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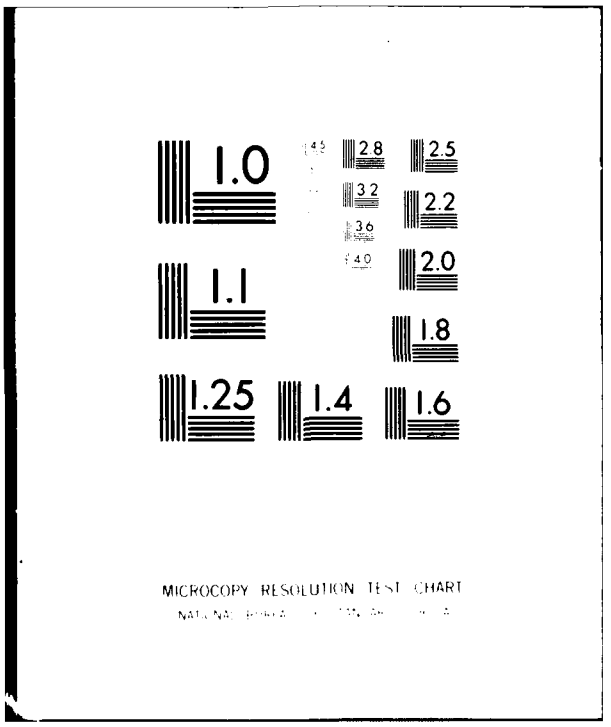
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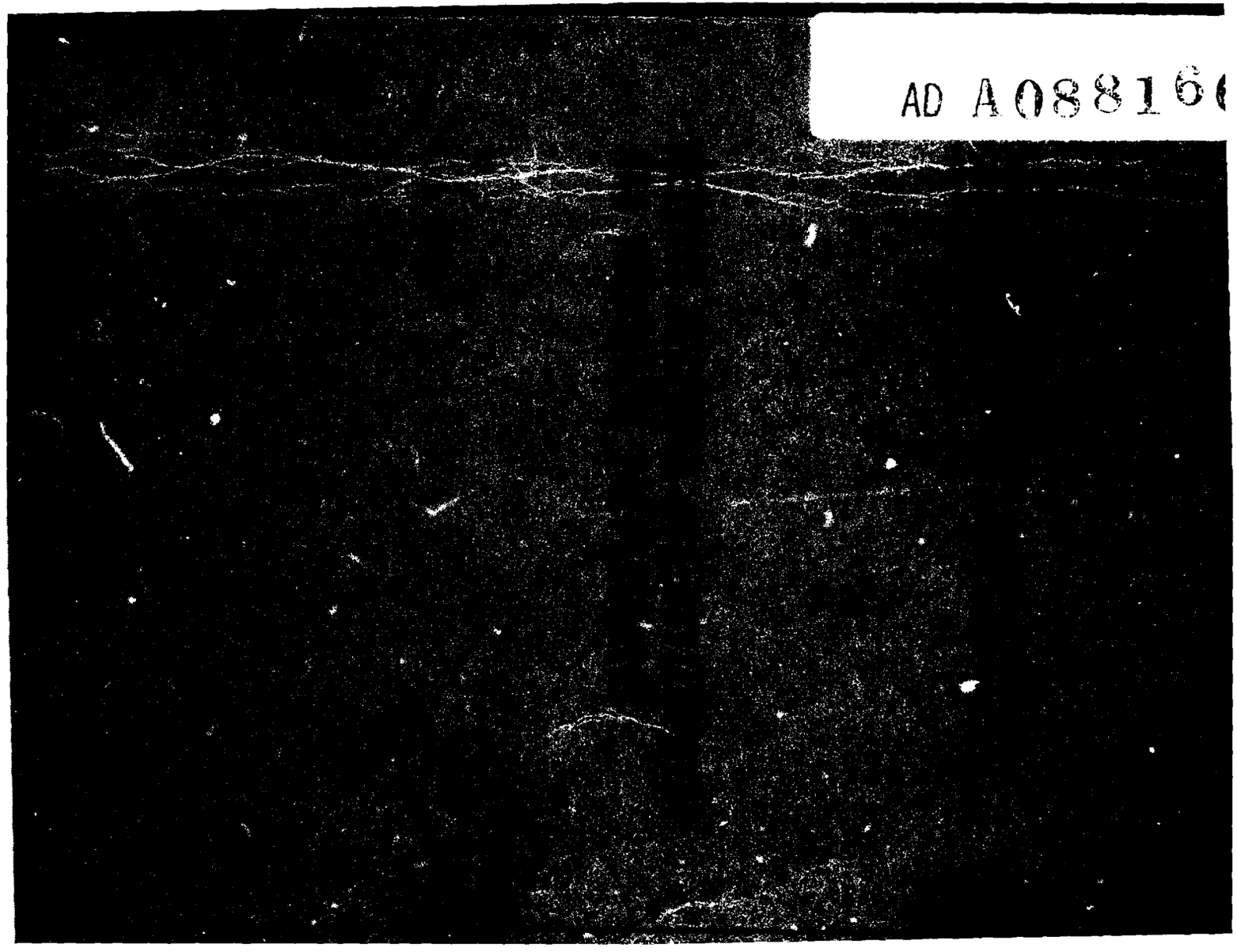
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RESEARCH AND DEVELOPMENT BRANCH

