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SWEDISH DEFENCE RESEARCH

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A PROTECTION - ATOMIC

A1 Consideration and appraisal of the threats from nuclear explosions.  
Forecasts, summaries.

(199) FOA4 report B4063-A1

Reversal auto-radiography: a method for the examination of small radioactive particles. (In English)

J. Sisefsky

February 1973

Extract from J. Phys. E. Sci. Instrum., Vol.6, pp.74-76, 1973

FOA reprint 1972/73:24.

By means of this radio-autographic method a transparent preparation of both radioactive and inactive particles can be transformed into distinct circular zones against a surrounding, coloured, transparent background. As a result, they can be identified and studied without disturbing them, by their auto-radiographic signatures.

The strength of each particle's individual activity can be determined from the dimensions of the circular zone.

The report amounts to a shortened version of FOA4 report C4417-28 (FRO 69/70-3 item 186, RAE Translation LT 1509) and is in effect, an improvement of the essentially similar method described by Sisefsky, Br. J. Appl. Phys., 10, 526 (1959).

(200) FOA4 report B4065-A1

Seismological array stations and global seismicity. (In English)

O. Dahlman

Extract from Proc.Semin.Seismology Seismic Arrays.

NTNF/NORSAR, Sept.30, 1972, pp.81-84;

FOA reprint 1972/73:29

(201) FOA4 report B4066-A1

Seismic identification using short period Hagfors data. (In English)

H. Israelson

Extract from Proc.Semin.Seismology Seismic Arrays,

NTNF/NORSAR, Sept.30, 1972, pp.61-78

FOA reprint 1972/73:30

(202) FOA4 report C4523-A1

Observations on blast explosions at Medeo, USSR, 1966.

(Translation from Russian)

January 1973

The report is a translation of an article in Nutjnyy Stati i Zametki (Scientific articles and information). The article reviews two different blasting operations with 1700 and 3600 tons explosive respectively, which were used in constructing a dam at Alma-Ata in the USSR in 1966. The report describes how the explosives were positioned, the course of the explosion, the results and the seismic recordings, the latter in considerable detail.

(203) FOA4 report C4529-A1

The world's supply of uranium  
B. Andersson

February 1973

The report presents information on the presence of uranium in different countries, including deposits which are not at present an economical proposition. The information has been obtained from literature and the international trade press available up to October 1972.

(204) FOA4 report C4530-A1

On the possibilities of a 'directly igniting' fusion charge.  
G. During

February 1973

A 'directly igniting' fusion charge refers to a charge which is ignited by some non nuclear process. It has been calculated that to ignite a thermo-nuclear combustion in a mixture of equal parts deuterium and tritium, it requires between  $10^4$  and  $10^9$  J supply of energy, depending on the density of the fusion materials. The higher value corresponds to the density at a nearly completely frozen state of the mixture, the lower to a compression  $10^4$  times that density. None of the many methods of initiation discussed seemed likely to be realized from present day development. The two methods considered nearest to realization consisted of irradiating the fusion material with intensive, high energy electron beams or by compression by irradiation with a laser. With the former method it is reckoned that a current of  $10^7$  A of 100keV-electrons for  $10^{-8}$  seconds would initiate a mixture of deuterium and tritium in a nearly completely frozen state, that is, with  $10^4$  J supply of energy. With the latter method the calculations indicate that the same amount of energy could compress the material  $10^4$  times. Both methods are based on assumptions which have not been verified by experiment. As an attempt to forecast the future, laboratory initiation of thermo nuclear combustion will probably be achieved during the next decade and a guess for achieving direct military ignition of fusion charges would probably be during the 1980s.

## A2 Characteristics of nuclear explosions

(205) FOA4 report B4060-A2

Crystal potentials and the band electrons of iridium. (In English)  
G. Arbman and S. Hörnfeldt

Extract from J. Phys. F: Metal Phys., Vol.2, pp.1033-1045, 1972  
FOA reprint 1972/73:18

Energy band calculations have been made for metallic iridium by the relativistic APW method. A number of electron potentials have been examined and variations in the band and Fermi surface for the different potential propositions have been studied. It has proved useful to analyse the variations by

a method based on perturbation theory. The authors have found that both the band and the Fermi surface are noticeably more sensitive in relation to variation in terms of exchange and correlation than with respect to other uncertainties in the potential theories. This sensitivity is also shown to depend on an unexpectedly strong localization of '5d-electrons' at the Fermi energy.

- (206) FOA4 report B4061-A2  
Combined basis function method for energy band calculations. (In English)  
G. Arbman and D. Koelling  
Extract from Phys. Scripta, Vol.5, pp.273-278, 1972  
FOA reprint 1972/73:19

A method is given for calculating relativistic energy bands and wave functions, in which rapid converging sets of base functions are generated from linear-combined RAPW functions. By constructing a second set of base functions one can study the band structure of complex materials (e.g. groups of alloys) with a matrix of reasonable size. The result of an application to surface centred praseodymium show the usefulness of the method and possibilities of potential development.

- (207) FOA4 report B4062-2  
A simplified method for collective excitations in realistic systems.  
(In English)  
B. Johansson and G. Arbman  
Extract from J. Phys. (Paris), Vol.33, pp.C3-95, 1972  
FOA reprint 1972/73:20

A method has been developed for calculating collective excitation energies such as plasmon, in realistic multi-fermion systems. In order to test the method the authors carried out calculations on the electron gas with proportionately good results.

- (208) FOA4 report C4524-A2  
Lectures for FOA plutonium days, 3 and 4 May, 1972. January 1973  
The report consists of a written version of the addresses delivered at two 'plutonium days' arranged by FOAs institution for material research on 3 and 4 May, 1972.

### A3 Effects of nuclear explosions

- (209) FOA4 report C4525-A3  
Studies on plant accumulation of fission products under Swedish conditions. XIII entry of  $^{90}\text{Sr}$  and  $^{137}\text{Cs}$ , into the herbage of contrasting types of pasture. (In English)  
E. Haak and others. January 1973

The uptake by pasture vegetation of  $^{90}\text{Sr}$  and  $^{137}\text{Cs}$  from simulated single deposits has been studied over a six year period of long term trials arranged at two different places. The one trial ground consisted of natural pasture on moist sand and the other of cultivated pasture on clay. Both sites had been used for experiments with manures eleven years earlier. The distribution of nuclides in the ground profile was studied after the end of the trial period. At the first opportunity for harvesting during the year of contamination uptake of  $^{90}\text{Sr}$  by the pasture vegetation was higher than the uptake of  $^{137}\text{Cs}$ . Subsequently it dropped more quickly during that year, for  $^{137}\text{Cs}$  than for  $^{90}\text{Sr}$ . It then dropped further from year to year for both  $^{90}\text{Sr}$  and  $^{137}\text{Cs}$ . The average contents of  $^{90}\text{Sr}$  per g Ca was about four times higher on the natural pasture vegetation than on cultivated pasture during all the six years of the tests, whilst corresponding average contents of  $^{137}\text{Cs}$  per g Ca were approximately ten times during each of the two years following the year of contamination.

(210) FOA4 report C4526-A3

Experiments on conventional excess voltage transient protection as a protection against an EMP transient.

K. Daxberg

February 1973

The aim of the report is to elucidate the problem of whether a conventional over-voltage protection has any protecting effect against an over-voltage transient with a small rise time. The equipments tested were ASEA's protector type XHF and Siemens type KI-D1a. Also studied was the influence of the connections to and from the equipment as regards the effectiveness of the protector. The experiments show that the equipment used was very good for limiting an EMP transient. As regards the connections to and from the equipment, these should be reduced to minimum length to achieve the desired protection.

(211) FOA4 report C4527-A3

Attendance at a Conference on 'Workshop on survival of food crops and livestock in the event of nuclear war' held at USDA Training Center, Front Royal, Virginia and followed by relevant visits in USA.

L. Ekman

February 1973

The report gives an account of the Conference arranged by the Defence Civil Preparedness Agency - USDA-AEC dealing with the immediate agricultural problems arising in the event of a nuclear attack. The conclusion was that advanced methods existed in the USA for predicting the agricultural problems as regards their character and extent but a knowledge of their practical solution was imperfect.

(212) FOA4 report C4528-A3

Transfer of simulated fallout particles from pasture to grazing dairy cattle. II Experiments with wet deposited 40-63 and 100-200 $\mu$ m particles. (In English)

L. Ekman and others

February 1973

Six field experiments were carried out with 40-63 and 100-200 $\mu$ m particles marked with  $^{141}\text{Ce}$  and  $^{140}\text{La}$ . The proportion of particles spread over the pasture that was in water suspension and consumed by the cattle, was determined by analysis of radioactivity in the excretions.

On average the cows consumed 18% (range 6% to 39%) of the smaller particles and 21% (range 6% to 27%) of the larger particles.

Measurements of  $^{141}\text{Ce}$  and  $^{140}\text{La}$  in grass tests taken before and after the pasture trials were also intended to determine how much of the particles were consumed by the cows. However, the tests taken were not representative of the way in which cows graze.

(213) FOA4 report C4534-A3

Ignition of paper and cloth by short pulses of heat radiation.

B. Onnermark and L. Altvall

March 1973

The experiments reported study the required amount of radiation ( $\text{cal cm}^{-2}$ ) to ignite thin cellulose materials (paper and cottons) and the way in which it varies when the radiation is in short pulses ( $< 1$  second). The object of the experiment was to improve the basic knowledge for determining the effect of heat from small nuclear explosions and explosions at high altitudes.

The experiments were made with the FOA heat radiating apparatus (arc lamp and parabolic mirrors) with the shortest radiation pulses that the apparatus is capable of producing. The maximum radiation intensity was  $130 \text{ cal cm}^{-2} \text{ s}^{-1}$  and the shortest pulse time was about 100 ms.

The results support the hypothesis that the amount of radiation necessary to cause ignition increases with reduction in irradiation time within a range 500 to 50 ms. The basis for estimating ignition effects for still shorter pulses was considered to be very weak.

(214) FOA4 report C4535-A3

The transmission of neutrons in angled passages.

G. Danielson

March 1973

The report gives calculations of the reduction factors for initial neutron radiation falling on the mouth of an angled concrete passage with a deflection. A graph shows the ratio between the dose in the guide and the dose in free space and is considered suitable for use in calculating doses at the entrance

to many types of shelters. In conclusion, a comparison is made between the calculated values and the values given in Prov. Fort H.I. 1972.

