experiences of qualification and assessment, and

the difficulties of creating common criteria in units and organisations. Relationships are established such as that between failure of command and failures to utilise the available manpower resources.

- (191) FOA report D55007-H8  
 Research in the division for behavioural sciences (in English)  
 Gunnel Frenzel-Norlin June 1978

A brief historical account of research in military psychology is followed by a review of current research at Institute 55, Behavioural Sciences.

This comprises summarised descriptions of projects dealing with the feedback system in the army, group training, unit psychology, job satisfaction, O and M and flight safety. Areas of current interest for research into behavioural science in the near future are also discussed.

H9 Man and machine systems

- (192) Ergonomics in the defence services (Introductory remarks 17.1.1978).  
 Charles Strömblad

Ergonomics is a term which is becoming increasingly widely used though, partly owing to the lack of a generally accepted definition, one which denotes different things to different people. For this reason, proceeding from my own definition of ergonomics - but without staking any claim to a preferred interpretation - I have elected to illustrate the type of ergonomic problems to which the defence services should primarily address themselves, as a complement to knowledge gained from the civilian world.

Definition: Ergonomics is the activity which, proceeding from various human characteristics, endeavours to achieve a purposeful matching between humans and technical systems.

Transactions and Journal of the Royal Swedish Academy of Military Science, (1978), 182, No 2.

- (193) FOA report C56005-H9  
 Accuracy in extrapolating from partly visible figure targets  
 Nils Haglund March 1976

An observer's ability to extrapolate from partly hidden figure targets whose shape is known is an important factor in the use of certain range-finding instruments, particularly for tank weapons.

The experiment examined the ability to perform such extrapolation.

The figure targets were partly military vehicles and partly circles. For both types of figure the lower portion was partly cut off, and the test subjects were required to indicate where the bottom edge of the figure would appear if it were visible. Each test subject extrapolated 216 different silhouettes of military

vehicles and 90 of circles. Twelve subjects took part. The tasks were presented in the form of pictures on paper.

The accuracy of extrapolating circles was found to be a function of the time available per task and of practice at the task. This extrapolation exhibits systematic errors.

Accuracy in extrapolating the silhouettes of military vehicles is largely independent of the size of the visible portion, and the accuracy is constantly low. The standard deviation frequently amounts to about 15% of the height of the silhouette.

Some significant systematic errors occur. The height of a silhouette is frequently over- or under-estimated by more than 10%.

Silhouettes of some military vehicles proved to be more difficult to extrapolate than others.

(194) FOA report C56014-H9  
Correlations between night vision tests (in English)  
Hans Marmolin December 1977

The object of the present investigation was to study inter-individual correlations among various night vision tests. Correlations among 20 different measures of the power of night vision were calculated, and a factor analysis produced for the correlation matrix so obtained. Six independent factors were derived: for contrast sensitivity; for light sensitivity; two factors for dazzle, one related to dazzle from a point light source, one related to dazzle from a diffuse light source; and two adaptation factors, one mesopic and one scotopic.

(195) FOA report C56015-H9  
Perceived quantisation error (in English)  
Hans Marmolin and Anders Sporrang December 1977

The present study compares two methods of quantisation, one linear and one non-linear. The non-linear method is based on the psychophysical relation between subjective brightness and the physical light intensity  $R = s^n$ . By means of these two methods three different scenes were quantised in 4, 8 16 and 32 pictures, and the relation was also varied between the quantisation level and the reflection level of the image. The investigation showed that the non-linear method of quantisation was generally better than or as good as the linear method. The study also revealed that the number of quantisation levels should be at least 16, and that the relation between quantisation level and reflection will be linear.

- (196) FOA report C56016-H9 (in English)  
 A visually optimised restoring filter December 1977  
 Hans Marmolin and others

The present report describes a linear restoring filter based on a visual parameter  $T$ , which determines the degree of restoration. High values of  $T$  result in unsharp but high-noise images. This filter was evaluated and optimised visually in terms of  $T$  in three experiments. In experiments 1 and 2 the filter was used in a simulated real-time system (FLIR), while the properties of the filter were studied more systematically in experiment 3. Good restoring effects were obtained for this filter in most situations. The data also indicated that the filter could be regarded as a weighted Wiener filter optimised for a scene and a noise factor having a constant spectrum.