DEPARTMENT OF NATIONAL DEFENCE

CANADA

CRAD-2/80

DEFENCE RESEARCH AND DEVELOPMENT AND INDUSTRIAL PREPAREDNESS

PRESENTATION TO ARMED FORCES COMMUNICATIONS AND ELECTRONICS ASSOCIATION

8 APRIL 1980

by

E.J. Bobyn

CRAD REPORT NO. 2/80

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ABSTRACT

Discusses the role of defence-related research and development policy and programs as it affects the preparedness of Canada and its allies to be sensitive to the ever-changing threats to national security and to reduce the element of technological surprise. Suggestions are made for increased industrial participation in defence preparedness.

RÉSUMÉ

Étudie le rôle de la politique et des programmes en matière de recherches et de développement rattachés à la défense, lequel influe sur l'état de préparation du Canada et de ses alliés, ce qui leur permet d'être sensible aux menaces sans cesse changeantes posées à leur sécurité nationale et d'atténuer l'élément de surprise technique. On propose une participation accrue de l'industrie au niveau de l'état de préparation militaire.

TABLE OF CONTENTS

DEFENCE RESEARCH AND DEVELOPMENT AND INDUSTRIAL PREPAREDNESS

PRESENTATION TO ARMED FORCES COMMUNICATIONS AND ELECTRONICS ASSOCIATION 8 APRIL 1980

by

E. J. Bobyn

INTRODUCTION

I have been informed that the principle objective of the Armed Forces Communications and Electronics Association is to strengthen national security by bringing about closer understanding between government and industry in defence-related areas. It is my intention today to discuss the role of defence related R&D policy and programs as it affects the *preparedness of our nation* and its allies to be sensitive to the ever-changing threats to our national security and to reduce the element of technological surprise.

In times of emergency, people will rally and make sacrifices to meet the challenge. But it is the smarter nation that will postulate potential scenarios, take precautionary measures to avoid conflicts, and make plans to be prepared parametrically to handle emergency situations threatening our security.

RESOURCES

Let us now reflect on the resources we can rely on in Canada to achieve preparedness for maintenance of our national security. These principally involve the following:

- An armed force of about 80,000 military personnel and about 30,000 civilians covering air, land and maritime operations and technological support.
- An inhouse R&D scientific civilian staff of about 2000 working in seven (7) research centres across Canada and at Defence Headquarters in Ottawa.
- A reserve force of civilians trained in air, land and sea operations.
- A highly diversified industrial base comprising many foreign owned subsidiaries in Canada, a few large Canadian owned firms and many small industrial companies involved with exploring the abundant natural resources of our country, manufacturing, often under license, consumer and high technology products, providing maintenance and repair services and regretfully relatively little innovative or R&D capacity.
- Other government departments, each involved with their own programs some of which are crucial to our national security, such as Department of Agriculture, Communication, Transport, Energy Mines and Resources, Industry Trade and Commerce, Supply and Services, Environment, National Research Council, etc.

- Our Educational Institutions producing a very high quality product of trained graduates, sometimes not necessarily compatibly trained for our current requirements.
- Our allied resources with whom we train, exchange information, conduct joint programs and from whom we buy many of our armed forces requirements and on whom we rely on to assist us in times of national peril.

R & D RESOURCES

Now let me concentrate on the R&D portion of our resources as they relate to preparedness.

