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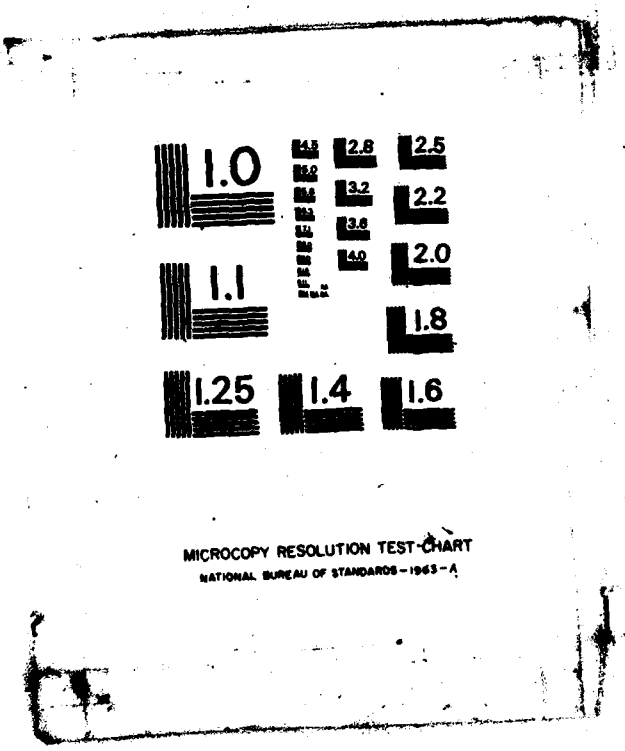
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SWEDISH DEFENCE RESEARCH ABSTRACTS 81/82-3

[FRÖ FÖRSVARS FORSKNINGS REFERAT 81/82-3]

by

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EDITOR'S SUMMARY

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

EDITOR'S NOTE

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

FOA Centralbiblioteket, S-104 50 Stockholm, Sweden

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A PROTECTION - ATOMIC

(112) FOA report C30250-A
Transient radiation effects on certain CMOS circuits in the 4000 series
Gunnar Goransson and others December 1981

A number of simple CMOS circuits from the 4000 series were studied in a transient radiation environment by flash X-ray equipment at FOA 3 at Linköping. The performance of the circuits was studied under different operating conditions both during and after the radiation pulse. At the same time some important practical experience was gained in taking the measurements.

The radiation was applied as a transient dose at a dose rate of about 2×10^8 rad/s (total dose of about 15 rad over 120 ns), *is* a type of radiation which may be produced by nuclear explosions.

Investigations were made on a number of the simplest types of CMOS circuit. It was found that transient radiation can produce a relatively large effect on CMOS circuits of the standard type. This was also observed in some radiation-proofed variants. Some wide variations occur between different makes and different types.

A3 Effects of nuclear explosions, and protective measures

(113) FOA report C20445-A3
Flame heights outside windows (in English)
Rolf Jansson and Bengt Onnermark March 1982

In order to predict the spread of fire from one window in a facade to another above it, we need to know the height of flames outside a window. A series of experiments was run in order to study the relation between certain parameters of a combustion chamber and the flame height z . The result is summarised in the formula: $z = a(R - R_1)/A\sqrt{H}$, where R is the rate of combustion in the chamber (kg/min), R_1 is the rate of combustion required to ignite the chamber thoroughly, A is the area of the window opening and H(m) is its height. The value obtained for the series was $a = 0.7$.

(114) FOA report C30243-A3
Measurement of transients produced by excitation of the Viggen-37 aircraft with a pulsed current
Sven Gemland October 1981

This report contains an account of field and voltage measurements of the excitation of a Viggen aircraft with a pulsed current. These measurements were made in conjunction with lightning tests on the same aircraft made by SAAB-SCANIA. Responsibility for injecting the pulsed current lay with SAAB-SCANIA in conjunction with the Culham Laboratories. The prime objective of these measurements was to test our measuring system consisting of computer-controlled "transient digitisers", a computer, a microwave link and field sensors, on a realistic measurement.

The difference between measurements in the field like these and those in a laboratory environment also meant that the previously-developed computer program was improved and adapted to actual measurements. The measurements also of course yielded some important technical experience. The actual results from this operation were of lesser importance, an example from the report.

(115) FOA report C40143-A3
The solubility of reactor-activated uranium glass particles in the rumen juices of a cow
Stig Doverhall and others — November 1981

Artificial particles of uranium glass were produced in order to resemble short-range fall-out. The particles used in this introductory experiment were of 100-200 μm diameter. After being irradiated with neutrons in a reactor they contained fission products from ^{235}U. The solubility of these fission products was tested in the rumen juices from a cow at pH 1.5 and 7.5 over two different incubation periods (1 and 7 days). The amount of dissolved activity was measured with a germanium detector. The measured amounts of fission products were considerably less than expected, probably owing to hard bonding to the glass. The conclusion drawn is that the particles made from uranium glass are unsuitable for studying the transfer of fission products from the digestive tract to *eg* meat and milk in experimental animals. On the other hand there is some advantage in using these artificial particles where it is intended to study radiation effects from an intake of fallout in animals, *eg* ruminants. No serious effects are thought to be produced by long passage times as regards the solution of activity from these particles.

(116) FOA report C40147-A3
Computer unit for radioactivity
Göran Hultén — January 1982

The existing calculator for radioactivity, model 601, can be supplemented by a computer unit. Simple experiments have shown that it is entirely possible to use pre-programmed units in the radioactive protection organisation. The principal functions on the calculator can be easily programmed into a unit. Its applications are limited to Battalion HQ level or above. A very rugged calculating system is needed at Company level, and the calculator is to be preferred in this case. A computer unit today costs about 1000-2000 when priced individually. This type of unit can be programmed alphabetically, so that it can be interrogated in plain language for various measurements. The opportunities for a wrong input are drastically reduced.

The computer unit can also be obtained in a form adapted to the user. It is then supplied with only the essential keys. These can be supplied with an optional text. A fixed store with stored program can be developed. The total development cost for a user-adapted cell is about Kr 100-150k. This price does not include any special facilities applicable to military use.

The vulnerability of the computer unit due to the EMP effect was not investigated.

