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1992–93
Strategic Plan

Defence and Civil
INSTITUTE OF ENVIRONMENTAL MEDICINE
INSTITUT DE MEDECINE ENVIRONNEMENTALE
pour la défense

1133 Sheppard Avenue West, PO Box 2000, North York, Ontario, Canada M3M 3B9
Tel. (416) 635-2000
Fax. (416) 635-2104

1992–93
Strategic Plan

Defence and Civil
Institute of Environmental Medicine

1133 Sheppard Avenue West, PO Box 2000, North York, Ontario, Canada M3M 3B9

1992–93
DCIEM Strategic Plan

Prepared by:	J.P. Landolt, PhD M.W. Radomski, PhD D.G. Pearce, PhD
Other Planning Group Members:	K.N. Ackles, PhD L.V. Allin, P.Eng R.G. Angus, PhD LCol M.J. Ballantyne, MD D. Beevis, MSc Capt (N) C.J. Brooks, MB R.D. Butt LCol R.A. Davidson, MD W.D. Fraser, MSc D.E. Gardham, CPM, CAM J.J. Grodski, PhD I. Jacobs, Dr.Med.Sc. L.E. Magee, PhD C.A. McCann, MSc LCdr P.D. Morson R.Y. Nishi, MASc R.A. Pigeau, PhD B.H. Sabiston, PhD Maj K. Scharnitzky, P.Eng P.N. Shek, PhD M.M. Taylor, PhD
Designed, produced and edited by:	K.M. Sutton, BSc

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Introduction

Canada's new defence policy reflects the realities imposed by the changing international and national situations. Externally, the end of the Cold War and the breakup of the Soviet Union have resulted in regional instabilities requiring greater emphasis on peacekeeping, humanitarian assistance, the pursuit of peacemaking and military assistance against new adversaries. Internally, there is an increased requirement for civil responsibility and direction by the government toward fiscal responsibility, deficit reduction and public service accountability. It is against this background that the Defence and Civil Institute of Environmental Medicine (DCIEM) has developed its strategic plan.

DCIEM's strategic plan is an organized approach to making future decisions in research and development (R&D) involving the human, and how to implement these decisions. This plan will assist the Institute in fulfilling the mission requirements of the Department of National Defence (DND) for the next 15 to 20 years.

The strategic plan describes DCIEM's mission and mandate, lists the environmental factors that will influence management decisions and directions, presents an analysis of the Institute's capabilities, and describes the strategic issues that must be considered in fulfilling the implementation process. A detailed action plan is presented, including both immediate and long-term goals, and criteria with which to monitor performance. Finally, a framework for achieving the strategic issues is described.

DCIEM's strategic plan is an organized approach to making future decisions in research and development (R&D) and how to implement these decisions.

Background

Mission & mandate

Mission

To enhance the effectiveness and ensure the health and safety of the human in any human-machine system or adverse environment.

To accomplish its mission, DCIEM is committed to:

- scientific excellence in its programs
- the effectiveness and safety of Canadian Forces (CF) personnel
- the well-being and professional development of its employees
- high ethical standards of conduct
- fostering defence R&D in Canadian industrial and academic sectors
- respecting the environment

DCIEM is Canada's centre of expertise for defence R&D in operational medicine, human performance and protection, and human-system integration.

Mandate

DCIEM's mandate comprises four prime functions:

- To conduct R&D in the areas of operational medicine, human performance and protection, and human-system integration
- To provide advice and technical support in aid of CF operational requirements in the above areas
- To provide training to CF biomedical and operational occupations in areas related to DCIEM's mandate
- To conduct specialized medical selection and screening in the aircrew and diving occupations