Our in-house DND R&D resource as mentioned earlier is about 2000 scientists, engineers and support staff virtually all civilian with at least another 200 military technical personnel involved with supporting engineering, test and evaluation with a total budget of about 105 million dollars in 1980, which is about 2% of the total DND budget. Capital expenditure will be about $47M, materiels and supplies about $15M, personnel $40M, miscellaneous maintenance and operation costs of special facilities about $3M. Total contracted out activity should be about $55M of which about $3M will go to universities and the rest to industry.

We conduct research and development in-house in our laboratories to insure that we have available scientists and engineers well trained in carefully chosen defence related areas that can be harnessed or tasked to solve current and future problems of the armed forces and the defence department as a whole. Prime focus for in-house capabilities is in areas which cannot be contracted outside. A typical example is chemical and biological defence research where industrial and university capability is almost nil. In addition to the prime focus, we must have a competent in-house staff to do systems analysis and evaluation, systems integration, experimental development, to define specifications, to monitor intelligently the contracted out R&D and to carry out test and evaluation. One cannot contract out these customer's responsibilities to provide the required in-house professional capabilities in defence science.

The conduct of a productive R&D program requires special management skills and procedures. Institutional management barriers which inhibit effective and innovative use of laboratory resources must be removed. Improvements in our current system in DND in the areas of personnel, procurement, construction and project initiation, monitoring and performance measurement are challenges we cannot ignore. Our pool of trained individuals is our most important resource. We must create vigorous personnel policies aimed at attracting the top technologists in the country for defence R&D and for maintaining effective use of the allocated manpower resources.

In a recent overview of our current in-house capabilities from a preparedness point of view, we find weaknesses in the following areas:

- **Aeronautics.** We have virtually no in-house capacity here relying mainly on NRC and industry.

- **Communications & Electronics.** The transfer of the Defence Telecommunications and Electronics Research Establishment to the Department of Communications has left us very vulnerable in radar, communications and space technologies. Modern weapon, communication, command and control systems make very high demands on this technology, thus in-house departmental capability is essential to meet these requirements. The total effort available to us at CRC at DOC is not only insufficient but it belongs to another department which has different priorities to our own.

- **Vehicles & Mobility.** We have a lack of expertise in the technologies involved with land and sea vehicles operating under severe Canadian conditions and terrain. The industrial capacity is available but our in-house resources being so inadequate have inhibited us in tasking and developing the industrial resources for DND purposes.

- **Data Processing, Solid State Components, Digital Signal Processors.** Key elements in the requirement for self sufficiency for Canadian original equipment manufacturers and for the future missions of DND have not received sufficient attention in-house for lack of trained manpower.

Simulation. Increased emphasis on simulation to conserve materials and energy are now major requirements.

– **Cost-Reduction Innovation.** The advent of costly sophisticated weapon systems is pricing us out of our capability to arm our forces within reasonable budgets. Innovative ways and means must be found on a priority basis to loosen our stringent military specifications, simplify designs, standardize, increase reliability and decrease life cycle costs.

UNIVERSITIES

Universities, particularly in the basic research area, provide an important resource for national defence preparedness. It is important that we contract with universities to earmark specialists that we can contact and exploit to advise us on technical problems as they arise in peace and emergency situations.

I am very disappointed that the central Granting Councils recently established by MOSST do not include defence or security of the nations as a national goal and thus no funds are earmarked for this purpose. We must continue to lobby our requirements so that the grants can be applied to defence science as well.

INDUSTRY

The limited budgets we have for R&D and materiel procurement makes it essential that we rationalize carefully the selection of projects which when contracted out to industry will ideally provide a technology base for repeated tasking, will provide equipment or materiels which will be purchased by our armed forces and which preferably have export potential or will be adopted as a standard by our NATO allies.