B PROTECTION - BIOLOGICAL

B2 Protective measures

(117) FOA report C[illegible](B2)
Wind profile measurements with SODAR (in English)
[illegible] — January 1982

The report gives a description of a remote-sensing system which is used to measure wind profiles in the lowest layers of the atmosphere.

The method is based on measurements of the Doppler shift of the return scattering of an acoustic signal. This system is a further development of SODAR.

B4 Microbiology in overall defence

(118) FOA report A40037-B4
The role of micro-organisms in oil spillage. A catalogue of the problems and study of the literature
Roger Roffey and others January 1982

The microbial breakdown (bio-degradation) of oil has been found to be an important process for the ageing of oil and its eventual precipitation from a marine environment. Bio-degradation is the dominant factor for the settlement of oil out of any given environment. Studies of the rate of degradation can afford answers to how long oils will persist in a medium if clearance operations are not performed, *eg* on beaches or at sea.

The report describes the micro-organisms and the mechanisms by which they can break down oil pollution at sea. The limiting factors in microbial degradation are also discussed, and the manner in which a possible stimulation of the degradation process might be brought about.

Studies of the importance of bio-degradation in the sea, the beach zone and bottom sediments in the case of some major shipwrecks are briefly described.

The report is a summary of a literature search up to 1981 inclusive, which was undertaken with respect to the role of micro-organisms in oil spillage.

The need is explained for further research and development in this field. The report was compiled at the instance of Stockholm T.U.

(119) FOA report D40088-B4
Microbial problems in the long-term storage of aircraft fuel in underground caverns. Interim Report 4.
Roger Roffey February 1982

This report constitutes a summary of investigations carried out from 1 July 1981 to 31 December 1981 concerning microbial problems in the long-term storage of aircraft fuel in underground caverns, at the instance of the National Committee on Economic Defence.

The results in this interim report represent a continuation of the work done earlier and reported in interim reports 1, 2 and 3 (2, 3, 4). This interim report can therefore be said to constitute an informal report on the state of the project and an account of work over the past 6 months.

A method has been worked out for determining the rate of conversion of sulphates to hydrogen sulphide in the ground water and mud of underground caverns, using a radiological technique. This method is of high sensitivity and is able to detect at an early stage whether, and to what extent, hydrogen sulphide is being produced in ground water.

An investigation of the chemical and microbiological situation was performed in installation NK 154. Among other things it shows that a maximum of 14 g of sulphate per cistern and per day is converted to hydrogen sulphide. The content of micro-organisms was of the same order as that encountered in other caverns.

Inhibition studies with the introduction of oxygen into ground water has yielded some good results in model systems which simulate underground conditions.

Some preliminary studies have been made to test whether zinc chloride, copper sulphate and sodium molybdenate can be used as inhibiting agents. The studies have been continued, now in model systems which simulate underground conditions, to see whether alkalisation of ground water is able to inhibit the formation of hydrogen sulphide in underground caverns.

Work has continued on developing a chemical method of analysis based on polarography. Apart from measuring elementary sulphur, a development is in progress to adapt this method of analysis so as to be able also to detect the presence of mercaptans in the fuel.

Development has also been initiated on an alternative test by silver corrosion. This method should make it possible to achieve a higher degree of sensitivity and permit an objective evaluation of corrosiveness as compared with the standard procedures. Using this method it should be possible to discover early whether the fuel is beginning to become corrosive, and how fast this is happening.

Tests have been carried out on purifying corrosive fuel by aluminium oxide, though with unsatisfactory results.

Studies are in hand to evaluate the purifying capacity of various solid adsorbents, such as copper and molecular sieves. It is necessary for this capacity to be known before any tests on a pilot scale can be started.

Scandiaconsult has drafted some proposals for a pilot plant to purify corrosive fuel, using solid adsorbents. It is based on a plate filter unit. Proposals have also been submitted as to how a purification plant ought to look on the large scale.

C PROTECTION - CHEMICAL

C1 Threat scenario

(120) FOA report A40036-C1
Skin penetration by organic phosphorus compounds - a survey of the literature
Tomas Öberg December 1981

Published information has been collected on skin penetration by what are known as nerve gases and allied substances. The substances examined include sarin, soman, VX, tabun, parathion and paraoxon. Experimental data are reported for both human skin and for test animals.

(121) FOA report A40039-C1
Normal operations and simulated accidents at the SAKAB plant in Norrtorp. Preliminary analysis of precautions against an escape of substances injurious to health and the environment. Part 3: Summary report
Per Olof Grenbom and others January 1982

Precautions taken against the escape of substances injurious to health and the environment from the planned installation at Norrtorp of the Swedish Garbage Conversion Company (SAKAB) have been analysed. The analysis was performed with the aid of theoretical studies of combustion conditions in the planned destruction furnace, and of a number of simulated accidents which represent the likely maximum levels of damage at different stages of handling.

The most serious risk of escape from the combustion furnace is considered to be the continuous emission over long periods of very low concentrations of poisonous

substances formed by incomplete combustion. The most serious risk of an escape of substances injurious to health and the environment from reception points and dumps is considered to be that of fire, which may effect poisonous substances stored in the vicinity.

Several precautions are suggested which may eliminate or reduce the dangers of an escape. The most important of them is that of rendering combustion in the destruction furnace as efficient as possible, and of designing dumps and handling methods so that large quantities of poisonous garbage cannot be stored together with or in the neighbourhood of combustible materials.

(122) FOA report C40129-C1
User's guide to the *TOXBAS* database
Kurt Persson and Lars Rejnus — October 1981

The Defence Research Establishment in 1975 was given the task [illegible] the Civil Defence Board (CFS) to produce papers for the CFS study on "Radioactiv[illegible] chemical risks during wartime and other emergencies" (the TOX study). The larg[illegible]ty of information obtained by the FOA in connection with the production of do[illegible]ntation received mainly from District Councils has been stored on a database entitled *TOXBAS*. This database has been used to provide summaries to the District Councils.

The report gives a broad description of the structure of the database and precautions against any unauthorised access to the information.

Rules are given on how to perform the input of new information, and on how the production of standard District lists is performed. Some general models of, and suggestions for, the modification, search and listing of information in the database are provided.