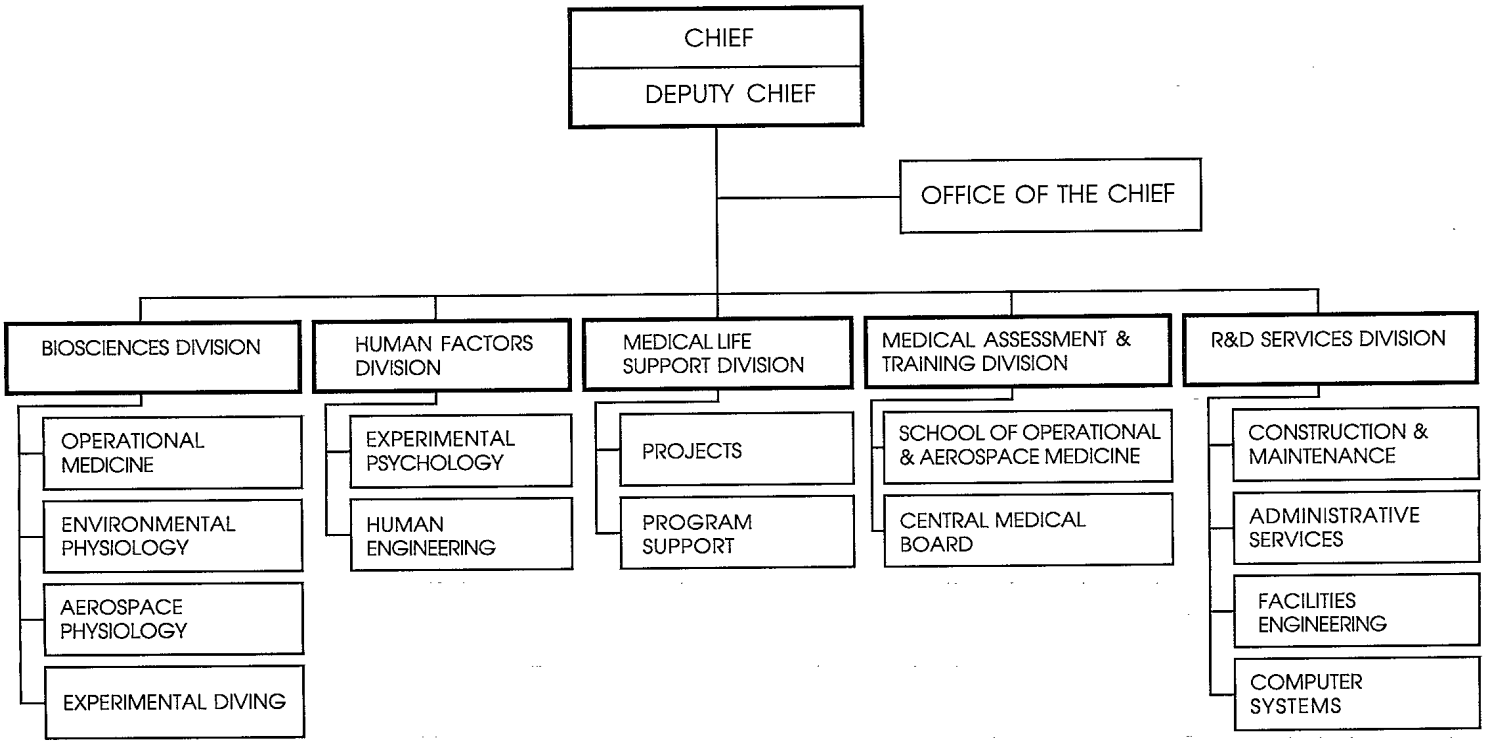
Investment strategy

To further its mandate, DCIEM has adopted the following investment strategy:

- Plan and conduct an effective technology base and technology applications program to meet existing and projected operational requirements
- Maintain scientific and technical leadership in the human factors and health sciences areas by attracting and retaining scientists who have demonstrated ability, creativity and achievement in R&D
- Foster and enhance multidisciplinary collaboration and achievement within the Institute, with other Defence Research Establishments, and with various universities, government and non-government agencies
- Contribute to the economic development of Canada through strong links to universities and industry
- Capitalize on emerging technologies which affect the development and achievement of the R&D program, and the CF capital acquisition programs

Organization

The current organization chart for DCIEM is shown below.