The DND priorities however have many constraining features to the above ideals. We have to place priority R&D on items which cannot be purchased off shore, where there is a unique Canadian requirement and where there is a reasonable degree of certainty that the item will be placed in our inventory if the development is successful. I do not have sufficient funds left after our priorities are tackled to invest in providing a technology base in industry solely for the purpose of preparedness for future tasking in times of emergency. The DITC Defence Programs Branch however partly fills this void in that the DIP funds on a shared basis with industry place priority on assisting industry in developing a technology base and capability primarily for export potential but not to meet a DND current requirement. This capability however does provide for our defence preparedness in cases of emergency or for possible future Canadian defence requirements. An example of this is the Canadair remote pilotless vehicle program, the products of which are not currently purchased for our inventories but the capability will be there, if support continues, to provide for Canadian requirements when they do materialize. The time phasing of such programs are crucial to insure that there is continued utilization of the industrial technology capability. This is where DITC, DSS and DND and other departments must work in full cooperation to maintain these unique skills. The ON-OFF programs are devastating to maintaining industrial capabilities but unfortunately this has been a Canadian syndrome.

As a result of our investments in-house and with industry and universities, we have accumulated many innovations that because of changing priorities and lack of funds cannot be immediately developed and phased in for acquisition by our armed forces in a timely manner. In a situation such as this, if the market potential for export appears lucrative, DITC should be induced to take over the development for production funding and thus maintain the technological lead and capability of our industry. Eventually, when we are in a position to buy, these products would be available at a more reasonable cost to us. This cooperative strategy maintains our industrial capability and is an important element of industrial preparedness.

DND's priorities today, within the fixed envelope allotted to us, is being placed on three very expensive programs: the Aurora, the NFA and the new ships programs. These are absorbing most of the capital funds thus reducing the capability of our armed forces to acquisition many of our very good innovative Canadian products which they need and would wish to have. These products are usually the smaller sub-systems or components thereof and unfortunately must take a lower priority in our re-equipment program. Delays such as we have experienced in the past year in procurement of our major equipments, of course, raise havoc with any orderly acquisition planning program. However, proper contingency plans can alleviate the situation but again this requires very close co-operation between the DND R&D investors, the operational acquisition investors, DITC, DSS and Treasury Board.

There appears to be increased emphasis in the recent past to place priority on Canadian made products for acquisition. This policy naturally places R&D investments in a very good position and obviously is a positive step forward to increase our Canadian Industrial Preparedness as well as our in-house capabilities. Offset programs for our large off-shore purchases, if properly chosen, can be a large asset in providing for and maintaining unique Canadian capabilities and again adding to our industrial preparedness. Offset investments in non-defence related technologies naturally do not excite me in my biased position and, although providing for employment, they may not be in the best interests of the country as far as defence preparedness is concerned.

I would now like to take a few moments to summarize some of our deficiencies in Canadian industry from the defence capabilities and preparedness point of view.

– **Microwave Capability**

We have very limited capabilities for design, development and production of large radars, although our radar purchases in the next twenty years will be relatively large. There are signs that this deficiency is being addressed and will be alleviated.

– **Electronic Warfare Capability** in Canadian industry is scattered among many small firms in a supporting role to our in-house resources at DREO and CRC. Project NAPKIN terminated a few years ago for lack of funds and was excellent in maintaining a reasonable industrial capability. This deficiency is being addressed and increased priority is being placed on revitalizing our capacity in this very vulnerable area.

– **Electronic Component Supplier**

Canadian industrial sources for solid state or semi-conductor technology and micro miniature components are considered essential for original equipment manufacturers and for future defence equipments. Other countries are jealously guarding their intellectual property in component manufacture to protect their original equipment supplier advantage. In many cases they will not export the key components. From a preparedness point of view, Canada must place high priority to insure its supply of Canadian made components. Semi-conductor components are the keystones of the data processing, computer and telecommunication industries.

We had at one time a very active Electronic Component and Devices Committee which coordinated in-house and industrial investments in component R&D. We need a revival of this committee and a very high government investment in industrial capability in this area. From a preparedness point of view, this is an essential technology base to develop and maintain. I am pleased to note that DITC and MITEL have reached an agreement recently to partly alleviate this situation.

We have recently funded in cooperation with DSS, CRC and NRC the first phase of an unsolicited proposal to develop a Gallium Arsenide Field Effect Transistor (GaAsFET) device capability in Optotek Limited of Ottawa. COMINCO in Trail, B.C. is the source of the rare very pure material of gallium arsenide as a result of a materials program we funded for many years. Had we not supported this program, COMINCO may have to sell their material south of the border for exploitation. We are concerned however that there does not appear to be a single government agency that is tasked with sponsoring such a crucial component development program.