(123) FOA report C40144-C1
Simulated accidents at the SAKAB plant in Norrtorp. Preliminary analysis of precautions against the escape of substances injurious to health and the environment. Part 1: Transport, reception and dumps
Per Olof Granbom and others — December 1981

The precautions taken against an escape of substances dangerous to health and the environment have been studied with the aid of a number of simulated accidents which represent the likely maximum amounts of damage in different stages of handling at the planned installation of the Swedish Garbage Conversion Company (SAKAB) in Norrtorp. These simulations served as an aid in analysing events and sequences of events which may lead to serious accidents, and in defining precautions to be taken against accidents and leakages. The simulated accidents are therefore not to be regarded as illustrations of probable accidents.

The most serious danger of a leakage is considered to be an oil or solvents fire, which would affect toxic or potentially toxic materials stored in the vicinity. The most important precautions are therefore to design storage and handling methods so that large quantities of toxic or potentially toxic waste cannot be located together with or in the vicinity of flammable material. Precautions are most necessary at the [illegible] should be divided into a station for "[illegible]" and one for other waste transported in drums.

This report is Part 1 of three reports on the SAKAB plant at Norrtorp. Part 2 deals with the combustion furnace and Part 3 is a summing-up.

(124) FOA report C40145-C1
Normal operations and simulated accidents at the SAKAB plant in Norrtorp. Preliminary analysis of precautions against an escape of substances injurious to health and the environment. Part 2: the combustion furnace
Per Olof Granbom and others December 1981

Conditions for the normal operation of the furnace plant are described, and in connection with this the risks are discussed of a continuous escape of very low concentrations of organic toxic substances. Two simulated accidents are described which are assumed will produce the greatest likely quantities of leakage. These simulated accidents have constituted an aid in defining the precautions to be taken against accidents and leakages, and are not to be regarded as illustrations of probable accidents, but as a basis by which to scale the precautions. Some other precautions are discussed, starting from a description of normal operations. The most serious source of leakages of toxic substances is considered to be continuous escapes of very low concentrations of toxic substances over long periods owing to incomplete combustion. The most important precautions for reducing any such risk are the optimisation of the conditions of combustion by accurate recordings of the operating conditions and analysing the content of toxic substances in slag, ash, dust and fumes over about half a year after start-up. Running checks and analyses are also needed during future operations, though on a reduced scale.

This report is Part 2 of three reports on the SAKAB plant at Norrtorp. Part 1 deals with transport, reception and storage. Part 3 is a summing-up.

C2 Protective measures

(125) FOA report A40038-C2
The suitability of compressed-air circuits for compressed-air masks. An investigation in different industries
Roger Sundqvist February 1982

For the purpose of investigating the extent to which breathing apparatus on a compressed-air supply is receiving contaminated air, the compressed-air system in 25 industries was examined.

The factors investigated include oil mist in the gaseous and aerosol phases, carbon monoxide and relative humidity. The effect of various filters was also studied.

Very good breathable air is obtained as a rule with oil-free compressors. On the other hand the air from oil-lubricated compressors is of uncertain quality. Most of the compressed-air systems under investigation however contain concentrations of oil mist which clearly lie below the hygienic limits in force. Some of the filters employed function rather poorly. Some of them were also found to be clogged with oil and fed an oil mist into the compressed air.

No carbon monoxide could be detected from any of the compressors under investigation.

The location of air intakes into the compressors must be taken into account when the air is intended for breathing protection.

(126) FOA report C40149-C2
The destruction of phenarsazine chloride (Adamsite) by sulphuric acid-bath degradation
Monica Lindmark January 1982

Acid-bath degradation or wet combustion is a method of destruction which began to be used on a large scale in the mid-1970s in order to reduce the quantity of combustible radioactive waste.

Wet combustion of an organic arsenic compound was studied in this investigation.

Degradation is performed in hot concentrated sulphuric acid, with either nitric acid or hydrogen peroxide as an oxidising agent. The reaction proceeds faster with hydrogen peroxide, since this is a more efficient oxidising agent than nitric acid, although with hydrogen peroxide a more uncontrolled process is obtained with a greater consequent risk of explosions.

The speed of reaction depends on the oxidising agent, reaction temperature and the dose rate of the oxidising agent.

During the experiments we obtained a destruction ratio of 99.9% in terms of adamsite.

D AMMUNITION AND WEAPON TECHNOLOGY

D1 Technology of explosives

(127) FOA report C20436-D1
Prolongation of the service life of HTPB-based propellants
Roland Sandén January 1982

The service life was determined for various propellants in which the bonding agent was based on hydroxyl-terminated polybutadiene (HTPB). All the propellants contained 85% ammonium perchlorate. The experiments were performed in a plastograph at a temperature of 58°C. Two types of hardening agent, DDI and IPDI, were tested. A longer service life was obtained with IPDI than with DDI. The effects of various additives were tested. Iron compounds such as the combustion catalysts Fe_2O_3 and n-butyl ferrocene considerably reduce the service life. The catalytic effect on hardening of these iron compounds is largely destroyed by the addition of tetracycline and certain other metal complex-forming organic compounds, and service lives were obtained which are about as long as if no iron compounds had been added.

(128) FOA report C20449-D1
Setback tests for cast blocks of hexotonal, octonal and octol
Ola Listh March 1982

At the request of Messrs Bofors the sensitivity to shock was studied in cast blocks of hexotonal, octonal and octol. The blocks were produced and prepared at Bofors and afterwards tested on the setback simulator at FOA.

These tests demonstrated that octol is more sensitive than octonal, which in turn is more sensitive than hexotonal. However further information is required if any conclusions are to be drawn as to the greatest amount of split base which can be tolerated in a shell.

Experience gained from the tests showed that some improvement of the test methods or the introduction of a different method of testing is desirable from the aspect of costs.

(129) FOA report C20450-D1
Supplementary experiments on the effect of stone filling on the progress of an explosion of an air/hydrogen mixture in a closed space
Henrik Almström and others March 1982

At the request of ASEA-ATOM supplementary experiments were performed on the effect of stone filling on the progress of an explosion in an air/hydrogen mixture in an enclosed space. This investigation is a continuation of experiments performed at the National Nuclear Power Inspectorate (Almström and Berglund, 1981).