(See also Ref.(253))

A4 Protection against atomic warfare

(See Ref.(214))

A5 Medical attendance (atomic injuries)

(215) FOAI report B1240-A5

Reticuloendothelial system phagocytosis following quantified combined injuries. (In English)

Bo. Schildt and M. Grundfelt

October 1972

Extract from Strahlentherapie, Vol.144, pp.50-59, 1972

FOA reprint 1972/73:17

The function of the reticuloendothelial system, RES, which is the body's most important cleansing system, has been studied in mice subjected to burn injuries (B), mechanical injuries (M) and injuries from radiation (R). The injuries were inflicted in two grades of severity, LD<sub>10</sub> and LD<sub>8</sub> (sub-lethal) and were applied either as separate injuries or in different combinations (B<sub>10</sub> + R<sub>8</sub>; B<sub>8</sub> + R<sub>10</sub>; M<sub>10</sub> + R<sub>8</sub>; M<sub>8</sub> + R<sub>10</sub>; B<sub>10</sub> + M<sub>8</sub>; B<sub>8</sub> + M<sub>10</sub>) and also in corresponding combinations in other arrangements. The time interval between the injuries was 8 days when R was applied first and 1 hour when M or B were the first injury inflicted.

The RES function was judged from the capacity of the animal to eliminate <sup>51</sup>Cr marked foreign blood bodies which were injected in the bloodstream, i.e. the phagocyte rate.

All of the single injuries impaired the phagocyte rate significantly compared with that in the control animal, as was also the case with all combinations of injuries. The functional impairments after combinations of injuries were additive, i.e. they corresponded to the sum of function depreciation for respective single injuries on the control animal. The order in which the injuries were inflicted had no significant influence on the phagocytes. RES repression was more correlated to the grade of injury rather than to the type. For several of the wound combinations the RES depression was closely correlated to the death rate.

The results indicate that the RES function in animals exposed to a combination of injuries, falls in proportion to the grade of injury severity. They also indicate a clear connection between the RES function and the final survivors.

(216) FOA1 report C1509-A5

Investigations into the sensitivity to radiation (LD50/20) in a family of mice used by FOA1 during the period February 1970 to July 1972.

C. Rönnebeck

March 1973

The sensitivity to radiation in terms of LD50/20 has been examined continuously for a family of CBA and C57/B1 mice used by FOA1. The report deals with experiments carried out during the period February 1970 to July 1972. The values found indicate a reversion to the levels of sensitivity which were valid from 1968 onwards.

Some approximate values for LD50 are stated for CBA/Fn 730R, CBA/LU575R and for some mice families C57/B1-650R which were not previously examined. No differences in survival times following radiation were observed. A rather altered method for external irradiation by X-rays is under development.

B PROTECTION - BIOLOGICAL

B4 Indication and identification

(217) FOA1 report C1510-B4

Bacteria content in the air of different working environments.

R. Andersson and others.

March 1973

The determinations of bacteria content inside different localities show that very wide variations exist. Well ventilated laboratories with modest activity show a content of some hundreds of bacteria per m<sup>3</sup> of air whilst the content in an enclosed purification plant falls in the 100 000 s. In a purification plant it is mainly the air consuming processes that create an aerosol. In other localities high bacteria content is caused by mechanical air humidification, sawing timber, plucking poultry feathers, demolitions and household cleaning.

(218) FOA1 report C1511-B4

Circulation by air of bacteria from an open public sewage plant.

R. Andersson and others.

March 1973

An investigation has been made into the circulation by air of bacteria from a sewage plant using biological purification (activated bed type). The results show that air circulation does occur. Higher concentrations are to be found in the immediate vicinity of the works and in the ventilation shafts from the works. This is true for the total bacteria content as well as the coliform bacteria. The proportions decrease rapidly with distance and level out at 400 to 500 m where the content is only slightly over the background values. The subsequent commentary discusses the values obtained from the tests.



B5 Protection against biological warfare including studies of technical systems

(219) FOA1 report A1563-B5

The medical risks in using glutaraldehyde as a means of biological decontamination.

B. Lundholm

March 1973

An estimation of the risks in using glutaraldehyde for decontamination purposes, was made against a background of available literature data concerning the materials' toxicity.

The conclusion arrived at is that glutaraldehyde may be used in wartime if normal methods for decontamination are not considered sufficient. Personal decontamination could be permitted for limited parts of the skin on the understanding that the contact time is short. The decontamination of dwelling houses, clothes, vehicles, masks, etc. is permissible if personnel are dressed in full protective clothing. Afterwards it is necessary to disperse the glutaraldehyde in some convenient manner, e.g. by blowing warm air on clothes and washing living quarters with water. Before living quarters are used again they should also be aired for 24 hours. It is important to be aware of the fact that repeated skin contact with glutaraldehyde, even in small quantities, can give rise to skin sensitivity.

(220) FOA1 report C1508-B5

Ground coverage and survival of bacteria spores after spraying fruit trees.

A. Bovallius and P. Anäs

March 1973

The spraying of fruit trees with a commercial preparation containing spores of *B. thuringensis* was carried out during the summer of 1972 at the Statens Væxtskyddsanstalt. FOA had opportunities of comparing the proportions of air-borne *B. thuringensis* with that on the ground at different distances from the spraying position.

Some studies were also made on the survival of *B. thuringensis* spores at different time intervals after spraying. A strong killing/survival ratio was obtained during the first days. After three months viable spores continued to be found round about the spraying site.

These sort of results can be used in the more important preparations for protection against biological means of warfare, e.g. the risk of infection from secondary aerosols and the need of washing after contact with a micro-biological aerosol.

See also Refs. (276) and (280)

B6 Medical attendance (B-injuries)

(221) FOAI report B1263-B6

Synthesis of 1-(2-diethylaminoethyl)-2-( $\alpha$ -hydroxy-benzyl) and 1-(2-diethylaminoethyl)-2-( $\alpha$ -acetoxybenzyl) benzimidazole. (In English)

L. Holmquist and L. Larsson

March 1973

Extract from Acta Pharmaceutica Suecica, Vol.9, pp.602-604, 1972

C PROTECTION - CHEMICAL

C1 Consideration and appraisal of the threat of chemical warfare, forecasts, summaries

(222) FOAI report B1256-C1

Considerations on a chemical arms control treaty and the concept of amplified verification. (In English)

J. Lundin

February 1973

The control situation for a treaty forbidding the development, production and storage of chemical warfare materials, differs from that banning nuclear weapon tests, in that in the former case, many widely different activities have to be controlled. Internationally regulated control methods for this purpose can seldom result in valid proof when a breach occurs. A piece of information can even give rise to a danger sign which prompts a party to reassess its future participation to the agreement. This type of control is too late in exposing an opponent, to act as an effective insurance.

The problem of achieving a workable international control in a treaty for the control of chemical weapons can perhaps, be made easier by exploiting the strengthening effect of applying several control methods, each of which alone may be of low effectiveness when used to expose a breach of the treaty.

C2 Chemical warfare - characteristics and effects

(223) FOAI report C1499-C2

Release of low molecular weight substances from cholinergic vesicles resulting from phospholipase-A<sub>2</sub>-attack.

E. Heilbronn

February 1973

Phospholipase A<sub>2</sub> releases acetylcholine from the synaptic vesicles isolated from rat brains and from cholinergic vesicles from Torpedos electrical organs. Morphological studies show that the release of ACL can be obtained before the structure of the vesicles is distorted. The ATP bound to vesicles is released first of all in connection with disintegration of the vesicle membrane, which does not suggest the release of an ACh-ATP complex. Phospholipides are necessary for its preservation.

- (224) FOAI report C1507-C2  
X-FOC - a help program for 8-16 K TIROS-FOCAL  
J. Santesson

March 1973

With the help of X-FOC program, TIROS-FOCAL can make use of an 8-16K memory drum. The running time for the program using large scale DEC-tape can accordingly, be reduced by 30 to 90%. The report is mainly intended for the guidance of X-FOC users.

- (225) FOAI report C1512-C2  
Tritium marking of benzyl acid.  
B. Gustafsson and others

March 1973

Benzyl acid has been tritiated specifically in the benzene rings by Pt-catalytic hydrogen substitution with the tritium water in an alkaline environment with a relatively good exchange activity (35% of the theoretical value). In this way benzyl acid has been produced with relatively high specific activity ( $\sim 1 \text{ mC/mg}$ ). Esters of interest to pharmacologists can be produced from benzyl acid relatively easily. The report gives a description of this sort of synthesis for kinuclidynyl benzylate with the specific activity  $\sim 0.6 \text{ mC/mg}$ . (See also Ref.(279).

C3 Dispersal and propagation

- (226) FOAI report C1498-C3  
GASUT - a computer program for calculating gas flow from holders containing condensed gas.  
A. Hasselrot and others

January 1973

The report describes a mathematical model and a FORTRAN program for the determination of gas flow from a pressurized tank in which the outflow is through a hole or tube connected to the gas in the tank. The calculation is carried out for small time intervals for which the outflow is considered as constant.

The report is part of a paper entitled 'Risks in the handling of chlorine'. The paper is intended for the Kungl Arbetarskyddstyrelsen.

C4 Indication and analysis

- (227) FOAI report C1502-C4  
Investigation of carbon monoxide warning devices for use in Civil Defence establishments.  
N. Ekman and H. Frostling

February 1973

Certain commercial carbon monoxide warning devices have been examined with respect to their suitability for use in standard shelters. The main types of equipment have been tested with respect to sensitivity, selectivity and general reliability.

The testing equipment and results of tests for different gases are described. The equipment which completely fulfilled the necessary technical requirements, is unrealistic from a cost viewpoint and simpler arrangements of an automatic type are not recommended because they are unsuitable from a reliability viewpoint. An apparatus for manual indication was nearest to fulfilling the requirements. Suggestions for modifying the pumping arrangements for this gas are made which would result in a lower purchasing price.

(See also Ref. (224))

C5 Protection against chemical warfare including studies of technical systems

(228) FOAI report C1513-C5

The penetration of chemical warfare material through packing.

L. Fagerlind and B. Jansson

March 1973

The breaking down time and penetration for different chemical warfare materials through a number of foils used in the packing industry has been investigated. The effect of some substances which encourage penetration have been measured. The object is to obtain an understanding of how well packed materials (e.g. foodstuffs) are protected by their covering against chemical means of warfare and also to find suitable foils for the manufacture of protecting material. The results are also used for the dimensions of permeability cells in the production of low content chemical-warfare materials in air.

(See also Refs. (276), (280) and (286))

D AMMUNITION AND WEAPON TECHNOLOGY

D1 Technology of explosives

(229) FOAI report C1495-D1

Method for concentration of impurities in trotyl and amatol.

A. Alm and A. Rönnlund

January 1973

Impurities in trotyl and amatol have been concentrated in silica gel. The methods' field of application is discussed.

(230) FOAI report C1497-D1

Digital data collection with A/D-transducer DEC AF01, tape player AMPEX FR1300 and computer PDP-8/1.