M INTERDISCIPLINARY STUDIES AND INVESTIGATIONS

M2 Environment and social studies

- (197) FOA report A20028-M2 (D4)  
 International law and inhumane weapons - background considerations  
 Bo Janzon June 1978

Since the end of the 1960s Sweden has been campaigning internationally to achieve prohibitions or restrictions under international law against certain conventional weapons considered to be especially cruel, or to cause unnecessary damage with respect to their military effect, or which injure both combatants and civilians indiscriminately. Certain members of FOA including the author have been engaged on this study.

At the present stage of the enquiry, requirements have arisen for improved and deeper information as to several of the types of weapon concerned. It was therefore felt expedient to intensify the cooperation by FOA in this activity. This report is intended primarily as background information for those intending to cooperate in the project, or who wish to take up the subject for other reasons.

- (198) FOA report B10019-M2  
 Resource allocation and cheating within a decentralised organisation  
 with conflicting objectives (in English)  
 Christer Berg March 1978

Quantitative studies of decentralisation in structured organisations are usually based mainly on assumptions of a single objective and that the local organisations supply true information as to local conditions. The chief interest has thus been directed towards decision-making processes, which are decentralised in terms of information, and which afford the same optimum result as the central body would have obtained had it taken its own decisions on a basis of complete information.

If the local subsidiaries and the central body are instead allowed each to have their own objectives, it becomes possible to define centralisation and decentralisation in relation to the influence exercised by these objectives at the different hierarchical levels on decision-making by the organisation.

The report contains a detailed study of the case of 'decentralised decision-making subject to strong central influence'. In this case the central body allocates the centrally available resources in such a way that when the subsidiary maximises its own objectives, the central body will obtain the best possible value for its own objective. This procedure exhibits certain similarities to the procedure for the Swedish national budget. The report demonstrates how this problem can be reformulated as a vector-maximising problem which can be solved by existing algorithms. It is not always possible to interpret a dual vector as a price vector.

A subsidiary can improve its result by bluffing, eg by stating a false objective or by demanding greater resources. The report deals with the former case. In a case where all the subsidiaries but one are honest, an optimising problem can be formulated so as to find an optimum bluffing objective for the dishonest subsidiary.

Since all the subsidiaries have the opportunity of bluffing, this gives rise to a n-person non-zero sum game. The article shows how to generate the game strategies and matrices for the objectives. Conditions are studied under which it would be rational to take opportunistic action.

The problem of designing a bluff-proof organisation is discussed in relation to the fields of activity of the subsidiaries. Criteria are also discussed for finding the optimum fields of activity. The basic conditions for creating a bluff-proof organisation are studied, the result being that it is so difficult as never to be capable of fulfilment by any realistic organisation.

FOA reports (1977), 11, No. 1, 58 pages.

(199)

FOA report C10087-M2

Visit report from the 'European Workshop on Lifestyles and Social Change', Arc-et-Senan, France, 14-17 September 1977.

Ulf Landergren

March 1978

A conference was held in September 1976 at Arc-et-Senan on 'Workshop on Futures Research' (See FOA report C10064-M5, December 1976). The 1977 conference was regarded as a second conference in a planned series of conferences in the field of future studies, and the present report gives a brief account of it. As with the previous year's conference, the most tangible result this time was also mainly a certain number of agreed arrangements for cooperation in future meetings and contacts.



M6 Miscellaneous investigations and comparisons

- (202) FOA report C10088-M6  
Continuing cooperation between FOA Index and the Music Department of Swedish Radio  
C-G Stellan Morner (Swedish Radio) April 1977

The report describes collaboration between Swedish Radio and FOA Index. It covers the compilation of registers of tapes recorded in the three major producing sections of the Music Department, for orchestral, chamber and vocal music. Broadcasting statistics are also being collected concerning Swedish music on the Music Channel.