The new features about this series of experiments are that the shock tubes employed had been extended to double their length and that some new types of rock were tested.

Three grades of gravel were included in the investigations. They were supplied by Messrs Sydsten and are of a quality which may be actively considered for a filter plant at Barsebäck.

D3 Rocket engine technology and associated ballistics

(130) FOA report C20444-D3
Computerised measuring system at FOA Branch 27. Evaluation program for rocket motor tests
Sören Hasselrot February 1982

Software for the computerised measuring systems in the Branch consists mainly of three programs each of which controls one stage, depending on the time of measurement: count-down, data collection and evaluation. This report deals with the evaluation portion of the system used at Grindsjön for rocket engine trials. Development of the program was directed towards an automatic evaluation with a minimum of human intervention and other factors, thus rendering the results consistent and reproducible.

The report first gives an account of the physical background, including how various time intervals are defined. This is followed by a description of the most important methods for achieving automatic operation, such as scanning the time intervals, and the combination of stated lists of variables with that required for the evaluation run. It also describes the structure of the program and subroutines, and how they are combined into a workable program. Finally some instructions are given on starting-up the program, what evaluation and output data can be stored and how output can be controlled.

D4 Technical aspects o warheads

(131) FOA report C20437-D4
The effect of ANFO explosive with added aluminium in underwater detonations
Henrik Almström and others January 1982

This report contains the results of tests performed with ANFO, with and without added aluminium. Contents of up to 19% aluminium were tested.

The charges were fired at depths of 10 m, and pressure-time curves were recorded at four different distances from the charge.

The results reported include maximum pressure, pulse density and energy density of the pressure-time curve as functions of the distance and weight of the charge, and bubble-pulse energies for different compositions of ammonium nitrate/oil/aluminium.

(132) FOA report C20440-D4 (A3)
STEUL. Computer simulation of an Euler beam under stress by an atmospheric shock wave
I. Åseborn and J.E. Jonasson January 1982

The report presents the analytic solution in terms of elasticity theory for beams when subjected to a dynamic load (the Bernoulli-Euler theory). Bending and the distribution of moments and shear forces are determined as a function of time.

Three conditions of support are considered: free support, double-ended fixed clamping and single-ended fixed clamping. The dynamic load is assumed to consist of an over-pressure phase directly followed by an under-pressure phase.

The object of the report is to submit a mathematical method for studying reaction to the support, and the distribution of moments and shear forces at times immediately after a beam undergoes the stress of an aerial shock wave, *ie* during the stage when most building materials can be regarded as being linearly elastic.

D8 System studies

(134) FOA report C20441-D8
Some applications of remote sensing at the Defence Research Establishment in Norway. Report of a study visit 19-20 November 1981
Anders Wellving February 1982

At the Defence Research Establishment in Norway an interesting development is proceeding of methods for remote sensing and mapmaking. During a two-day visit some information was obtained, including terrain signature studies, measurements of levels of illumination, digital methods for the treatment of SAR recordings, radar techniques for measuring the depth of snow, geographical data processing etc. Some possibilities for co-operation were discussed.

(135) FOA report C20442-D8 (A3)
FOA conference on data-processing of geographical information
Marjorie Nilsson and Anders Wellving February 1982

The FOA conference on the data-processing of geographical information on 29 October 1981 assembled a good 40 participants, including 17 speakers. The object of the conference was to review projects in progress in which geographical data-processing forms an important part, and to explore some possibilities for greater co-operation and the exchange of experience internally within the FOA. Among other things access to, and the need for input data, software, equipment and methods were reported for the various projects.

E CONDUCT OF WAR - INFORMATION AND COMMAND TECHNIQUE

(136) FOA report A30031-E
Ionising radiation - a threat to modern electronics? An elementary introduction
Lennart Hagström December 1981

The report deals with the basic forms of interaction between ionising radiation and matter. Some common radiation effects are discussed in more detail. The sensitivity of various semiconductor technologies are also compared, and examples are given of how a greater resistance to radiation can be achieved.

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(137) FOA report C30234-E
MINOP - a computer program for analysing and optimising microwave circuits
Gunnar Filipsson December 1981

MINOP is a general-purpose computer program for analysing and optimising microwave circuits. It can be used both for the dimensioning of components and complex systems. The program contains a component library and routines for the interconnection and optimisation of microwave networks.

The report describes the construction of the program and its constituent parts. Interconnection and optimising routines are specially considered. An account is also given of the main program and the subroutines.

For the user of *MINOP* there is a detailed guide which shows how to operate the program. A special discussion is devoted to how the component library can be supplemented to meet particular needs of the user.

In order to demonstrate the possibilities of *MINOP* it is shown how to use the program in dimensioning a circulator.

(138) FOA report C30245-E
Impressions from the Fourth International Radome Conference on Île de Bendor 10-12 June 1981
Åke Bergquist December 1981

The report gives an account of some of the more interesting papers read at the Fourth International Radome Conference on Île de Bendor, 10-12 June 1981. It is introduced by a review of the current state of radome technique.

(139) FOA report C30251-E
Measurements of capacitance transients at deep levels in p-type MOS structures
Karl-Henrik Rydén December 1981

An investigation has been made into the energy state in the band aperture of p-type MOS components by means of deep-level transient spectroscopy (DLTS) measurements, from which two different states could be distinguished.

(i) A wide distribution of states with a peak concentration of $3.10^{13} cm^{-2} eV^{-1}$ between 0.3 and 0.4 eV over the edge of the valence band was observed in non-heat-treated (as-oxidised) samples. These states disappear by heat treatment at over 400°C and 30 min after metallising. It can be determined from measurements that the states are located entirely on the exterior.

(ii) One single energy level was observed at $E_v + 0.35$ eV which did not disappear on heat treatment at temperatures below 450°C/30 min. Measurement indicates that the level is present not only in the silicon/silicon dioxide interface, but also some way into the bulk material.