G. Blomquist and P. Ström

January 1973

Good quality measuring signals can often be digitized directly at the measuring position with advantage. The report gives a description of a data collecting system where a 14 channel analogue tape player can be used as the intermediate memory. This can later be transferred to a small computer for treatment.

The maximum rate of sampling, about 25 kHz was mainly determined by analogue/digital-transducers with multiplexers. The resolution was then 10 bits or 1024 units. The highest resolution, 12 bits can be obtained at slightly lower sampling frequency.

The principles and the main parts of the data collecting system are clearly described. The electronics, in the form of amplifiers and control unit are discussed schematically.

Time differences and interactions between the different tape channels have been studied for inputs and outputs. Measuring methods are described in relative detail, since they are perhaps of interest in the control and regulation of similar tape players. The method allows, among other things, determination of the effective column distances in the headings with a resolution of approximately 0.1  $\mu\text{m}$  (1000 Å), i.e. a fraction of a light wavelength.

(231) FOA2 report C2594-D1

Determination of carboxyl content in carboxyl terminated-polybutadienes by means of IR spectrophotometry.

R. Sandén

February 1973

Two methods for determining the carboxyl content in carboxyl-terminated polybutadienes by means of IR spectrophotometry have been examined. In both methods the absorption of the carboxyl band of the carbonyl groups has been determined for solutions with known carboxyl contents. Standard graphs have been prepared where the concentration is plotted against the absorption.

The peak height in one method has been determined according to the baseline method, and in the other, as a difference in absorption for similar wavelengths before and after ionisation, i.e. according to the  $\Delta\epsilon$  method.

Both methods gave standard curves in the form of straight lines where the measured values fairly well conform with these lines. The  $\Delta\epsilon$  method appears to be of more general use, since it generally gives more accurate results when analysing material which cannot be used in working out the standard curve.

D2 Gunnery technology and associated ballistics

(232) FOA2 report C2588-D2

The relationship between external ballistic stability and dispersion for high explosive shells with standard aftcone and with an extension in the form of a rather incurved spherical truncated cone known as a 'ducks tail'.  
S. Nordström and N. Nilsson

January 1973

The task MALFOM 4-483! refers to an investigation as to how changes in the different parts of a projectile affects its ballistic characteristics and also to

the connection between the projectiles' stability and dispersion in long range firing. In stage I of the task the rear part of the projectile was varied. This report only deals with two types, namely the original design and a projectile with the 'ducks tail'. The latter type has lower static stability and much greater spread in dynamic stability in the case of shots fired at the Nord range. Some projectiles had been dynamically unstable. With the long range firings however, the projectiles with the 'ducks tail' had the same or less dispersion than the original type.

**D3 Rocket engine technology and associated ballistics**

- (233) FOA1 report B1267-D3  
Studies in solid state chemistry. II On the structures of some oxo- and hydroxo complexes of lead (II). (In English)  
Å. Olin and R. Söderquist March 1973  
Extract from KTH proceedings, No.289, 1972.  
(See also Ref. (279))

**D4 The technology of war and effect on the combatants**

- (234) FOA2 report A2567-D4  
The range of different types of fragments and maximum height of ascent.  
A. Andersson and B. Palme March 1973

The report presents a number of different fragment types, their range and maximum ascent height, as a function of their mass, firing angle and speed. The results are relevant chiefly as a basis for estimating the danger areas for explosives testing. The numerical calculations were carried out on a computer with the aid of a program previously worked out and reviewed by FOA.

- (235) FOA2 report A2568-D4  
Apparatus for the automatic recorded weighing of fragments.  
G. Axelsson and others. March 1973

FOA section 254 have built an equipment which automatically records the mass of sample fragments using an electronic balance. The recordings are on punched tape. The mass of fragments can vary between 0.2 and 20 g and the accuracy of measuring the weight is 0.01 g. The maximum capacity of the equipment is, at present, 900 fragments/h.

- (236) FOA2 report C2593-D4  
Penetration by fragments from an ordinary large calibre steel case warhead.  
A study of parameters.  
Å. Johnsson February 1973

**Object** To provide a basis for estimating the penetration capacity of splinters from a warhead of 360mm calibre.

**Method** A simple weapon is described, the type being a tube filled with explosives. With a fixed calibre and overall weight, the wall thickness of the case

was varied. The case's material properties, the type of explosive, thickness of the target and distance to the target, were also varied. Calculations of the number of penetrations were made for every combination of the above parameters.

Results The figures are presented in a number of diagrams which enable a choice of suitable steel quality and case thickness of the weapon to be made for a given criterion of splinter penetration capacity.

(237) FOA2 report C2603-D4

Photographs of fragments striking a steel cable using a strip film cine camera.

B. Andersson and others.

March 1973

The trials were made to develop a photographic method for recording in detail what actually occurs when a fragment strikes something, e.g. a steel cable. The report describes how this can be filmed at a picture frequency of  $2 \times 10^6$  pictures per second. Certain preliminary conclusions concerning the course of events and the damage are reviewed.

The trials have shown that the method used is suitable for the study of rapid movements within reasonable dimensions, about  $1 \text{ cm}^3$ .

It was not considered necessary at this time to make a detailed analysis of the damage to the steel cable.

(238) FOA4 report A4504-D4

The effect of shock waves and splinters on buildings - the present state of knowledge and need for information.

H. Axelsson and others.

January 1973

A number of changes in the basic ideas for civil defence requires a wider knowledge of the effect of conventional weapons on dwelling houses. The report gives discussions on the effects of shock waves and splinters. Fire effects are not dealt with here but in another text.

The topic is divided up into a number of blocks representing tactical, technical, physical and physiological effect factors. Each block is dealt with in terms of the state of knowledge and the need for research.

On the basis of the need for knowledge, and taking into account time for coordination, priorities have been worked out for investigations over the next four years, concerning weapon performances, technical characteristics of buildings, the properties of shock waves and the effect of shock waves on isolated building elements. The stability of buildings and their collapse call for high priority in the future.

The report does not deal with the need for resources.

D6 Protection against effects on the combatants

(239) FOA4 report C4520-D6

Determination of boron in boron carbide.

B. Gelin and E. Helleday

January 1973

A method for the determination of boron in boron carbide has been tested. The test specimen was melted with sodium carbonate and dissolved in water whereupon, the solution was neutralized with hydrochloric acid and filtered. The amount of boron in the solution was determined by titration with sodium hydroxide in an atmosphere of nitrogen after adding mannitol. About 5 mg was found with a precision (standard deviation in separate tests) better than 0.04mg boron in the actual test material.

(240) FOA4 report C4531-D6

Ballistic test, determination of structure and properties of an aluminium oxide ceramic produced by the AB-IFÖ works.

F. Örtengren and others.

February 1973

An investigation has been carried out on aluminium oxide ceramics manufactured by the AB IFÖ Company. The intention has been to find out the suitability of the material as a component in lightweight armour and also to compare it with an American material (Frenchtown), which is used commercially for this purpose. Plates of ceramic backed with aluminium plate and two types of glass fibre armoured polyesters have been fired at to determine the limitations and the breaking characteristics. The solidity was determined by means of diametral compression of sintered rings. The modulus of elasticity was measured from the observed longitudinal speed of sound. The structure and composition of the material were examined by means of a light microscope, scanning electron microscope and micro sonde. The size and volume of the pores was also examined. The results from strength and structure tests, indicate that the material can be superior to the Frenchtown manufactured aluminium oxide for use as light-weight armour. Comparisons from firing tests are not available however.

(241) FOA4 report C4532-D6

Properties and structure of some ceramics used for, or adapted for, light-weight armour.

F. Örtengren and L. Ekbom

February 1973

Comparisons of the properties and micro structures of some light-weight armour, either using, or adapted for ceramics on aluminium oxide and boron carbide bases have been carried out. The comparisons comprise data obtained either from tests made by FOA or the manufacturer as well as current literature. The suitability of the material for use as a light-weight armour is discussed.



D7 Medical attendance (splinter, blast and burn wounds)

(242) FOAI report B1239-D7

Mortality rate in quantified combined injuries. (In English)

B. Schildt

October 1972

Extract from Strahlentherapie, Vol. 144, pp.40-49, 1972:

FOA reprint 1972/73:16

Mortality and survival life have been investigated in mice subjected to three types of standardized and quantified injuries in different combinations. Injuries of types: burns (B), mechanical (M) and radiation (R) were applied in two grades LD<sub>10</sub> and LD<sub>5</sub> (sub-lethal). The order in which the injuries were applied to the anaesthetised animals varied as well as the time intervals between the individual injuries (0 to 30 days). A total of 79 different combinations were studied.

All combinations of injuries caused an additional or strongly synergistic increase in mortality compared with corresponding single injuries to the control animals. R10 gave, for example, with different combinations of B<sub>5</sub> and M<sub>5</sub>, 95 to 100% mortality, which is 6 to 19 times as high as the total for single injuries on control animals. Different combinations of R<sub>5</sub> and B<sub>10</sub> increased mortality 4 times compared with the controls. The highest mortality when B<sub>10</sub> was combined with M<sub>5</sub> was 50% and when M<sub>5</sub> was combined with B<sub>10</sub>, it was 55%, similarly for B<sub>5</sub> + M<sub>10</sub> and M<sub>10</sub> + B<sub>5</sub>; this is about 4 times as high as for the control animals. Variations of the time interval between the injuries influenced mortality, which showed a maximum when B or M was applied to the animal 8 to 12 days after R. The maximum after B or M was 5 days, when the mortality for a following R reached a maximum. With combinations between M and B, the time interval for highest mortality was 0 to 3 days. The survival times were considerably shortened after most combinations compared with the controls and were rarely more than 24 hours after the second injury.

The results indicate that a powerful synergistic increase in mortality is the usual outcome of all the combinations of injuries studied, and that injury by radiation is not unique in this respect, and further, that it is not an obligatory component in the combination of injuries.

D8 System studies

(See Ref. (270))

E CONDUCT OF WAR - INFORMATION AND COMMAND

E1 Reconnaissance and location

(243) FOA2 report C2585-E1

Review of an amplifier tube for pictures at low light levels.

O. Andersson

January 1973

The first part of the report gives a general description of the fundamental principles of the electronic photo-amplifier and of the present stage of development. It also surveys those light levels and spectral divisions of light rays that can be expected at night-time. In the last part of the report a quantitative treatment of the photo amplifier system is carried out in which the composition of night radiation, the efficiency of the cathode, the objective diameter and the transfer function for the system, are all taken into account.

(244) FOA2 report C2587-E1

Recovery time after being dazzled, as a function of age.