– **Software-Hardware Integration**

Quality sub-systems on an aircraft, spacecraft or land and sea vehicles demand careful integration if their full potential is realized. Systems Integration is a risky portion of system development because of the large software requirements. We must develop and maintain a capability for software and hardware systems integration in our industries. Immediate requirements will be obvious in our New Ships program and in our Helicopter Update program. This is an area where DND investment must have high priority.

– **Manufacturing Technology**

Innovative manufacturing concepts which show potential to reduce materiel acquisition costs and to improve industrial productivity are essential. Special manufacturing and maintenance techniques to exploit the new materials, such as fibre optics, fibreglass and graphite fibres, and composites must be developed and maintained in Canadian industry.

– **Ammunition and Weapons**

Although some progress has been made to increase Canadian sources for ammunition we still require additional investments to make ourselves more independent. Weapon technology capability is almost nil in our industries, mainly due to lack of DND investments combined with a rigid non-export of weapons policy by external affairs. From a preparedness point of view we are very vulnerable in this area and very reliant on our allies.

– **Chemical and Biological Defence Capability**

Most of the capability here resides in-house in Ottawa and Suffield. We need to develop a capability for R&D and production in gas masks, protective clothing and detectors.

INDUSTRIAL PREPAREDNESS ASSOCIATION

We have had many rhetoric sessions, reports, and speeches made over the past few years concerning the lack of sufficient R&D, lack of government support for industry, lack of proper interdepartmental communication and definiteness of purpose, the split responsibility between departments and the lack of communication from DND to the industrial sectors and vice versa. There is no doubt in my mind that improvements in our organizations and in procedures are essential, if we are to substantially increase our collective defence preparedness.

In the industrial sector in 1947 there was an association established which concerned itself with industrial preparedness for the defence of Canada. It ceased to function in 1970, partly due to the fact that at that time it appeared that DND, DITC, DSS and the existing industrial associations collectively had sufficient capabilities to be aware of national deficiencies and had the mandates to correct these through their normal procedures. The waning interest in defence during the late sixties and early seventies had, I am sure, some effect on the demise of the Canadian Association. Perhaps some of you here have other explanations.

In the U.S.A., however, the American Defence Preparedness Association with similar objectives as the Canadian Association has been functioning with increasing effectiveness. Recently it has fostered participation by foreign allies particularly in conferences concerning the NATO RSI concept and the family of weapons concepts.

The membership of the ADPA (American Defence Preparedness Association) in 1979 was about 33,000, comprising military personnel, engineers, industrial reps and "concerned" citizens interested in the industrial preparedness for the defence of the U.S.A.

They are organized into 48 local regional groups and into subject divisions such as Air Armament, Ammunition Technology, Ballistics, Chemical, Cost and Value Management, Security Assistance, Undersea Warfare Systems, etc. Some of these divisions are divided into sections.

They publish a "National Defense" bi-monthly and a "Technical Bulletin" on alternate months. In May an annual conference is held in Washington.

They run about 40 to 50 technical meetings a year (1-3 days each) sponsored by sections or subject divisions. Most often these meetings are held at a U.S. Forces Command or Unit and the military actively participates in organizing the briefings, symposia, etc. For example, this week there will be a meeting on Tactical Vehicles at Monterey, California, and a Vehicle Components meeting on Vehicle Components in Alabama. In May there will be a "Bombs and Warheads" meeting in Aberdeen and a "Science & Engineering" Symposium in Washington. Some of these are classified security-wise, others are not.

At the meeting I attended in Washington last January, the theme was "International Conference on Defense Cooperation" where France, Germany, Holland, Canada and others participated. Only one representative from Canadian industry (CDC) was present to my knowledge and he was there to give a Canadian industrial viewpoint paper. We have had DND representatives at other meetings who were all very impressed with the seriousness of the group and the very effective dialogue between industry and defence personnel.

In Canada, we have over 30 industrial associations. The most effective group, from my experience, in establishing conferences with good industry government dialogue has been the Air Industries Association. Although many Canadian firms are members of the Air Industries as well as other associations, this group alone is not sufficiently involved in covering many other areas of defence interest.

From DND point of view, we are too small to actively interface with each of the 30 or 40 Canadian associations in addition to our relatively heavy interdepartmental commitments.