Work environment

External environmental factors

- Canada's new defence policy
- the economy and its effect on DND
- Public Service 2000 (PS 2000)
- work force adjustment
- rapid changes in, and growing costs of technology
- public concerns and attitudes
- government's attitude towards public servants
- reallocation of Environmental Protection Section (EPS) to DCIEM from Defence Research Establishment Ottawa (DREO)
- potential closure of CFB Toronto

Clients & stakeholders

DCIEM's clients are the CF and DND in general. The Institute provides its clients with expert scientific and technical advice and support in the human factors and health sciences areas directly relevant to CF missions as outlined in the new defence policy.

DCIEM stakeholders include:

- its employees
- Chief Research and Development (CRAD)
- Surgeon General (Surg Gen)
- CF Operational Commands
- Assistant Deputy Minister (Materiel) [ADM (Mat)]
- Assistant Deputy Minister (Personnel) [ADM (Per)]
- Canadian defence-related industries
- Canadian universities
- federal and provincial Centres of Excellence
- Canadian Space Agency
- other government and non-government agencies
- allied defence research agencies (national and international)
- Canadian public

Capability analysis

Expertise

- human-system integration
- human performance, both physical and cognitive
- human protection in all operational environments
- operational medicine

Corporate strengths

- employment equity
- broad base of expertise in the physiological, medical, and psychological sciences
- integrated civilian-military centre of expertise
- capability for multidisciplinary R&D
- excellent international recognition and links
- strong academic ties and graduate programs
- rapid response capability to meet new operational needs
- unique Canadian human experimental test facilities
- Central Medical Board (CMB)
- School of Operational & Aerospace Medicine (SOAM)

Corporate weaknesses

- strength of human factors lobby
- ability to demonstrate relevance of human factors in CF systems to National Defence Headquarters (NDHQ)
- level of manpower in key technical areas
- ineffective channel for technology transfer to industry
- marketing of DCIEM's capabilities and achievements
- rotational posting of military personnel

Strategic issues

DCIEM plans to realize its mission and mandate through five strategic issues. All are considered essential to the maintenance of DCIEM's leadership in defence R&D in human factors and health sciences for the next 15 to 20 years.

DCIEM plans to realize its mission and mandate through five strategic issues:

- *key strategic technologies*
- *organizational refocusing*
- *multidisciplinary approach*
- *human resources management*
- *marketing*

These issues are:

- enhancement of capabilities in **key strategic technologies**
- **organizational refocusing** of DCIEM to enhance allocation of R&D resources to higher priority technologies
- promotion of a **multi-disciplinary approach** to problem solving, both inter-divisional and inter-establishment
- improved **human resources management**
- improved **marketing** of the importance of human factors and of the Institute to clients and stakeholders

Key strategic technologies

The range of activities conducted by DCIEM scientists for the CF covers a very broad spectrum of disciplines in human factors and health sciences. This is a natural outcome of DCIEM's ability to conduct multidisciplinary R&D, its unique facilities for simulating different operational environments, and the expertise and dedication of its scientists and technologists. However, DCIEM has insufficient manpower in key technical areas. In some instances, specific technology thrusts are dependent solely on the efforts of individual defence scientists (DSs).

Current government initiatives for reducing the deficit and downsizing DND in accordance with the new defence policy, and the outcome of PS 2000, may further reduce available DS positions and funding.

This challenge will be addressed by focusing resources more appropriately on **key technology thrusts**—those in which DCIEM has perceived strengths, and which are identified as the most important R&D issues facing the CF in human factors and health sciences in the next 20 years.

Key technology thrusts:

- *individual protection*
- *biomedical technology*
- *information and decision systems*
- *crew system integration*
- *training systems*

Selection criteria

The selection criteria considered in determining the key technology thrusts were:

- current expertise, funding, facilities, other resources
- meets requirements for CF operations
- current constraining commitments (e.g., CMB)
- areas that will become critical to CF
- should involve research
- breadth of utility (land/sea/air/civilian)
- industrial benefit
- chance of success
- availability of technology

For each key technology thrust, a detailed list of research areas appears in Annex A.

Organizational refocusing

Manpower resources are decreasing. In order to ensure the correct balance and distribution of services and resources within DCIEM, it is essential that manpower and dollars are allocated to key technology thrusts.