(140) FOA report C30258-E
The design of microwave circuits. Study visit to the USA, October 1981
Carl-Gustaf Svensson December 1981

In October 1981 I attended a 5-day course on "Microwave circuit design" at the University of California and Los Angeles (UCLA). The course covered the design of filters, amplifiers and oscillators etc by means of a computer.

The course directors laid great emphasis on computer-aided circuit design. The course therefore included a laboratory stage, in which the members had to design an amplifier with the aid of a computer.

E1 Reconnaissance, target location and fire control

(141) FOA report B30051-E1
FOA3 contributions at the 2nd Scandinavian conference on image analysis, Helsinki, 15-17 June 1981 (in English)

Headings of the FOA3 papers are as follows:

R.L.T. Cederberg: Attenuation of run-length coded binary images.

T. Elfving, J.O. Eklund: Some properties of relaxation procedures.

E. Carlsson, S.I. Åhlström: *PIXLIB* - an interactive computer tool for image-processing.

J.O. Eklund, S. Nyberg, K. Ernstson, C.E. Hedin: Discussion of Marr-Hildreth's model for edge detection.

Offprint of FOA3 Contributions at the 2nd Scandinavian Conference on Image Analysis, Helsinki, 15-17 June 1981, pp 24-333;
FOA reprints 1981/82:11

(142) FOA report B30053-E1
Image smoothing based on neighbor linking (in English)
J.O. Eklundh and A. Rosenfeld

A new method is presented for smoothing images by forming a local weighted mean. A measure is calculated of the way in which adjacent image elements belong together, and this is used as the weighting factor. This measure is a mean of the variations over paths of length two between elements. It was found that the method preserved edges, thin lines and mid-grey levels. It also transforms images into slowly changing regions which are mutually sharply demarcated.

Offprint from IEEE Transactions on Pattern Analysis and Machine Intelligence (1981), Pami-3, No.6, pp 679-683;
FOA reprints 1981/82:13

(143) FOA report [illegible]
Drop size distribution in rain (in English)
Sverre Wichmann January 1982

This report deals with the analysis of measurements of the distribution of drop sizes in rain and with simultaneous data on the intensity of precipitation. The object was to discover a relation which will describe the distribution of drop sizes as a function of the intensity of precipitation. Another purpose was to study it within the D-E relation known in radar meteorology.

The study was based on data collected during 1976 and 1977, from which values of the parameters studied were listed minute by minute.

(144) FOA report [illegible]
[illegible] theory, experiments and software
[illegible] December 1981

[illegible] is known as the multigrid relaxation method is a technique which is applicable to the automatic classification of image elements or sections of images. The report contains a brief review of the theory underlying the method. The detection of edges are is described as an application. A relaxation model is stated for this problem, and the results from tests of an evolved image are illustrated and discussed. In conclusion the software employed is presented.

(145) FOA report C30257-E1
Report of a visit to the USA in the laser field, 1981
Ove Steinvall — January 1982

This report gives a brief account of a visit to the USA in the field of laser radar. The purpose of the visit was for the author to attend with his own contribution at a SPIE conference (The Int. Soc. for Optical Engineering) at which the session on "Coherent Infrared Radars" was specially covered. After the conference a number of study visits were paid to industries and colleges, with emphasis on the fields of CO_2 laser radars and depth-sounding lasers.

(146) FOA report C30260-E1
Annual report for 1981
FOA Branch 32, Information Processing, and Branch 53, Psychology of Information Technique.
February 1982

The report gives a general review of activities in information processing and psychology for information techniques in calendar year 1980.

(147) FOA report C30261-E1
Study visit to the USA in 1981
Rolf Helgodt and Björn Rosén — February 1982

The purpose of the visit was to attend the SPIE symposium "The 25th Annual International Technical Symposium on Instrument Display", San Diego, 24-28 August 1981, and also to visit various industries to study the development of pyroelectric mosaic detectors with semiconductor readout, and SOS technology and its application in the field of VLSI.

E2 <u>Communications</u>

(148) FOA report B30052-E2
A comparison between selenium mass-transported and selenium-diffused silicon (in English)
B. Skarstam and L.J. Lindström

Selenium-doped silicon (Si:Se) has an optically defective state which exhibits sensitivity to infrared about the 4 μm region, which enables Si:Se to be used to advantage as an IR detector. In order to study its optical and physical properties, two methods of producing Si:Se were compared, namely:

(i) growth through a selenium-induced mass-transport reaction, and
(ii) selenium-diffused silicon.

Measurements were taken with a Fourier transform infrared spectrometer (FTIR), and the results demonstrate that similar optically defective states occur.

From a comparison between measured widths of the absorption peaks an indication is obtained of the difference in the microscopic structure of the defects in the two types of sample products.

Offprint from Appl. Phys. Lett. (1981), 39, 6, 488-490;
FOA Reprints [illegible]

(149) FOA report [illegible]
[illegible] in time and space of rainfall rate (in English)
[illegible] — March 1982

The report contains statistical information on the intensity of precipitation, based on measurements made over 3 years 1977-[illegible]. The intensity was collected each

minute from a network of 24 gauges. The area in which the rain gauges were located at 1 km intervals was situated from Farsta to 15 km south of it.

The programme of measurements formed part of a co-operative project between the Swedish Telecommunications Authority and the FOA, its purpose being to study meteorological influences on the propagation of radio waves over 10 GHz.

The rain measurements also formed part of a project ordered by FMV-F concerning "The radar properties of precipitation".

(150) FOA report C30255-E2
Binary sequences with *auto-correlations and cross-correlations* in a prescribed range (in English)
Eva Edberg December 1981

The principal object of this activity was to find a method of constructing quantities of binary sequences, all having the property that their auto-correlations and cross-correlations lie within a prescribed range. The length of the sequences is assumed to be between 500 and 1200 binary digits.

One such method is described and the test results are given. Comparisons are drawn with results from quantities of sequences chosen at random.

We also present a survey of sequences having the property that when such a sequence is compared with the same sequence cyclically shifted by a number of steps (this number not being a multiple of the length n), they always differ by $\frac{n+1}{2}$ positions. This section also serves as an introduction to the principal problem of finding quantities with their auto- and cross-correlations within a prescribed range.