B. Högman and others

January 1973

The ability of the eye to recover or its readaptation (RAT) after photo-stress depends on a number of factors such as the light characteristics of the dazzle source, angle of vision, level of adaptation, etc. This capacity of recovery is also influenced by the individual's age. The report deals with RAT studies on different age groups. For this, the opto-kinetic nystagmus (OKN) has been used. OKN has been recorded by EOG technique. The results show that the different age groups differ mainly at low background luminance.

(245) FOA2 report C2591-E1 (In English)

Detectability of an unsharp edge in additive noisy background.

T. Orhaug and R. Johansson

January 1973

The report gives a review of the results of perception experiments which were aimed at studying the observer's ability to detect an edge of varying sharpness, intensity and area. The edge was observed against a background of additive, normally distributed noise. The results have been analysed with allowances for the background noise characteristics and the visual systems characteristics. The result of the observations can be described by a linear detection model whose characteristics comprise spatial derivation and integration of the visual stimulus pattern.

(246) FOA2 report C2596-E1

The principles of colour systems. (In English)

G. Tannquist

February 1973

Extract from Die Farbe 19 (1970), Nr. 1/6.

In the same way as colour is a perception and can be classified as such, so do methods that represent colour stimuli include many physical, chemical and technical problems. Colour and coloured material must accordingly be

definable and systematized on this basis. The report outlines the fundamental philosophies which attempt, in different ways, to systematize colour.

The paper has been published in a festival edition of Die Farbe in honour of Manfred Richter's 65th birthday.

(247) FOA2 report C2600-E1

Radiation of HeLa cells by HeNe laser.

G. Nilsson and others

March 1973

Unintended exposure of the eye in laser experiments can give rise to injury. This has already been shown in animal experiments. The results however, are not easy to interpret. There is therefore a need for a simple test system for investigating cell damage. A description is given of radiation for  $\geq 1$  m on the epithelial cells in culture (HeLa cells grown on glass surfaces) with a HeNe laser (40mW output). Irreversible changes in the structure of the cell membrane were observed both with the visual microscope and with the scanning electron microscope.

(248) FOA2 report C2604-E1

A versatile 60kV switching system for pulsed excitation of lasers.

(In English)

L. Lidholt

March 1973

Extract from Rev. Sci. Instruments, Vol.43, pp.1765-1768, 1972

A rapid switching high voltage system for 60 kV is described. The system uses a hydrogen filled high pressure spark gap as the switching device. A silicon rubber insulated connection allows different high voltage units to be changed without risk of losing any insulation oil. The system has been used to construct a laser which transmits pulses of radiation of some nanoseconds duration over a wave length band from 337 nm in ultraviolet to 9.0  $\mu$ m in infra-red. The UV pulses contain enough energy to pump a tunable rhodamine 6G dye laser.

(249) FOA2 report C2605-E1

Raman scatter laser radar detection based on a sampling technique.

(In English)

L. Lidholt

March 1973

Extract from Opto-electronics. Vol.4, pp.133-139, 1972

A study of the total differential Raman cross section for  $\text{CO}_2$ ,  $\text{O}_2$ ,  $\text{CO}$ ,  $\text{CH}_4$ ,  $\text{H}_2\text{O}$  and  $\text{H}_2$  relative to that for  $\text{N}_2$ , is presented. The scattered radiation is collected at right angles to the excitation beam from a 337 nm nitrogen laser with 50kW pulse output. The pulses of short duration, 2.5 ns could be conveniently dealt with by a sampling oscilloscope. The sampling

technique made it possible for an average value composition of the Raman scattered signal to be carried out on the output side of the sampling oscilloscope. This process does not affect the time resolution but can improve the signal to noise relationship of the recording of a Raman spectrum.

(250) FOA2 report C2606-E1

A study of literature on methods to determine the effect on visibility of the atmospheric particle concentration, size and distribution.  
E. von Zeipel

March 1973

The report gives a brief account of methods reviewed in literature, for the recording and collection of airborne particles that affect visibility together with a list of references in literature. In addition, principles are proposed for an electrostatic particle separator.

(251) FOA3 report C3731-E1

The E region of the ionosphere at night time - a literature study.  
A. Hedberg

January 1973

In order to obtain information about the ionospheres E-region during the night, (night E), and the processes which control this region, publications on this subject have been examined. The study covered 45 publications issued during the years from 1950 to 1972.

(See also Ref. (301))

E2 Communications

(252) FOA2 report C2584-E2

Communication link with CO<sub>2</sub> laser.  
H. Lindstrand and S. Nordlander

January 1973

A communication link constructed around a CO<sub>2</sub> laser, has been set up in a laboratory. Both transmitter and receiver have been placed in the FOA2 horizon room, with a reflector mounted on Kaknäs tower. The measuring track was 2 x 1.6 km. Good communication for speech and music has been obtained.

(253) FOA3 report B3035-E2

Travelling ionospheric disturbances initiated by low altitude nuclear explosions. (In English)  
W. Stoffregen

An address to the Specialist Meeting on electromagnetic wave propagation, Wiesbaden, April 1972:

FOA reprint 1972/73:14

The report summarises observations on disturbances in the ionosphere caused by two large nuclear explosions at Novaya Zemlya on 23 and 30 October, 1961.

(254) FOA3 report C3730-E2

Mounting thin film circuits on ferrite substrates.  
H. Steyskal

February 1973

This investigation was started because of the frequency of faulty mounting of integrated microwave circuits on ferrite substrates.

It was found that a covering applied *in vacuo*, of chrome and gold had adherence to ferrite, even when the substrate temperature was as low as 250°C during the vapourizing process. The peeling force was in the order of 2 to 10 kp/mm<sup>2</sup> when tested. The attachment did not change during the whole chain of processes from the electro-plating of the pattern with gold. It showed that in this phase the appearance of a weakening in the attachment depended on diffusion of nascent hydrogen through the vaporized chrome-gold down to the ferrite surface, where a chemical reduction of the intermediate layer could take place at room temperature. This reduces or completely destroys the existing binding between chrome and ferrite.

This signifies that the usually recommended cathodic treatment before electro-plating must be replaced by proper chemical cleansing methods, the effect of which is controlled by means of the water test. Furthermore, one must endeavour to attain maximum cathode efficiency during plating in order to minimise the development of hydrogen.

It was also established that different gold plating baths produced internal mechanical stresses of considerable variation in the precipitated gold layer. Electrolytes and plating conditions do exist which give very low internal stresses. Furthermore, a procedure for making a good adhering chrome layer consists of raising the substrate temperature from about 250°C to about 350°C during vaporization of the chrome.

The combination of all three possible procedures, namely (1) avoidance of cathodic impregnation, (2) plating with high cathode efficiency in the gold bath with lowest inner mechanical stresses in the gold deposited and (3) chrome vaporization at about 350°C substrate temperature, resulted in fully acceptable circuit patterns on ferrites with no rejections.

(255) FOA3 report C3732-E2

Impedance matching of an open free radiating circular wave guide for use as an antenna array element.  
A. Bergquist

January 1973

The report is a survey of the results of work on the development of a matching unit for an antenna element consisting of a circular wave guide aperture

within the frequency range 8.5 to 9.5 GHz. Such antenna elements can be used with advantage, in electrically controlled array antennae. The use of 'cut-off' wave guides has resulted in a broader band and mechanically simple arrangement. The report also presents curves of the calculated standing wave relationships variation with the array angle of the adapted antenna element.

E3 Fire control

(See Refs. (243), (247), (248) and (249))

E4 Guidance, navigation and target characteristics

(256) FOA2 report C2598-E4

Description of the FOA electronic turntable for measuring gyro drift.

L. Lekzén

February 1973

This report describes the FOA gyro turntable and associated electronics which has been completely revised and rebuilt to take into account the much higher accuracy of modern gyros. With appropriate measuring methods, a gyro drift of around  $0.001^{\circ}/h$  can be recorded.

The work is part of a request from FMV-F.

(257) FOA2 report C2599-E4

Description of electronics for the Gyroflex (Singer-Kearfott).

L. Lekzén

February 1973

The report presents a description of the electronics associated with the gyroflex. The work is included as part of an order from FMV-F.

E5 Computers

(258) FOA2 report B2040-E5

Doubly stochastic Poisson processes and process control. (In English)

M. Rudemo

Extract from Adv. Appl. Probability, Vol.4, pp.318-338, 1971

FOA reprint 1972/73: 22

The intensity parameters in a Poisson process are assumed to vary stochastically and to form a Markov chain with continuous time and finite space condition. The point process obtained in this way is a special case of doubly stochastic Poisson processes. A system of ordinary differential equations is derived for the necessary apportionment of the Markov chain, given observations of the point process. An estimate of the intensity, optimized in terms of least quadratic methods, has been calculated with the aid of this apportionment. Applications in the field of reliability and maintenance are considered. A special case with two conditions corresponding to a process being in or out of

control, is discussed in detail. Governing strategies based on the necessary probability for the process being out of control are studied.

(259) FOA2 report C2589-E5

A program for listing card indices for A4 reports.

G. Fick

January 1973

The report describes a program for listing card indices in such a way that the copy can be used directly in an A4 report. The program is written in *FORTRAN* and is intended for use on IBM 360/75 at The Computer Centre, Stockholm.

(260) FOA2 report C2590-E5

Flexible table printing subroutines in *FORTRAN*. (In English)

G. Fick

January 1973

The report describes the setting up of subroutines for writing tables. The operator can select table size, their own variable name, their own printed *FORMAT*, etc. The subroutines, which are written in standard *FORTRAN* can be implemented in most installations but to some extent uses unconventional programming technique.

(See also Refs. (294), (295), (297) and (298))

#### E6 Counter measures

(261) FOA2 report C2586-E6

Changes in mass of biological cells when irradiated with Q-pulsed ruby laser.

B. Rosengren and B. Tengroth

January 1973

The instantaneous changes in mass of coloured biological cells when irradiated with a Q-pulsed ruby laser have been studied. The mass change has been measured with the aid of X-ray absorption technique. A mass increase for cells in a surrounding liquid was obtained when irradiated at  $6 \text{ MW/cm}^2$ . Without the liquid, a reduction in cell mass was measured, with irradiation at  $0.9 \text{ MW/cm}^2$ .

(262) FOA2 report C2592-E6

Skidproof dyes for concrete and asphalt.

R. Pettersson

February 1973

Painting concrete and asphalt often results in a lowering of the dry and/or wet friction. By adding about 6% ground quartz of  $\leq 0.2 \text{ mm}$  in size, the coefficient of friction is considerably increased. The surface to be covered uses in addition, about 7% of  $30\mu\text{m SiO}_2$ . By this means the coefficient of friction obtained for the dyed layer in the wet or dry condition rises accordingly from about 0.6 to 1.2. Other factors, e.g. the binding medium, application technique, consistency of dye, proportion of pigment and surface structure

have been shown to have great significance. A connection between the choice of vertical profile and the value of the coefficient of friction has been obtained using the dynamometer method. The laboratory investigations are proceeding with practical outside tests with three trial dyes.