A re-examination of management levels will be made, and the distribution of management responsibilities within the Institute will be assessed.

DCIEM's R&D program is currently carried out in four Divisions: Biosciences, Human Factors, Medical Life Support, and Medical Assessment and Training. Support is provided by the recently formed R&D Services Division. This organizational structure may not be the best way for focusing on the technology thrusts identified as important to DCIEM's strategic interests.

To maximize R&D efforts in the key technology thrusts, DCIEM has consolidated the Technical Services Division (TSD) and the Administration Division into a single services Division: Research & Development Services (RDS). This will enhance the effectiveness of delivery of administrative and technical support services to the R&D program. As well, an internal review of the DCIEM R&D organization, to assess its relevance to its new technology thrusts, is underway.

In order to ensure the correct balance and distribution of services and resources within DCIEM, it is essential that manpower and dollars are allocated to key technology thrusts.

Multidisciplinary approach

With rapid technological changes and new defence initiatives taking place, DCIEM needs to be able to address new CF problems that require a multidisciplinary approach to R&D. In that regard, one of DCIEM's strengths is the number of relevant disciplines in human factors and health sciences that its scientists can apply to different problems. The full potential of the multidisciplinary approach to problem solving has not been realized adequately at DCIEM. Steps will be taken to alleviate this shortcoming.

To improve interdisciplinary communication and cooperation in R&D projects, DCIEM will establish mechanisms to increase awareness among DCIEM scientists of work being done by others in different disciplines.

To address major projects, matrix management will be utilized to a greater extent in the establishment of interdivisional project teams.

...one of DCIEM's strengths is the number of relevant disciplines in human factors and health sciences that its scientists can apply to different problems.

Human resources management

DCIEM is committed to the well-being and professional development of its employees. To that end, the work environment will be improved in ways that demonstrate the high value that DCIEM places on its employees.

Moreover, DCIEM has a long-standing tradition of practising employment equity, and it welcomes all government initiatives in that direction.

Marketing

DCIEM has an excellent international reputation in defence R&D. However, there is inadequate awareness—within DND, the CF, other government departments (OGDs), industrial and academic sectors, and the scientific community at large—of the Institute's unique facilities and its scientific expertise, capabilities and accomplishments. Moreover, the Canadian public has little knowledge of DCIEM's important role and achievements in human factors and health sciences, or how its accomplishments have benefited Canada as a whole.

It is essential that DCIEM advocate the importance of human factors input at the systems design level to the field Commands and senior NDHQ officers. To that end, DCIEM will develop a marketing scheme that will enhance its profile among clients and major stakeholders. Through the effective use of promotional activities, DCIEM will exploit the full potential of its facilities and expertise to align its R&D programs more closely with "market demands" for its specialized services.

A successful promotional approach that emphasizes the economic and technological benefits to industry and academia in conducting defence R&D will have important implications for the Institute's clients and stakeholders.

Action Plan

Immediate term

A series of immediate actions will be undertaken over the next year to enable DCIEM to realize its strategic priorities.

Key strategic technologies	Action	Responsible unit	Completion date
	Hold second Strategic Workshop to define specific technologies that DCIEM should concentrate on	SMC	March 1992
	Initiate and complete review of all projects/tasks as to relevance to technology thrusts	SMC	March 1993
	Review international commitments and focus resources more effectively	PPO, SMC	May 1993
	Reassess and focus the external contracting program	PPO, SMC	June 1993

PPO Plans and Programs Office
SMC Senior Management Committee

Immediate term, cont'd

Organizational refocusing

Action	Responsible unit	Completion date
Consolidate Technical Services and Administration Divisions into R&D Services Division	Chief, D/TSD	March 1992
Redefine role of Senior Management Committee	PPO	December 1992
Reorganize the four DCIEM R&D Divisions into three Divisions	SMC	December 1992
Integrate EPS from DREO	SMC	July 1993

Multi-disciplinary approach

Action	Responsible unit	Completion date
Institute weekly colloquium	PPO	April 1992
Implement and conduct, as appropriate, R&D projects/ tasks in matrix management structure	SMC	Ongoing