E3 Guidance, navigation and target identification

(151) FOA report C30259-E3
An image store for PEV - its structure and application
Staffan Lindström February 1982

The image store has been resorted to in order to investigate the improvements to be expected in spatial resolution, both in static and dynamic scenes, for the pyroelectric Vidicon equipment (PEV) held in Sect. 374. In constructing it therefore the special problems which arose in the use of PEV were allowed to influence the design. Furthermore any redundant image information is not placed in the store, *i.e.* the image store processes only that information which is bounded by the circular field of vision of PEV. The image store is based on half-images and it can sum 2-32 half-images and 2-32 odd/even half-images. Images read-in to the computer can be read out via a parallel channel.

With this image store a considerable improvement is obtained in image quality when using the current PEV camera, with respect to flicker and the signal/noise ratio.

(152) FOA report C30267-E3
An examination of the intensified research effort into the sensitivity to radiation of LSI semiconductor circuits
L. Edgrella and others February 1982

The report presents the results of an investigation into "the effect of new processes and equipment introduced on the sensitivity to radiation of LSI circuits".

The investigation covers an activity in FMV3 under three different budgetary headings.

E4 Countermeasures, including signal interception and technical intelligence

(153) FOA report C30249-E4
A measuring system for laser spot studies
Sune Johansson and Bengt Carlsson December 1981

The report describes a system for recording and analysis of variations in the intensity of a laser pulse after passing through a divergent lens. The sensors used for the system have their greatest sensitivity in the wavelength range 620-1070 nm. A pulsed laser emitter with a wavelength of 1060 nm was used in the present case. An arrangement consisting of 12 sensors attached to a rotatable arm was erected at 40-50 m from the emitter. In this case the surface being studied was a circle of 2 m diameter. The available electronics for the system provide for the connection of 256 sensors. When extended to this larger system the method may perhaps be applicable for studies of the transmission properties of aerosols. The 256 sensors are then placed in the form of a matrix.

Two different laser emitters were used in the present experiment for studying variations of intensity in short pulses (10-20 ns).

(154) FOA report C30263-E4
The sensitivity of IFM and crystal video receivers with pre-amplification
Hans Bergdal February 1982

The report describes a method of determining the sensitivity of a receiver consisting of a broadband amplifier followed by a square-law detector and a video amplifier.

As a first step the required signal/noise ratio before the detector is determined, based on the desired value of the probability of detection and the danger of false alarms, and the ratio between bandwidths before and after the detector. Then as the second step the sensitivity is calculated in the ordinary way, using the values for losses, noise factors and bandwidth before the detector.

In order to facilitate the first step in calculating the sensitivity, the report includes curves for the required signal/noise ratio before the detector as a function of the probability of detection, risk of false alarm and bandwidth ratio. The formal basis for these curves was devised together with Richard Wallden. Programming for the calculation and plotting was carried out by Lars Bergström.

The report further discusses the required amplification before the detector, and also the indicated sensitivity for the combined aerial and receiver in dBm/m^2 and dBm respectively.

H [illegible]

H1 [illegible]

(155) [illegible]
[illegible] February 1982

[illegible]

The literature quoted covers the period from about 1940 up to and including the symposium on "Survival in Shelters" arranged by Cfs at Rosersberg on 21-24 May 1976.

Questions particularly involving ABC protection were not included except where they concern the general ventilation and state of air-conditioning in shelters (*eg* gas traps and sand filters).

Original reports and photostats of the material are available from the library, FOA5 (*one copy*) and excerpts have been passed in one copy to Cfs.

(156) FOA report C54038-H1
Preliminary data from an analysis of some wild plants previously used in Sweden as food or emergency food, I.
Stefan Källman January 1982

Analytical data are presented for a number of wild plants used as food. The constituents analysed are chiefly carbohydrates and vitamin C, but also protein, amino acids, mineral substances, ash and water content were also determined for a number of species. The methods employed for analysis of carbohydrates and vitamin C are relatively new, and have not been used to a great extent on similar material.

The results indicate that the species analysed are rich in carbohydrate and vitamin C, and that analyses of raw protein should be supplemented by analyses of the amino acids owing to the variable composition of plant proteins.

(157) FOA report C54039-H1
Studies of moose repellants
W. Thorsell and others February 1982

In view of the increasing number of traffic accidents involving moose, efforts are being made to find countermeasures. Among other things these include the use of deterrents or repellants which will prevent moose from venturing on to busy highways.

About a score of substances have been studied for their moose-repelling effects. From the animal world for instance poultry manure and certain extracts of it have shown some interesting results. From the plant world the same applies to Asa foetida and extracts of it.

(158)

H1 Report XLVI, 1980, KAMEDO

Medical studies of an emergency in Bologna. Bomb outrage at the Central Station on 2 August 1980
Lennart Bergenwald and others

H2 Man and technical systems

(159) FOA report B53001-H2
Picture simulation of contrast sensitivity in organic and functional amblyopia (in English)
B.H. Lundh and others

The present report illustrates defects in contrast sensitivity by picture simulation of data from two patients: a woman with damage to the optical nerve (vision 0.5, Snellen), and a 7½-year-old boy with anisometropic amblyopia (vision 0.6). Damage to the optic nerve is characterized by a uniform loss of contrast sensitivity for all spatial frequencies, and the anisometropy by a loss of only the high spatial frequencies. A position image was divided into 1.25 × 10⁶ image points by a drum scanner. Each of the

spatial frequency components in the image was multiplied in a computer by the ratio between the patient's sensitivity rating and the mean of an aged-matched reference group, after which a modified image was obtained. The images illustrate that here the poor image quality occurs with the general loss of contrast sensitivity, even when visual definition is only moderately reduced.

Offprint from Acta Ophthalmologica (1981), 59, 774-783;
FOA reprints 1981/82:13.

(160) FOA report C40148-H2(C2)
Comparison between commercially available chlorine gas indicators, Figaro sensors and the chlorine gas sensors developed at FOA4
Erik Dahlgren and Lars Hägglund — January 1982

A chlorine gas sensor has been developed at FOA4, which is intended for use in measuring concentrations of chlorine gas at about the medical safety limit for chlorine (0.5 ppm). The principle of the sensor, which is of the semiconductor type, is that it registers the electrical changes which occur in a thin film when it reacts with chlorine gas.