E8 Reviews and threat scenarios

(263) FOA3 report B3036-E8

Microfiches as a medium for information.  
R. Gezelius and others

March 1973

Extract from Dokumentation, Vol.28, No.5, 1972

FOA reprint 1972/73-25

See FOA3 report C3718-E8 (FRÖ 71/72-4, item 341. RAE Translation, LT1693).

(264) FOA3 report C3734-E8

Inaccuracy in measurements and calibrations. (In English)  
R. Olsson

January 1973

The report presents in graphical form, the normal estimated inaccuracies in FOA measurements and calibrations of radio electrical quantities. The curves give a rough indication of the FOA measuring technique resources in this field.

(265) FOA3 report C3738-E8

The Seventh URSI Congress in Warsaw, 1972  
C. Aurell and others

March 1973

This is a brief account of the activities of the Union Radio Scientific International seventeenth general meeting in Warsaw, August 1972. The report mainly consists of a collection of the written papers used as a basis for a verbal report by the Swedish official delegates to the different commissions at USRI XVII plenary meeting before SNRV, at its session in Stockholm on 13 October, 1972. Many of these papers had been sent to the members in SNRV as appendices to the report of proceedings on 7 November, 1972 and are now published in this FOA report by kind permission of the authors.

F VEHICLES AND SPACECRAFT

1.3 Aircraft

(266) FOA4 report C4521-F3

Determination of chrome in copper alloys.  
B. Gelin

January 1973

A method has been developed for the determination of small amounts (30-3000 ppm) of chrome in copper alloys. After dissolving the specimen in sulphuric acid and nitric acid the copper is separated electrolytically. The solution now free of copper is oxidized with hydrogen peroxide (in alkaline solution) and the chrome is then determined by spectro-photometry as the chromate



ion. The quantity of specimen is selected so that the final determination of chrome is made with a solution containing between 30 and 300µg chrome. The standard deviation in an individual test was then rather better than 2µg chrome.

(267) FOA4 report C4522-F3

Determination of uranium in iron-uranium alloys.

B. Gelin and E. Helleday

January 1973

A method has been developed for determining small quantities of uranium (0.01% and 0.001% uranium respectively) in iron-uranium alloys. After dissolving the specimen in sulphuric acid and nitric acid the iron is separated electrolytically on the mercury cathode. Uranium and traces of remaining iron in the solution are extracted in the form of oxinate by chloroform. After shaking the chloroform phase with a solution of ammonium carbonate, the uranium is transferred in the water phase from which the uranium is again extracted as oxinate with chloroform, after the carbonate ions are removed. The amount of uranium is determined in the extract by means of spectrophotometry. The precision (standard deviation for isolated determinations) was approximately 0.4µg uranium within the range 4 to 25µg uranium.

(See also Ref. (269))

F5 Missiles and torpedoes

(268) FOA1 report A1562-F5

Examination of an object from space.

G. Larsson

March 1973

An object found in Jämtland has been examined. The results indicate that it originated in the USSR and that the fragment is probably a small rocket unit from a spacecraft. It may have been used either for braking or separation purposes.

F8 Reviews and threat scenarios

(269) FOA2 report A2566-F8 (F3)

Ground effect devices for the transport of personnel and goods over short distances using air suspension.

S. Palme

March 1973

Ground effect devices is a collective name for many different light-weight devices of varying form which are preponderantly for non-contact flight over short distances carrying loads of different kinds.

The report deals with such devices, their function and certain fundamental characteristics. Information has been obtained from unclassified literature and available matter which, after certain appraisal and arrangement, has been compared so as to give a survey of the development.

(270) FOA2 report C2597-F8  
Information on attack helicopters - a comparison.  
C. Haglund

February 1973

The attack helicopter, equipped with anti-tank rockets, is now attracting considerable interest. Since 1965 the leaders in this field, and up to now the only country which has tried out attack helicopters, is the USA. The experience from the war in Vietnam and simulated trials show that the attack helicopter equipped with anti-tank rockets, is a very effective weapon against tanks because it avoids enemy anti-aircraft fire provided suitable tactics are employed.

The experiences of Vietnam and the tests made, have been noted by NATO countries who are now preparing to obtain attack helicopters with anti-tank rockets.

The report mentions some war experiences and the extensive tests which have been carried out and also describes types of attack helicopters and weapon systems for them. In conclusion, a brief reference is made to the next generation of attack helicopters in the USA.

G RELIABILITY AND LOGISTIC TECHNOLOGY

G1 Store maintenance technology

(271) FOA1 report B1259-G1  
Inhibitors against tank corrosion.  
P. Atterby

January 1973

Extract from 'Oljeskydd', No.1, p.5, 1972  
FOA reprint 1972/73: 31

The report begins by defining the inhibitor concept. It goes on to describe in simple terms such anodic, cathodic and double acting inhibitors. Two different forms of corrosion occur in oil tanks, namely general corrosion and pitting. Of these the most dangerous form of attack is pitting. The conditions in tanks, e.g. presence of water, sludge, rust, etc. are described. Oil dissolves 80 to 100 ppm oxygen from the air and this constitutes a large reservoir of oxygen which is a prerequisite in the advance of corrosion. A good corrosion inhibitor is defined. Known methods for the evaluation of inhibitors against tank corrosion, for example, dip testing, are dealt with and research now proceeding in FOA concerning new electro-chemical methods is described in detail.

(See also Ref. (275))

G2 Reliability and inspection techniques

(272) FOA4 report C4533-G2

A relaxometer for polymer material.

T. Åredal

March 1973

The report describes a recently produced relaxometer for measuring polymer material and test results arising from them.

The relaxometer works by compression and is mainly intended for measurements on rubber material and elastic plastics.

(273) FTL A report A28:1

A look at the future of electronic components.

T. Charles

February 1973

Available statistics on electronic components are very scarce, and professional components are not separated from 'entertainment' components. The largest amount of information originates in the USA but is characterized by a constant over-optimism. The report is mainly concerned with the period 1968-80.

The total component market seems to have a stable annual value and is divided equally between USA, West Europe and Japan. Japan ought to attract a greater interest than hitherto especially if they carry out their intentions of paying more attention to professional variants.

The increase in annual value is expected to become relatively large for opto-electronics, integrated circuits and batteries. Moderate increases are expected in electrolytic, ceramic and plastic condensers as well as metal film and metal-glass resistances. Reductions are anticipated for transistors, diodes, electronic valves, variable resistances, transformers and contact devices.

In the long run hybrid circuits may replace printed circuits, but before this change happens many stages will have to be gone through. The reactions on conventional components will be great and far reaching.

Type testing in future may trend against increased specialization in favour of tests for certain special areas which seems more appropriate than a spread of resources over the whole field.

G3 Storage

(274) FOA1 report C1468-G3

Electrochemical testing of deposit corrosion and pitting on mild steel in inhibited salt solutions. (In English)

P. Atterby and L. Schön

September 1972

Experiments were first conducted according to the 'static water drop test' and the steel test specimens examined by the scanning electron microscope. This

showed that a lack of inhibitor resulted in an amorphous cavity, the geometry of which, depended on the metal structure. With a total absence of inhibitor a general corrosion took place which corresponded to the crystal structure of the metal. The method of examination was not suitable for evaluating the inhibitors' effect on deposit corrosion and the propagation of pitting. For this purpose an electrochemical column corrosion cell was developed. The current through the cell as a function of time, was studied for six inhibitors:- two soluble in water and four soluble in oil. A tentative model for the corrosion inhibitors' effect could be established on a current/time graph. The cells electrode potentials were measured and the anodic performance for certain inhibitors could be correlated with the current/time results. The rate of diffusion for the inhibitors is discussed. By means of full scale trials in tanks for Fuel Oil I, a rough correlation has been provided by data from the column corrosion cell and the conditions in the tanks.

(275) FOA1 report C1493-G3  
Fifth International Congress on metal corrosion.  
Tokyo, May 1972  
P. Atterby

January 1973

The fifth international Congress on metal corrosion was attended by about 560 scientists from 28 countries. Six full days of lectures were arranged. The field of corrosion was divided into 15 different sections on which 214 papers were submitted. The author was chairman for one of the sessions. The author also contributed a paper (FOA1 report B1243G1, C1468-G3, abstract No.174 in FRÖ 72/73-2, RAE Translation 1732) on electro-chemical research on deposit corrosion and pitting of low alloy steel in inhibited salt solutions. Further sessions were arranged with two groups of Japanese scientists and technicians, mainly from the Japanese Association of Corrosion Control and the Japanese Petroleum Institute.

(See also Ref. (271))

#### H HUMAN FACTORS

##### H3 The closed room environment

(276) FOA1 report A1561-H3  
Methods of cleaning and servicing air supplies, and their control.  
G. Lindner

March 1973

In recent years there has been considerable interest in the cleaning of air, arising mainly from the steadily increasing discharge of sulphurdioxide, carbon monoxide and nitrous oxides, etc. Methods of cleaning gas from gaseous

impurities without chemical reactions are available by absorption, adsorption, molecular sieve and condensation, whilst those methods with chemical reaction include absorption and heterogeneous catalysis as well as combustion.

The air or gas often carries particles of impurities in the form of different large vapour droplets, bacteria or solid particles. Air cleaning in these cases is achieved by separation in different filters and centrifuges.

In enclosed spaces with important military applications there is also a demand for lower contamination content and for air maintenance so that normally harmless gases such as carbon dioxide are removed.

In conclusion there is a discussion on air maintenance and control.

(277) FOA1 report C1492-H3

Experiments with a catalytic cleaner for car engine exhaust gases.

K. Bergquist

December 1972

Trials have been made with a fixed layer of a catalyst through which the exhaust gas flows radially. This was used to determine the extraction of carbon monoxide from pulsed exhaust gases from a Volvo B18 engine. The layer of catalyst consisted of 0.1% platinum on spherical grains of aluminium oxide.

Pulses of exhaust gas were produced with the aid of an oscillating fluidic valve. The tests revealed no difference in carbon monoxide extraction with forced pulses of gas at a frequency of 35 Hz by comparison with normal flow through the catalyst layer. The addition of air in varying quantities had a great influence on the extraction.

(278) FOA1 report C1501-H3

The chemical engineer and environmental conservation.

G. Lindner

February 1973

For his work of plant operation, the training requirements of the chemical engineer have to be the most general of all engineers. An analysis of environmental conservation also indicates that the required knowledge acceptable for the development and application of environmental conservation really corresponds to the chemical engineer's physical/chemical background. The questions are discussed against a background of water and air-pollution and the treatment of refuse. The chemists' fundamental role in connection with descriptions of the environment is also emphasised.