Some improvement has been made in the NIAG Group (NATO Industrial Advisory Group). It was established in 1968 by CNAD of NATO to provide a forum for free exchange of views on the various industrial aspects of NATO armaments questions. This group had a shaky start because of industrial competitiveness and inability to focus on problems of common interest, but is slowly becoming an effective forum. The Canadian group was relatively late in realizing the potential of NIAG as a forum for becoming better informed of NATO plans and where Canadian Industry can best participate. However, I believe that more needs to be done.

It appears to me that it would be highly desirable to reactivate or establish a new Canadian Defence Preparedness Association patterned more via the U.S.A. systems but with a different membership system. It could be a joint government-industrial and perhaps even university represented group. We might even consider including the professional societies, such as the Engineering Institute, Chemical Institute, etc.

I think it would be essential to have a permanent secretariat of say about three staff members (the U.S.A. has 25) with part-time support from the member societies. The Association could essentially consist of one or two members of the permanent secretariat of each of the associations interested in Defence including representatives from each concerned government agency, in particular, DND, DOC, DITC, DSS, MOSST, Emergency Planning Organization, and perhaps NRC including Crown Companies such as Canadian Arsenals, CCC, etc.

The main industrial associations would include:

- Machinery and Equipment Manufacturers Association
- Air Industries Association of Canada
- Electrical and Electronic Manufacturers Association of Canada
- Canadian Advanced Technology Association
- Canadian Manufacturers Association
- Society of Plastics Industry of Canada
- Pharmaceutical Manufacturers Association of Canada

- Canadian Association of Manufacturers of Medical Devices
- Canadian Shipbuilding and Ship Repairing Association
- Canadian Truck Body and Equipment Association
- Motor Vehicle Manufacturers Association.

Other groups that should be represented are:

- Defence Associations of Canada
- Armed Forces Communication and Electronics Association
- NIAG
- Engineering Institute of Canada
- A.I.E.E. and I.R.E., and other Societies
- SCITEC
- Individual members.

Funding to operate this association can be shared by industry and government.

The main objectives of this Association would be:

(a) to organize seminars, symposia and meetings on defence related topics for the purpose of establishing a forum to communicate defence requirements and plans to the appropriate industrial sectors.

(b) To identify areas where Canadian Industrial capabilities need to be created, expanded or improved to meet current and future requirements in peace or emergency situations and to recommend methods of achieving the aim.

(c) To be available in time of national emergency to act as a vehicle to assist in harnessing Canada's industrial and scientific potential.

(d) To improve Canada's defence industrial capability to provide for Canadian military requirements as well as off-shore sales.

(e) To promote greater dependency on Canadian made defence related products.

(f) To promote international allied use of Canadian Industry for co-production in line with RSI concept of NATO.

(g) To recommend means of improving Canadian Industrial R&D capabilities with particular emphasis on defence related areas.

Our Chief of Defence Staff has recently warned Canadians of the very explosive situation facing us in the next five years, he warned us of the ever-increasing threat of the Soviet world domination and the over-all powder-keg situation in the mid-east that could engulf us in another terrible war. I need not elaborate anymore on the threat.

It is essential that all of us become increasingly aware that Canada must improve its defence posture not only in its military forces but in its R&D capabilities, its defence preparedness in industry and universities and in other government departments. Today I have proposed one way to improve our Industrial Preparedness awareness. I would be most pleased to hear your views.

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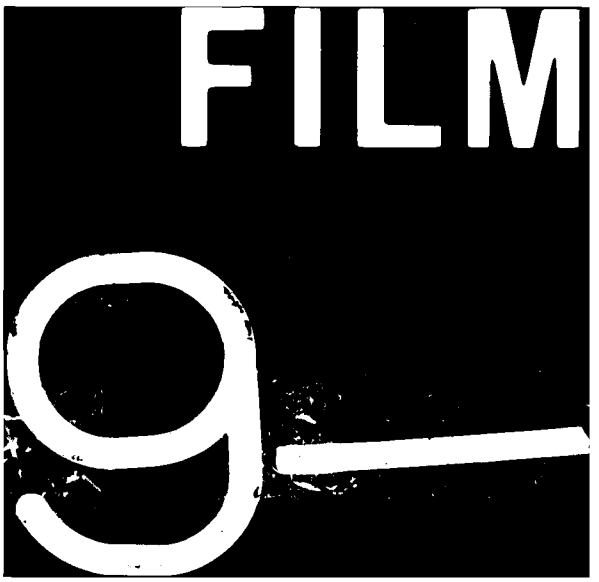
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