In order to evaluate the sensor, comparative tests were performed with two semiconductor sensors and an electrochemical sensor as used in chlorine gas indicators, and with three different Figaro sensors.

The results demonstrate that the FOA sensor, as against the other semiconductor sensors, has a number of unique properties which may make it more suitable for use, *eg* in chlorine gas indicators. The technique *of* manufacturing it and the methods of measurement can also be used in developing sensors for gases other than chlorine.

(161) FOA report C56028-H2
Real-time simulation in a terrain model. A general description. (in English)
Kenth Carlsson — January 1982

A simulator is described, the central component of which is a model of an actual section of ground. The simulator is intended for use in behavioural research into perception and cognition with applications to various weapon systems. The terrain model, which measures 3 × 5 m, is on a scale of 1:100. A turntable serves as a platform for aiming devices, optical equipment and weapons. For purposes *of* pointing on the surface of the model, *eg* as feedback to a marksman, a laser pointer is used. A mobile target can be moved about the surface of the model on any desired linear path. A digital computer controls the simulator and performs all the calculations during a simulation operation. Among other things the existing configuration can be used in research on light anti-tank weapon systems. An application is presented.

(162) FOA report C56029-H2
The role of bio-engineering in technical systems development: some problems
Hans Furustig — February 1982

The present report covers the following problem areas: (1) questions about the nature, spread and application of ergonomic knowledge, (2) a critical evaluation of the ergonomic process of operating the system, and (3) a broad-based treatment of criteria in connection with ergonomic/bio-engineering activity in technical systems development. Three types of ergonomic activity are distinguished: scientific, construction and finally critically-oriented ergonomics/bio-engineering.

(1) The transfer of knowledge is discussed from the point of view of a model of "paths of knowledge". This raises a need for action as regards (a) documentation and evaluation, (b) the research process and (c) the process of systems development.

(2) The evaluation of the ergonomic process of operating the system reveals that the aspects which cause problems have to do with (a) conflicting objectives, (b) functional thinking, (c) certain constraints on the real freedom of the ergonomist/designer, and (d) irrational circumstances. In defining the problems and exemplifying some likely remedies it would seem as though the causes, conflicts or obstacles are not exclusively ergonomic, nor that the remedies are purely ergonomic. Failure to take suitable counteraction however leads to negative ergonomic consequences. This involves the ergonomist in an undefined role-playing situation. This therefore raises the need for modifying the role of the ergonomist in technical systems development. The problem is how the ergonomic contribution to decision-making information should be designed (a normative aspect), and how this contribution should come before the right decision-maker on the right occasion (an organisational aspect coupled with the problem of the transfer of knowledge).

(3) Questions of criteria. What characterises a well-executed ergonomic operation? The report distinguishes a contribution to the scientific world from one which is practice-oriented. A scientific ergonomic study ought to bear theoretical fruit. It implies firstly that a scientific fundamental requirement, say for validity, reliability, consistency, comprehensibility, simplicity and the observance of ethical and formal standards, should be satisfied, and that the problem ought to possess some theoretical interest.

An application-oriented ergonomic study should bear practical fruit. Some criteria which may be mentioned include relevance, applicability, credibility and communicability. For critical ergonomic activities aimed particularly at the development of one's own discipline, the demands on the ergonomist for accuracy, precision and freedom from bias are intensified.

It is important for all criteria affecting technical systems development to be explicitly worded, otherwise they will not be observed. There are some factors which are underestimated though of serious ergonomic importance, such as ethical, aesthetic and cultural preferences. By observing the relevant criteria the ergonomist should be able not only to propose alternative courses of action, but also to show a relationship between proposed ergonomic measures, system effects and the biological cost/benefit.

(163) FOA report C56030-H2
Transfer of knowledge in bio-engineering. Some results of an inquiry.
Hans Furustig February 1982

The report contains an account of an inquiry into the consumer's opinion of problems connected with the transfer of knowledge in bio-engineering. A listing of the problems affords a basis for suggested measures, the implementation of which presupposes ergonomists with competence in systems analysis and some experience of technical development. The measures are directed towards (1) documentation, liaison activities and research into systems analysis and (2) consultation and inquiry into ergonomics and system ergonomics.

H3 **Man and social systems**

(164) FOA report C55050-H3
Research into the working environment in the Defence services - some trends, prospects and experiences of behavioural research in the 1970s
Alice Walhall — March 1982

"To hew into rock can be useful, this is the way to strike ore", (Törnebohm, 1976).

This is an account of research into the working environment by FOA inst 55 (at that time MPI) during the 1970s as regards trends, prospects and fields of activity. Investigations performed during the past 5 years (numbering 17) have been classified in type of inquiry, method, class of objection, result etc, and the background to the outcome in terms of frequency is discussed. Briefly, the documentation which was abstracted constitutes an impressive fund of experience, resulting in several appropriate changes in units and administrative bodies. However this does not diminish the impression that after its completion several studies were left as to speak in suspense. The parts played both by the clients and the researchers in this unfavourable situation is illustrated in various sections of this account. The report concludes with some reflections on the coming 1980s, including some suggestions for future areas of research.

H [illegible]

H2 [illegible]

(165) FOA report [illegible]
[illegible] 17-19 November 1981
[illegible] — January 1982

[illegible] during the conference "IIASA task force on gaming", [illegible] on this subject.

[illegible]

M5 Economic studies

(167) FOA report C10191-M5
Money and prices in Sweden reconsidered (in English)
Curt Wells September 1981

During the 1970s economists became interested in identifying causal relations. During the same decade the monetarists were maintaining that inflation can be controlled only if growth of the money supply is reduced. This report presents a statistical method of discovering causal relations, and it then applies them to Swedish statistics (1871-1970) for prices and the money supply. The conclusion is that the simple model does not reflect the reality, that the causal relation works both ways: inflation is a function of expansion of the money supply, but also that the converse is true.