(279) FOAI report C1515-H3  
Chemical reaction engineering.  
J. Lindner

March 1973

Chemical reaction engineering (genie des réactions chimiques, chemische Reaktionsführung) is the name given to a branch of chemical engineering science developed since the middle of the 1950s.

The author has had the advantage of being the only Swede to take part in all the Symposia arranged on the subject, (Amsterdam 1957, 1960 and 1964, Brussels 1968 and Washington 1970). These were organized by the European Federation of Chemical Engineers working committee for chemical reaction engineering. Since 1960 the author was accompanied by Professor Otto Stelling who was replaced in 1971 by Professor Nils-Herman Schöön, and has been the Swedish delegate to the Working Committee which implied taking part in the informal symposia of 1966 at Pont à Mousson and in 1969 at Venice. Chemical reaction engineering has grown during this time to such a significance that the subject regularly forms part of congresses on chemistry in general. At the beginning of May 1972 the fifth European Congress was arranged in Amsterdam, unfortunately, without a paper from Sweden. Since 1970 the subject has been the responsibility of a professor at Chalmers Tekniska Högskola.

There are grounds for mentioning that the chemical reaction engineers' principles, now under the name of 'biochemical reaction engineering' are subject to continuous development.

The report deals with the development of chemical reaction engineering in USA and Europe and begins with the programme for the professor at CTH, discusses past symposia on the subject up to and including Amsterdam 1972 and the CHISA Congress in Prague, September 1972, concluding with a quick look forwards. An Appendix gives some excerpts from a competent opinion of the CTH professor's appointment.

Chemical reaction engineering is of great importance in the work at FOA on forecasting future events. The report is the basis of a paper at IUA Symposium on chemical reaction engineering, March 1971, and can be regarded, together with the extracts from the competent opinions, as a stage in the spread of information about this important subject.

H4 Provision of water and food

(280) FOA1 report A1560-H4

Water purification - a new technique.

G. Lindner

February 1973

A water supply and associated hygienic conditions are becoming more and more significant for both civil and military purposes because of increasing pollution. The report presents a systematic arrangement of all possible types of pollution and their basic methods of treatment. A rather more detailed account of future technique is given such as electrodialysis, reverse osmosis, and adsorption.

The question of pure water is really not only a question of health and hygiene but also of well-being with possible intrusion of physical illnesses.

(See also Ref. (278))

H5 Performance, ability and behaviour of the individual and the group

(281) FOA2 report C2595-H5

Laser cane for the blind. (In English)

L. Fornaeus

February 1973

The report is a short account in English, of the technical solution and practical comments on the use of a laser cane for blind people.

The information reflects the situation in December 1972 and is mainly intended as an answer to world wide enquiries arising directly or indirectly from an article in the FOA news bulletin.

(See also Refs. (245), (306) and (307))

H6 Health and medical attendance, field hygiene

(282) FOA1 report A1564-H6

Studies on risks of catastrophe in the handling of chlorine.

I. Railway accidents.

O. Hertzberg and others

March 1973

A study has been made of a simulated railway accident with chlorine in transportation. The accident was assumed to have happened in a densely populated community.

Certain methods of calculations have been used in connection with these studies as regards the magnitude of accidents with chlorine and the toxic data resulting.

The significance of different types of chlorine spillage is emphasized with special reference to procedure to be carried out for salvage purposes.

Aspects of preservation statistics on evacuation of the population within the contaminated area are given.

The study shows that an incident of this type can give rise to a catastrophic medical situation, which motivates an increased contribution from the population as regards preventive and damage restriction procedures. Suggestions for these procedures are given. In this way better information should be given to the public *via* mass media, on the opportunities to seek protection against chlorine contamination indoors. Methods for preventing gas fumes spreading by means of water or heat curtains are considered to be the subjects of further investigations. Equipment for the indication of chlorine should be produced and kept at police stations in those areas where chlorine is transported. Furthermore a number of civil defence gas masks should be deposited in police stations in areas of potential risk. In conclusion, it is proposed that the advantages of transporting chlorine in chilled containers should be more closely examined, e.g. with respect to the cost aspects.

(283) FOA1 report B1257-H6

Late microvascular changes after slow and rapid thawing of frozen tissue.  
(In English)

B. Albrektsson

January 1973

Extract from *Advan. Microcirculation*, Vol.4, pp.161-176, 1972

Rapid thawing of frozen tissue by immersion in liquid at  $+42^{\circ}\text{C}$  has been demonstrated to reduce the overall loss of tissue. As regards the formation of blisters which has occurred at  $+43^{\circ}\text{C}$  it may well be questioned whether immersion at  $+42^{\circ}\text{C}$  is to be recommended.

With the idea of examining whether rapid thawing involves increased damage in thin tissue, comparisons of micro-vascular studies have been made of frozen rabbit ears after rapid thawing in liquid at  $+42^{\circ}\text{C}$  and slow thawing in air at  $+22^{\circ}\text{C}$ . Macrophotography, infra red thermography and microangiography have been used for this purpose.

Both micro-vascular hyper- and dysfunctions have been observed after thawing of mild injuries due to freezing. The amount of vessels has been significantly fewer in rapid thawing tissue than in slow thawing. The observations would seem to indicate that freezing lowers the threshold level for heat injuries and that thawing ought to be carried out at lower temperatures than  $+42^{\circ}\text{C}$  in order to avoid further tissue damage.



## (284) FOAI report B1258-H6

The influence of cold stress on catecholamine excretion and oxygen uptake of normal persons. (In English)

L. Lamke and others

January 1973

Extract from Scand. J. Clin. Lab. Invest., Vol.30, No.1, 1972

Catecholamine excretion has been investigated in 22 healthy test personnel during 24 hours in warm surroundings (+28°) and during 72 hours in cold (+15°). The excretion of noradrenaline and adrenaline greatly increased in the test personnel in the cold environment. At the same time oxygen intake increased. These circumstances show that catecholamine plays an important role in the regulation of the heat balance. The significance of this is discussed with special reference to severe wounds or patients with burn injuries.

## (285) FOAI report B1260-H6

Electrometric cholinesterase methodology in the monitoring of biocide workers. (In English)

E. Heilbronn and others

February 1973

Extract from Arch. Environ. Health, Vol.25, pp.370-373, 1972

A fast electrometric method for the determination of butyrylcholinesterase and acetylcholinesterase in small volumes of capillary blood, has been applied to blood from people exposed to biocides. As a comparison, a commercially available half quantitative method, Merckotest Cholinesterase, has been used. The experiments indicate the importance of using the erythrocytic cholinesterase activity as a measure of biocide infection.

## (286) FOAI report C1494-H6

Damped rags as a protection against breathing chlorine.

E. Ekedahl

January 1973

In order to decide whether damped rags can be used as a temporary protection against breathing chlorine the gas was leaked through damped pieces of linen and scouring flannel for an experiment. In addition, breathing tests were made with scouring flannel in a chlorine gas atmosphere. The flannel gave relatively low resistance to breathing and indicated that it could be a certain protection for a short time ( $\frac{1}{2}$  to 1 minute) in low chlorine density (about 50 mg m<sup>-3</sup>), and some protection (a few seconds) even with high chlorine gas content (about 300 mg m<sup>-3</sup>). The linen cloth rendered bad protection and far too much resistance to breathing for practical use.

(287) FOAI report C1505-H6

Insect repellents. Field trials. Description for FOA Information Day,  
13 December 1972.

W. Thorsell

February 1973

During the summer of 1972 pilot field tests were carried out on volunteers from conscripted soldiers as the basis of a field test for repelling midges and for ultimate use by the military. The repellents were applied to the skin and consisted of N, N-diethyl-m-toluamide; dimethyl phthalate; 2-ethyl-hexandiol-1,3; N, N-diethyloctanamide; pyrethrins with additions of piperonal butoxide.

The field studies will be continued. The purpose is to test new preparations against stinging midges, gnats, gadflies and sand-flies because preparations available at present only partially fulfil requirements.

(288) FOAI report C1506-H6

Tests on a 'Flying Insects Exterminator'.

W. Thorsell and L. Wennberg

February 1973

Tests on an insect trap called a 'Flying Insects Exterminator' using an attracting light and destroying high voltage device, have been made on midges in the Järva fields. The experiment showed that the trap attracted fewer midges than a bare forearm from which it is concluded, that the trap is not suitable as a midge trap under the conditions similar to those used for the test.

(289) FOAI report C1514-H6

Studies on midge repellents. 6th Nordiska Symposium on parasitology at Rungsted, Denmark, December, 1972

W. Thorsell and others

March 1973

The antennae of midges have been shown to react electro-physiologically with some chemical repellents such as N, N-diethyl-m-toluamide and 2-ethylhexandiol-(1,3). The receiving apparatus consists of two small thin-walled growths on the antenna. On these are funnel shaped formations which lead in to the nerve fibres. One can assume that the repellent molecules exercise their effect *via* the funnel shaped formations. Among known repellents are alcohols, esters and amides. On the assumption that properties of significance for an active repellent molecule are for example, size of molecular shape, plasticity, ability to bind with hydrogen, and polar structure, a number of phthalicacids, toluene acid esters and amides have been synthesized. They have been characterized physically and chemically as regards melting point and boiling point, gas chromatographical separation, infra red and ultra violet spectroscopy. Their momentary repellent effect have been studied in laboratory experiments.

(See also Refs. (226), (306) and (307))

M ASSOCIATED STUDIES AND THEIR SOLUTIONS

(290) FOA P report C8357/M

About the intentions behind the Swedish planning system. (In English)

L. Grape

March 1973

A critical survey of the intentions behind the new defence planning system and the provision for its implementation. The report is an English translation of the statement to the group of defence planners.

M1 The defence operational analysis organization

(291) FOAP report C8349-M1

LYSTER - Luftvärnets Yttäckningsförmåga i Svensk Terräng.

(Air defence surface protection capability in Swedish Terrain).

B. Eriksson and E. Tarras-Wahlberg

January 1973

LYSTER is a stochastic computer model for calculating the effectiveness of the air defence unit against hostile air units. The model is specially adapted for studying the results against low flying attack aircraft. The following influencing factors are therefore considered with special care:- the terrain, anti-aircraft gun units, technical obligations and tactics, the aircraft units, technical obligations and tactics, optical aiming, electronic and other counter-measures.

M3 Predictive planning

(292) FOAP report A8162-M3

Terms of reference for compulsory military service.