T CERTAIN MEASURES FOR LIMITATION AND CONTROL OF ARMAMENTST1 Seismological multiple stations

- (203) FOA report B40058-T1  
Airborne short-lived radionuclides of unknown origin in Sweden in 1976  
Lars-Erik De Geer (in English)

On five occasions during the first half of 1976, traces of  $^{239}\text{Np}$  and  $^{99}\text{Mo}$  were detected in southern Sweden. These activities were followed by small quantities of fission products such as  $^{131}\text{J}$  and  $^{140}\text{Ba}$ . One of the instances coincided with a few sharp increases in the atmospheric content of gaseous Tritium. Offprint from Science (1977), 198, pp. 925-927; FOA reprints 1977/78:34.

- (204) FOA report C20231-T1  
The capability of a network of seismological stations to detect events and to obtain identification parameters (in English)  
Eva Elvers April 1978

A model is studied for estimating the ability to detect seismic events and to obtain identification parameters, with special reference to the importance of different parameters. Detecting ability is expressed in terms of that magnitude which corresponds to a given probability that a minimum number of seismological stations will detect the event, and a similar method is employed for the ability to obtain identification parameters. Numerical results are studied for networks representing fifty existing stations. The overall variation in the level of the magnitude of about 1 unit is found to depend more on the irregular geographical distribution of the stations than on their various individual capabilities. The results are relatively insensitive to variations of parameters such as station reliability and signal strength variations.

The capability varies by several tenths of an order of magnitude when the parameters such as the least number of detections by a station, which determine the confidence with which events are detected (or identification parameters are obtained), are varied instead. There is a difference of 0.2 to 0.5 units between the levels of magnitude representing probabilities of 90% and 10%.

- (205) FOA report C20232-T1  
 Seismic magnitude estimates, with a minimum number of detections  
 (in English)  
 Eva Elvers April 1978

The accuracy is investigated for three methods of estimating seismic magnitudes, with special reference to estimates in which a minimum number (L) of station magnitudes are obtained, for L = 1, 2 and 4. Station magnitudes and detection thresholds are simulated by a method which corresponds both to a fairly heterogeneous network of stations and to a more homogeneous network. A maximum likelihood (ML) method is introduced, which is suitable when events with fewer than L obtained magnitudes are excluded from the estimate. It is compared with the 'usual' ML method and the conventional mean value for the magnitudes obtained. Standard deviations are relatively large, in particular for L = 1. On the other hand the bias is closer to zero than for the other two methods, and is the only factor which improves as L increases. At the level of magnitude for which an estimate is made for 10% of events, the compound quantity RMSE (rms deviation from the parameter required) exceeds the minimum by 0.2 - 0.3 units for the two networks, and RMSE decreases by about 0.1 unit. On L increasing further to 4 the corresponding increase in magnitude level is higher, while the improvement in accuracy is less. It was further found that the usual ML method with L set at 2 (1) has a greater accuracy for a given magnitude than the conventional mean value with L equal to 4 (2), especially with respect to bias, though the standard deviation is lower for the homogeneous network, and about the same for the heterogeneous one.

- (206) FOA report C20234-T1  
 Impressions from the SIGGRAPH (ACM) conference, USA 1977  
 Tord Tengstrand April 1978

The 4th annual SIGGRAPH conference was held at San Jose, California, on 18-22 July 1977. This report contains some impressions from the conference.

- (207) FOA report C20249-T1  
 Seismic events in the USA in 1972 (in English)  
 Hans Israelson and others June 1978

The present report studies some seismic events in the USA during 1972. Out of the total 268 events, 260 have been reported by the National Oceanic and Atmospheric Administration in the USA. The other 8, all located at or close to the test range in Nevada, were obtained by means of measurements at seismological stations in Canada, USA and northern Europe. The number of defined seismic events is probably complete down to a subsurface wave magnitude of about  $m_b = 4.0$ . A special-purpose locating model was developed to permit the precise location of events near to coasts and national frontiers.