M6 Information systems

(168) FOA report C10199-M6
A suggested message structure standard for *GILT* (in English)
Jacob Palme February 1982

The *GILT* project is an international co-operative project to develop methods of exchanging messages among different types of computerised communication systems. The intention is for computers to be able to interconnect themselves in conformity with the international computer network standard X.25 and send one another textual messages formatted in terms of originator, recipient, text, date etc.

This report contains a Swedish proposal for the drafting of this standard. This proposal is *not* identical with the final standard, which the project will be compiling.

M8 Joint research and study projects

(169) FOA report C10195-M8
A numerical investigation of some quadratic polynomials containing a high density of primes, Part I, (in English)
Staffan Wrigge December 1981

This report examines some second-order polynomials with "high density of primes". It principally studies Euler's polynomial $n^2 - n + 41$ and the Karst polynomial $2n^2 + 40n + 1$. The investigation was performed as a stage in experiments to find methods of "producing" large prime numbers. These are in fact required in certain modern enciphering systems (the RSA method).

T CERTAIN MEASURES FOR LIMITATION AND CONTROL OF ARMAMENTS

T1 Seismological multiple stations

(170) FOA report C20443-T1
Common data base experiment - revised event bulletin (in English)
Harriet Ohlsson February 1982

Under the Common Data Base Experiment (CDBE) conducted in October 1980 seismic data were collected from a number of stations worldwide and analysed at the FOA in Stockholm. Data were collected during the period 1-15 October and consisted of bulletins, known as Level I data, from 59 stations in 21 countries, and of wave-form data, known as Level II data, from 58 stations in 13 countries.

The list of seismic events presented is a revised version of the one published in an interim report and at the Committee on Disarmament meeting of the seismic experts' group in Geneva in 1981.

(171) FOA report C20447-T1
Investigation of computer algorithm for automatic association of arrivals using synthetic data (in English)
Harriet Ohlsson March 1982

A list of seismic events has been produced, based on synthetic seismic data. The synthetic data were produced in order to constitute the best possible approximation to what was observed in reality. Thereafter it was possible to evaluate the existing methods of associating arrivals to seismic events and to examine the reliability of values obtained for the parameters.

T3 Scientific documentation

(172) FOA report C10204-T3
Disarmament and development. An international research project in the UN framework
Bo Hovstadius and Manne Wängborg February 1982

What would be the economic consequences of worldwide disarmament? And how could any possible savings come to benefit the LDCs in particular? These are the central questions in a study project under the framework of the UN on the connection between disarmament and development. This report is an attempt to illuminate the UN project and to afford an example of how its field of problems can be organised.

One means by which disarmament might contribute to development in the LDCs is by a stimulus to growth in the civil economy which disarmament would probably entail in both the developed and the underdeveloped countries. Another means would be by the transfer of resources which would be released for the support of development by disarmament in the industrialised countries.

The amount of the contribution to international support of development which might be provided by some future disarmament naturally depends both on how great the cutback of military investment might be, and on how great a share of the savings would be earmarked for development aid. In certain of the disarmament alternatives under discussion the contribution will be extremely marginal, although in some other likely scenarios the aid contribution increases so that before the year 2000, and perhaps by 1990, it will be as great as the present level of aid is otherwise calculated to become by then.

(173) FOA report C20446-T3
WMO, CAS VIII Meeting, Melbourne, 8-19 February 1982 (in English)
Sture Wickerts

X MISCELLANEOUS (in-house projects, etc)

(174) FOA report C60013-X5
Staff reporting
C PA and others February 1982

The present report is to be regarded as a supplement to the staff reporting contained in the FOA annual report 1980/81. The report describes events within the Establishments Branch and, as distinct from the annual report, it is problem-oriented and forward-looking.

It begins with a general description of the staff situation in the FOA, followed by various functions and activities by the Establishments Branch.

EMERGENCY COUNCIL FOR PSYCHOLOGICAL DEFENCE

(175) BN report No.109
Do we believe our mass media?
Peter Arvidson (Lund University) October 1981

This report constitutes the third and final part of the Emergency Council project on credibility. The author here has tested his four concepts of credibility - confidence, credibility, trust and reliability - on mass-media practices against a representative selection of the population in the Malmöhus area. The three parts make up Arvidson's doctoral thesis in sociology.

(176) BN report No.110
The Soviet submarine and Swedish public opinion
Kurt Törnqvist December 1981

A small survey of public opinion was carried out from 11-17 November 1981, *ie* 5-12 days after the Soviet submarine had left Swedish waters. The survey shows that the will for defence continues to be high, that the proportion who considered that the strength of defence was too small had doubled, that the proportion who felt that the USSR represents a threat to Sweden had grown from 14-34% over 2 months, and that almost every third person interrogated considered that the Government's precautions were too weak, while two-thirds considered them to be about right.

(177) BN report No.111
Opinion 81
Kurt Törnqvist December 1981

The Emergency Council's annual survey of public opinion was carried out in September 1981. Among other things it reveals that satisfaction with social conditions had become somewhat more widespread during the past year. Anxiety about political tension in the world and an awareness of the danger of war had greatly increased. Meanwhile the positive attitude to the USA in terms of world peace had become less positive, and the negative attitude to the USSR had become still more negative. Willingness for defence continued to be very widespread.

(178) BN communication No.92
Opinion surveys in the mass media
David L. Paletz and others (Public Opinion Quarterly)
Translated by Kurt Törnqvist and Jan Skoglund

This communication presents an American study of opinion measurements in the mass media. The authors take a critical look at layout, content and credibility. They study the investigators and sponsors and pass critical judgment on methods and presentation. They conclude with a discussion on the way in which opinion measurements are interpreted and the extent to which they influence opinion and those who form opinion.

(179) BN communication No.93
A systematic catalogue of books in the library of the Emergency Council
Jan Skoglund September 1981

A current catalogue of books in the library of the Emergency Council arranged according to the SAB system.

(180) BN communication No.94
Precision journalism
Maxwell E. McCombs and others (Gazette)
Translated by Kurt Törnqvist and Jan Skoglund October 1981

This study presents a new theory and technique for news reporting, termed precision journalism. It means that the journalist uses the methods of the social scientist, such as opinion surveys, content analysis, field experiments etc. Using the methods and approach of precision journalism, it will become possible to set the current day's news against a wider context.


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