J. Hummelgren

May 1972

In studies and investigations of conscripts and questions concerning defence personnel, a great variety of concepts and terms are used, often without precise explanation of their meaning. This results in unnecessary opportunities for subjective interpretations and misunderstanding and implies special difficulties for the uninitiated, when it is intended to explain the subject. A comparison of such concepts and their explanations is considered to be urgent.

The report is a by-product from studies of problems associated with the compulsory military service system, carried out in other connections. The comparison does not claim to be comprehensive but an attempt has been made, from a choice of terms and through historical and geographical outlooks, to see the problems of the individual soldier from a wider angle than that given by the Swedish compulsory military service system of today.

(293) FOAP report B8016-M3

*SOM* - an education simulation method. (In English)

B. Schwarz

Extract from Becker & Goudappel (Ed). 'Developments in simulation and gaming', Sociologisch Instituut te Utrecht, Meppel 1972, pp.47-73.

FOA reprint 1972/73: 13

A simulation model of the educational system known as *SOM* was developed in 1969 to 1970 at the Centre for Educational Research and Innovation (CERI/OECD) in Paris. The article consists of a lecture given at the second international conference on the theme 'Simulation and gaming in the social sciences' in Utrecht. The contents are not a detailed description of *SOM* but only a short abstract as a background for a discussion on the use of simulation models and consequential analysis in long term, strategic planning.

*SOM* perform evaluations of future students who find themselves in the respective countries at different levels of a national educational system. It also calculates the supply of teachers and the demand on general and monetary resources for the educational system. The model is flexible in construction so that it can be used both for the simulation of the educational systems of different countries and for examining structural changes of an existing system. The *SOM* project was started in connection with preparations and appraisals of the OECDs Conference on 'Budgeting, Program analysis and cost effectiveness in educational planning' in April 1968.

The article includes a discussion as to why *SOM* was designed as a simulation model and not as an optimizing model. It also deals with the model's validity in relation to the different levels of validity needed for forecasts and planning respectively. In conclusion, a concept model of the planning process is presented as background for a discussion of the inclusion of function models of *SOM* type in this process.

(294) FOAP report C8350-M3

Duration of program for program optimization.

S. Arnborg

January 1973

Examinations of production programs have shown that compilers and programmers devote too much time on code optimization which does not measurably affect the program's running costs. By taking measurements on the program while it is operating one can quickly establish whether optimization of a program would result in a reasonable return. The report describes instrumentation for

these measurements, partly in general and partly in specific cases. The latter includes two program packets for measuring the performance of an arbitrary S360 program and an arbitrary *SIMULA* program respectively.

(295) FOAP report C8353-M3

*LECO* - a compacting and editing program.

K. Mäkilä

February 1973

*LECO* is a program for IBM 360/370 which facilitates the management of such basic programs and computer data as are wanted for recording on a memory disc. By means of *LECO* a basic program can be stored in a very compact form on memory discs. When this packed program is wanted for use, a combined unpacking and updating is carried out as a stage before compilation.

*LECO* packs the program in two ways. In one it takes away all blanks at the beginning and end of each punched card. In the other it codes frequently occurring phrases (e.g. '*INTEGER*') into compact single sign forms. The space required for a basic program is reduced to approximately one quarter of the original. Since the program is condensed so much it can often be recorded on active disc packs.

(296) FOAP report C8354-M3

Fourteen hypotheses on planning and organization.

Å. Sandberg

February 1973

These fourteen hypotheses deal briefly with long term planning from a sociological point of view. In a productive planning theory the planning method must be completed by 'planning sociology'. The significance of the special planning organization is emphasized for the possibility of applying the actual theory to 'alternative planning' and for opportunities for control, democratic observation and participation.

(297) FOAP report C8355-M3

Introduction to *LECO*

J. Palme

March 1973

*LECO* is a program for IBM 360/370 which facilitates the management of basic programs and other texts stored on memory discs. *LECO* enables the texts to be stored in very compact form - the space needed being only one quarter the size of the original amount of text. It is very convenient, with the help of *LECO* to introduce alterations at arbitrary places in the stored text. The text can, *via LECO* be transferred to compilers or other programs which will produce the text.

This introduction gives enough information for the reader to begin using *LECO*. The instructions are not intended to give complete descriptions of all the possibilities of *LECO*.

FOA consider that *LECO* is a saleable program product. Final decisions have still to be made. Anyone who wishes to use *LECO* should therefore make contact with FOA first.

(298) FOAP report C8359-M3  
PL360 Compiler with Macros. (In English)  
L. Enderin

March 1973

Descriptions are given in the report of some additions to program language PL360, a mechanical language with Algol-like structure especially devised for IBM 360. PL360 gives direct access to all computer instructions, register, etc. The compiled code offers the same effectiveness as when using assembler code. The compiler is very quick.

The first compiler for PL360 was set up and coded by N. Wirth and J. Wells at Stanford University. The version of compiler described in this report is an extended one by other additions intended to make PL360 more available for program development.

(299) FOAP report C8361-M3  
Introduction to the structure of dialogue directed computer programs.  
S. Leijonhufvud

March 1973

The aim of the report is to give *FORTTRAN* programmers certain advice on running dialogue directed programs. It is mainly directed to programmers who wish to use the *DEC* system-10 at the Stockholm Computer Centre.

(300) Research group for planning theory (FOA/KTH) report PT 1972:7  
Mathematical models for some problems in water conservation.  
T. Kaijser

The report presents a number of mathematical models for different processes and occurrences in a water system. The models considered are relatively simple, but nevertheless offer good chances of developing to an analysis of variables and situations of interest to the water engineer. The presentation of respective models is usually quite short, and because of this a list of literature associated with the model is added after each model's presentation.

The first chapter reports on models which describe the movement of water particles in a water system, known as distribution models. Starting from the models, calculations are then made as to how impurity concentrations in the water system vary with respect to time and space.

The next chapter gives a conventional example of a decision problem concerning purification procedures. By making different assumptions on the distribution of impurities it is shown how the choice of model affects the conclusion.

In the third and fourth chapters an account is given of models which describe how biological oxygen consuming material influences the oxygen content in a water system. The Streeter-Phelps and other well known models for oxygen content in a river are mentioned.

The fifth chapter presents a number of models for the growth of population. An account is included of the logistic growth equation.

The sixth chapter concludes with a shortened description of a mathematical model which deals with the system of ecology in a sea.

#### M4 System and program planning

(301) FOA2 report B2041-M4

A fast computer method for matrix transposition. (In English)  
J. Eklundh

Extract from IEEE Trans. Computers, Vol.C-21, No.7, pp.801-803, 1972.

FOA reprint 1972/73:23

The report describes a method for transposing a  $2^n \times 2^n$  - computer matrix which is bigger than the available high speed memory.

(302) FOA2 report B2042-M4

Modified linear multi-step methods for a class of stiff ordinary differential equations. (In English)  
B. Bjurel

Extract from BIT, Vol.12, pp.142-160, 1972;

FOA reprint 1972/73:28

Implicit and explicit multi-step formulae are derived for differential equations of the type  $P(d/dt)y = f(t,y)$ , where  $P$  is a polynomial with constant coefficients and where  $|\partial f/\partial y|$  is small compared with the roots of  $P$ . Such equations arise for example in control theory. An analysis of the local truncation error is made, and some of the results discussed, where an appreciable gain in calculating time is obtained compared with classical methods. Finally reference is made to expansions of the method which enable treatment of more general differential equation problems.

- (303) FOA4 report B4064-M4  
On the practical applications of majorants for non-linear matrix iterations. (In English)  
T. Skröm

Extract from J. Math. Anal. Appl., Vol.41, pp.137-147, 1973

FOA reprint 1972/73:27

In order to solve matrix equations  $H(T) = 0$ , where  $T$  is a matrix and  $H$  is a matrix valued function of  $T$ , one can use the iteration procedure of the type  $T_{n+1} = F(T_n)$ .  $F$  can then be selected in several different ways and it is often difficult to decide *a priori* which of many alternatives will be the most effective. In the paper a technique is developed which makes it possible instead, to look at a real function of a variable  $f(t)$  and, from the convergence rate, for the single iteration  $t_{n+1} = f(t_n)$ , draw conclusions on the rate of convergence for the matrix problem. This makes the problem much easier to handle.

- (304) FOA1 report C1496-M4  
Nord data 72 at Helsinki, June 1972  
K. Eriksson and others

January 1973

The report consists of an account of lectures given at the Nord data-72 Conference which was arranged by the Finska Dataförbundet och Nordiska Dataunion at Helsinki.

- (305) FOA1 report C1500-M4  
FORTRAN dialects - a selection.  
E. Könberg and I. Widegren

February 1973

The report is intended to be a guide for users of FORTRAN. Different FORTRAN dialects and two proposals for standardisation have been set out. Some comments have been made about the computer and a few general observations.

The FORTRAN dialects set out are those of present interest within FOA.

- (306) FOA1 report C1503-M4  
Computer treatment of climatic research data: Table type A.  
S. Löf and I. Widegren

February 1973

The report presents a program for selection, statistical treatment and tabulation of data stored with the program INKLIMAT described in FOA1 report C1457 (see FRÖ 72/73-1 abstract 93, RAE Translation 1711).

The program makes use of data from each individual and of the defined groups of experimental personnel. Tables are written for every desired criterion of the recordings obtained from the experimental personnel during the maximum



four days. Different average values, standard deviations, the t-values and their significance, are also included in the tables.

(307) FOAI report C1504-M4

Computer treatment of climatic research data. Table type B.

S. Löf and I. Widegren

February 1973

The report describes a *FORTTRAN-IV*-program for selection, statistical treatment and tabulation of data stored on memory discs with the program *INKLIMAT* described in FOAI report C1457, (see FRO 72/73-1 abstract No.93. RAE Translation 1711).

The program calculates for specified criteria, the average value and distribution of the defined experimental groups together with statistical comparisons between one reference group and each of three comparison groups. The deviations are given with the t values and their significances.

M5 Forecasts

(308) FOAP report B8017-M5

Communication system analysis and studies of the future. (Communication, analyse de systèmes et l'étude de l'avenir: autonomie ou identité?)

(In French)

S. Schwarz

Extract from Trans. Symp. 'Future Research and long-term planning', at Pietra Neamt, Rumania, July 1971.

FOA reprint 1972/73:15

An attempt has been made to distinguish characteristic qualities of studies on the future, which can give a fresh contribution to planning and decision making. The aim of the studies of the future is not to attempt to make unqualified pronouncements on the future but to try to understand how present day (and past) action influences the future. A condition for better decision making is an understanding partly of the system which is affected by decision, and partly as to how existing knowledge should be dealt with and communicated so as to be taken into consideration in a way compatible with its real meaning.