Parameters based on measurements at the Canadian seismographic network, at Hagfors Observatory and at two VLPE stations in the USA were used for identifying the defined events. A special method was developed for combining measurements of  $m_b$  ( $M_S$ ) from several stations. This also allows for extreme upper estimates of  $M_S$ .

A procedure for identifying seismic events by means of the different parameters was devised from observations of earthquakes and explosions previous to 1972. A total of 75 events were identified using this procedure, few of them being presumed wrongly identified. Of events which could not be identified, 7 have a  $m_b$  between 4.1 and 4.4. These values for magnitude, based on a small number of measurements, are very likely over-estimated. All the other events which could not be identified had lower values for  $m_b$  or none at all.

Besides 8 publicised explosions, a further two were identified. The identification procedure was found possible to apply to explosions in tuff or rhyolite with estimated yields as low as a few kilotons. Two other events on the Nevada test range just missed being identified by extreme upper estimates of  $M_S$ . These events had an estimated equivalent yield in tuff or rhyolite of about 1-2 kt. For an additional 10 events on the Nevada test range, for which no identifying criteria could be obtained, it cannot be ruled out that some or all of them were explosions. The estimated equivalent yields of unidentified events in Nevada were of about 1-3 kt or less in tuff or rhyolite.

In conclusion it should be noted that the results contained in this study are not necessarily representative of what might be achieved by a worldwide seismological monitoring system.

#### EMERGENCY COUNCIL FOR PSYCHOLOGICAL DEFENCE

(208) BN report No. 83  
General knowledge of overall defence  
Kurt Törnqvist

March 1978

The report covers an investigation into the public's knowledge of civil defence, economic and psychological defence and defence costs. The result is compared with previous investigations in order to identify any developments. Some connections are studied between the public's knowledge of defence and its attitude towards defence.

(209) BN report No. 84  
Opinion 77  
Kurt Törnqvist and Lennart Pragsten

April 1978

A number of tests of public opinion have been reviewed in order to produce a survey of opinion in Sweden during 1977. It covers attitudes towards

politicians, parties, organisations and authorities, confidence in the mass media, attitudes to society, international relations and overall defence.

- (210) BN report No. 85  
 American news in Swedish newspapers (In English)  
 Cheryl Doten (University of Stockholm) May 1978

A content analysis of American news in 'Aftonbladet' and 'Expressen' during the 1976 US Presidential election campaign. The result is compared with a corresponding study of the 1968 American Presidential election campaign in ten Swedish daily newspapers.

- (211) BN report No. 86  
 The BT Kemi Affair at Teckomatorp  
 Bengt Lundell (Lund U) June 1978

A study of the information from the authorities and the mass media during this environmental crisis. The author studies the ways in which the views of the public, the authorities and the company of one another and of the problems changed, and how the authorities acted to solve the crisis.

- (212) BN report No. 87  
 Failures of objectivity  
 Göran Hermeren (Lund U) June 1978

An examination of some conceptual and classification problems of research into objectivity. The author discusses the lack of veracity, relevance, neutrality and of balance.

- (213) BN Communication No. 74  
 Stress under extreme conditions  
 Anna-Stina Gyllencreutz (CTH) March 1978

A survey of the literature to illustrate the concept of stress, the factors which expose us to stress and the body's defence reactions.

- (214) BN Communication No. 75  
 The role of the mass media in opinion-forming  
 Lennart Pragsten April 1978

Abstract of a study of opinion-forming both in the individual and the social context. The author emphasises the importance of the composition of the public, its size, and the various roles of different media. As regards the mass media and the individual the author constructs two models: one for influences and one for participants.

- (215) BN Communication No. 76  
 Finnish attitudes to foreign policy and defence  
 Kurt Törnqvist and Ingemar Staaf April 1978

Abstract of an investigation of attitudes of the Finnish public to foreign policy and defence. The author attempts to discover the relationships

between class of employment and party adherence on one hand, and opinions on security policies on the other.

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