(309) FOAP report B8018-M5

The relations between science and technology and their implications for policy formation. (In English)

D. Solla Price

March 1973

(A lecture at KTH, June 1972 at the invitation of FOA and KTH.)

FOA reprint 1972/73:26

The arguments of Professor Price of Yale University on a number of theses are:-

- (1) When one speaks of the social service of science, one is concerned with science and technology, where the justification of science is decided by its often difficult appraisable significance for technical development.
- (2) In the interaction between science and technology, the strongest and most direct driving forces go from technology to science. Most of new technology has no roots in actual science.
- (3) The scientific system (costs, work power) show during the last 300 years, a regular growth of 7% per annum.
- (4) Practically every nation in the world, developed or under-developed, subscribes about 1% of its BNP for research and development.
- (5) The scientific system is international through fundamental principles of communication and publication. It is not possible to direct scientific development in any important way. Corresponding relationships are not valid for technical development.
- (6) Technology follows the market sooner than the market determines technological development.
- (7) Continuous investment in technical development is necessary even in a stagnant economy. In the interaction with our environment we are presented with more and severer problems which call for new solutions.

(310) FOAP report C8283-M5

Communication, analysis systems and future studies.

(Communication, analyse de systèmes et l'étude de l'avenir: Autonomie ou identité?) (In French)

S. Schwarz

October 1971

Apparently identical with FOAP report B8017-M5 referred to in this issue, abstract No.308.

(311) FOAP report C8291-M5

Remarks on the use of citation data in predictive models of scientific activity. (In English)

G. Borenus and S. Schwarz

October 1971

See FOAP report B8015-M5. FRÖ 72/73-2 abstract 194.

(RAE Translation 1732)

## (312) FOAP report C8347-M5

Future scientific research - the elites new latin or a new name for some old ways of thinking.

S. Schwarz

January 1973

New impression of earlier published reports, C8284-M5 (FRÖ 71/72-2 abstract 181 RAE Translation 1659) and C8309-M5 (FRÖ 71/72-3 abstract No.292. RAE Translation 1674)

(1) Some critical points of view are given on an article about future scientific research in 'Ord and Bild'.

(2) Some ideas are put forward to illustrate the role of future scientific research as an element in the solution of the problem of responsibility in the process of making decisions.

M6 Remaining investigations and comparisons

## (313) FOAP report C8341-M6

Constant flow speed or constant variation coefficient. An investigation of some properties of the cell cycle.

B. Jansson

December 1972

An empirical material consisting of 80 PLM-analyser, has been used in an investigation of how cells move along the cell cycle with constant speed or whether the number of underphases are the same in all cell cycle phases. The results show that the flow rate is constant in the reproductive part of the cell cycle ( $S + G_2 + M$ ), but generally very much lower in the productive part ( $G_1$ ). The number of underphases is about the same in  $G_2$  and  $G_1$ . In the material examined,  $G_2$  occupied on average, 12% of the cell cycle with fairly small distribution, whilst  $S$  and  $G_1$  took up 47% and 41% respectively, and with a noticeable distribution around these values.

A consequence of the investigation is the hypothesis that the cell cycle consists partly of a reproductive phase enveloping  $G_1 + S + G_2 + M$ , with the same rate of flow through, and partly of a productive phase  $G_0$  with another and as a rule, lower rate. The  $G_0$  phase comes before  $G_1$  and in series with it. The original  $G_1$  phase has thus been divided up into a  $G_1$  part which is conveyed over to the reproductive phase, and a  $G_0$  part which is solely composed of the productive phase.

(314) FOA P report C8342-M6

A classification system for gramophone records and sound tapes together with printed music on ADP routines according to *CORSAIR* S program system. FOA.

C. Mörner

November 1972

The aim has been to construct a classification system which has convenience of access and at the same time is constructed to be suitable for a computer, so as to make possible a quick search for a special subject, hierarchically divided up in each of its own controllable sub-division.

With the *CORSAIR* program, special and easily manageable sorting methods can be simplified, for the purpose of heterogeneous systematics and maximum advantage, and at the same time made variable, especially by the use of appropriately designed search objects.

(315) FOA P report C8348-M6

Cooperation between FOA index and Swedish Radio's musical department.

C. Stellan Mörner

January 1973

The report is an account of cooperation between the Swedish Radio's musical department and FOA index since 1968 for reproduction of ADP produced statistics and planning material for the music called for on radio P1 and P2; (Swedish Home and Light programmes.)

The *CORSAIR* system from the beginning, has made possible a flexible construction of the frequently exchanged material and particularly with *CORSAIR III*, has simplified and cheapened many of the different routine runs.

Moreover, at present, tests are being made on simplified methods for collecting data *via* remote terminals.

M7 Consideration and surveillance of scientific research outside FOA

(316) FOA2 report C2601-M7

Gerhard Herzberg - Nobel prize winner for Chemistry 1971.

B. Kleman

March 1973

Extract from *Kosmos* 1972, pp.25-29.

A biography in the Swedish Physics Association year book '*Kosmos*', 1972.

(317) FOA2 report C2602-M7

ABC1 Molecular spectra.

B. Kleman

March 1973

Extract from *Kosmos* 1972, pp.30-32.

A short account of nomenclature, formulae, etc. used in molecular spectroscopy. The paper was presented to the Svenska Fysikersamfundets year book *Kosmos*, 1972 in connection with the Nobel prize award to Gerard Herzbergs.

- (318) FOA P report C8345-M7  
East Asia in perspective.  
Impression from IISS annual conference 1972.  
N. Andr  n and S. Str  mb  ck

December 1972

This reports on the general character of the conference - mainly due to it being held in North America (Ste. Ad  le, Quebec, Canada) - and also some points of view arising from the discussion on the papers put forward.

- (319) FOA P report C8346  
A presentation of the activities of FOA Index. (In English)  
W. Uhlmann

January 1973

FOA Index is a section of the Research Institute for National Defence which concerns itself with all aspects of computer based documentation including large scale systems and computer program development.

FOA Index is not primarily a centre for documentation but a consulting organization for applied research and development, comprising documentation and alpha-numerical data management. Since the work is directly concentrated on practical applications, the FOA Index activity must naturally, also include a service activity for the customer.

- (320) FOA P report C8351-M7  
On the form of spectra of radar echoes from precipitation.  
Translation from Russian by H. Engstr  m.

February 1973

The report is published in Fizika atmosf  ri i okeana, No. 9/72 and the authors are V.A. Kapitanov, J.V. Melnichuk and A.A. Chernikov. The author's summing up is as follows:-

The study of 3.2cm radar echo spectra in light rain and snowfall has shown that the spectrum form at small elevation angles, exactly follows a gaussian curve within an interval of spectral density from maximum to approximately the -30db level. Continued reduction down to -40db level does not follow below the power law  $f^{-6}$ , where  $f$  stands for frequency. At levels below -40 db the spectrum can be expected to diverge considerably from the gaussian form of curve. It is collisions between reflecting particles depending on variations in dropping speed or turbulence in the air which affects spectral density at such low levels. Contributory factors to this can also be fluctuations in the turbulence rates of the circulating particles, vibrations of the drops, oscillation of snowflakes, changes in the number of circulating particles in the illuminated

volume, etc. When the doppler technique is used for measuring particle distribution with respect to size, one should include in the calculations the fact that the doppler spectrum is completely determined by the distribution of particle rates within a limited interval of the spectral density.

(321) FOA Preport C8360-M7

FOA Index adaptation of ILO's information system *ISIS* for operating in the Computer Centre, Stockholm in cooperation with the State Office.

L. Andersson

March 1973

FOA Index section has adapted the information system *ISIS* for operation in Stockholm's Computer Centre. *ISIS* is a system for both data collection and interactive search for information, developed by the International Labour Office (ILO) in Geneva. It has been placed at FOA's disposal by the State Office with whom close cooperation has been cultivated.

(322) FOA Preport C8362-M7

On the possibilities of using a laser in transmission equipment for sighting measurements.

Translation from Russian by H. Engström

March 1973

The report is a translation of an article by A.P. Hain, in Trudy Nauchnoissledovatel'skogo instituta gidrometeorologičeskogo priborostroeniya.

The theoretical basis for equipment with reference to sighting measurements and working with transmission meters, is discussed.

The possibilities of using lasers instead of incandescent lamps as beam sources are analysed. Certain practical results are reviewed.

The Military Institute of Psychology

(323) MPI-A report No.16

Firing by an artillery battalion-simulation of system with special reference to ergonomic questions.

N. Haglund and J. Wirstad

December 1972

An artillery battalion is simulated. The companies fire together against a correction point. Afterwards the battalion carries out firing against a target within a fixed circular area around the correction point.

As a criterion of effectiveness the mean striking point is used and standard deviation for the first salvo against the target together with time and ammunition for the adjustments and/or firing.

Error additions to the simulated course of events are introduced for example, sources of error due to meteorological data, to the spread in ballistic

qualities and to errors caused by the human operators in the system. The error additions are added up and presented in the firing result. In the same way the time is added up for a total time covering adjustment and firing.

Each error or time addition is determined by random drawing from an empirical distribution or determined from firing tables. Empirical distributions have been obtained from data collected from firing records, experimental studies, expert appraisals and from measurements taken during training exercises.

The simulation method makes it possible to determine the effect of different procedures within the human/machine system, for example, new means or methods for calculating work on site or new means or methods for the firing commander to determine the target or his own firing position.

Results from the first trial simulation with the model are also included.

#### The Emergency Council for Psychological Defence

(324) BN report No.58

Students and defence. An investigation of opinions among students at Uppsala, Spring 1972.

J. Hartmann and B. Jenner

January 1973

This report deals with a study of Uppsala students' attitudes to the community and defence, together with those factors which may have significance for these attitudes, and for changing them. The results indicate two fundamental changes in the students' social structure and situation since 1967. The proportion of students over 25 years old has doubled. Moreover, the proportion of students in the social science faculties has increased considerably, whilst those in the humanistics and natural sciences, have fallen by a third.

The authors have also found a remarkable shift in the students' political party preferences. In comparison with 1964, the proportion of Communist sympathisers has increased from 1% to 27%. At the same time the proportion which sympathises with the People's Party and the moderates has decreased to one third.

In comparison with the year 1964, the students' willingness for defence and remaining defence attitudes has changed markedly in a negative direction. In relation not only to the whole population, but also to other young people, the students show a less positive defence outlook. For this change, it would appear that the increase in the proportion of students, with inclinations towards the social sciences and communist sympathies, has made a strong contribution, since both of these student groups show the least positive outlook on

defence. That students over 25 years of age should show a somewhat more positive outlook on defence than do the younger ones, does not, on the other hand, appear to have appreciably counteracted the negative development.

The students also show a clear negative attitude to the society. The authors surmise that it is this which reflects in the attitudes against defence.