Immediate term, cont'd

Human resources management	Action	Responsible unit	Completion date
	Define a civilian human resources strategy and management function	PPO, SMC	March 1993
	Develop and implement skills upgrading program for all staff	Div Dir	Ongoing
	Improve opportunities for employee assignment to different tasks	Div Dir	Ongoing
	Maintain and upgrade, as required, government objectives in employment equity, occupational health and safety, etc.	Chief	Ongoing
	Establish more effective means of communication within Institute	SMC	Ongoing

Immediate term, cont'd

Marketing

Action	Responsible unit	Completion date
Prepare public relations brochure	Chief	December 1992
Establish a DCIEM Public Relations Committee	PPO	January 1993
Re-examine Institute name with a view to matching it to DCIEM mission	SMC	March 1993
Prepare permanent display booth at DCIEM to demonstrate DCIEM activities	Chief, PPO, RDS	April 1993
Prepare one-page fact sheets on each key program, task, patent, test facility, etc.	PPO	July 1993
Develop strategy to market DCIEM to NDHQ responsible units, Commands, industry, OGDs, etc.	PPO	July 1993
Design and publish DCIEM technical newsletter	Chief, PPO, Information Services Group	July 1993
Prepare multi-media packages for tailoring presentations to specific audiences	PPO, RDS	September 1993
Upgrade and utilize current DCIEM promotional material (In Touch, Annual Report, etc.)	Chief, PPO	Ongoing, as appropriate
Seek opportunities to observe/ attend major exercises and operational doctrine boards in order to identify and advise on potential areas of assistance	D/Chief, Div Dir	Ongoing, as appropriate

Long term goals

DCIEM is dedicated to using strategic planning as a means of implementing continuous improvement in the organization.

As long term goals, DCIEM will:

- **conduct strategy reviews**, at least biennially, with the primary focus on key technology thrusts and human resources to set and maintain a course for the future
- **employ new and enabling management techniques** to enhance organizational culture and effectiveness
- **encourage and empower employees** to optimize their contribution to the Institute's performance and organization
- **continuously upgrade marketing techniques** to meet client and stakeholder expectations
- **upgrade broad technology base**, as required, to maintain position as DND's centre of expertise in human-system integration
- **upgrade environmental research facilities** to state-of-the-art, as required or mandated by new objectives

DCIEM is dedicated to using strategic planning as a means of implementing continuous improvement in the organization.

Key performance indicators

DCIEM will monitor a number of performance indicators, making annual comparisons with previous years, to assess progress in meeting the objectives of its strategic plan.

Technology & taskings

- technology transfer activities
- changes in nature of CF taskings
- taskings from outside agencies
- patents, licenses, publications, presentations, etc.
- sponsored Defence Industrial Research Program projects

Cooperative & multidisciplinary approach

- inter-sectional and inter-divisional projects
- inter-establishment cooperative projects
- industry/university/OGD cooperative ventures
- realignment and nature of international commitments

Marketing & public awareness

- visits to DCIEM (number and nature)
- media references to DCIEM
- outside requests for services/advice
- outside requests for speakers and presentations
- invitations to trade shows, working group participation, etc.

Employee related factors

- employee commitment to new thrusts
- employee satisfaction
- maintenance of employment equity
- ease of recruitment
- employee turnover
- scientific exchange
- awards and achievements
- invitations to pertinent functions

Meeting the challenges

Changes in program balance

The changes in DCIEM's R&D program are evolutionary and incremental. They are meant to address the new international realities imposed by the end of the Cold War as reflected in Canada's new defence policy and the pursuit, by the Government, of fiscal responsibility, deficit reduction, and accountability in the public service (PS 2000). The new defence policy calls for a Total Force that is flexible, versatile and mobile, and capable of countering instability and maintaining security in many parts of the world. This implies an increased commitment, on the part of the CF, to military and non-military tasking in Canada, and to international peace and security through arms control verification, humanitarian assistance, peacekeeping and the pursuit of peacemaking.

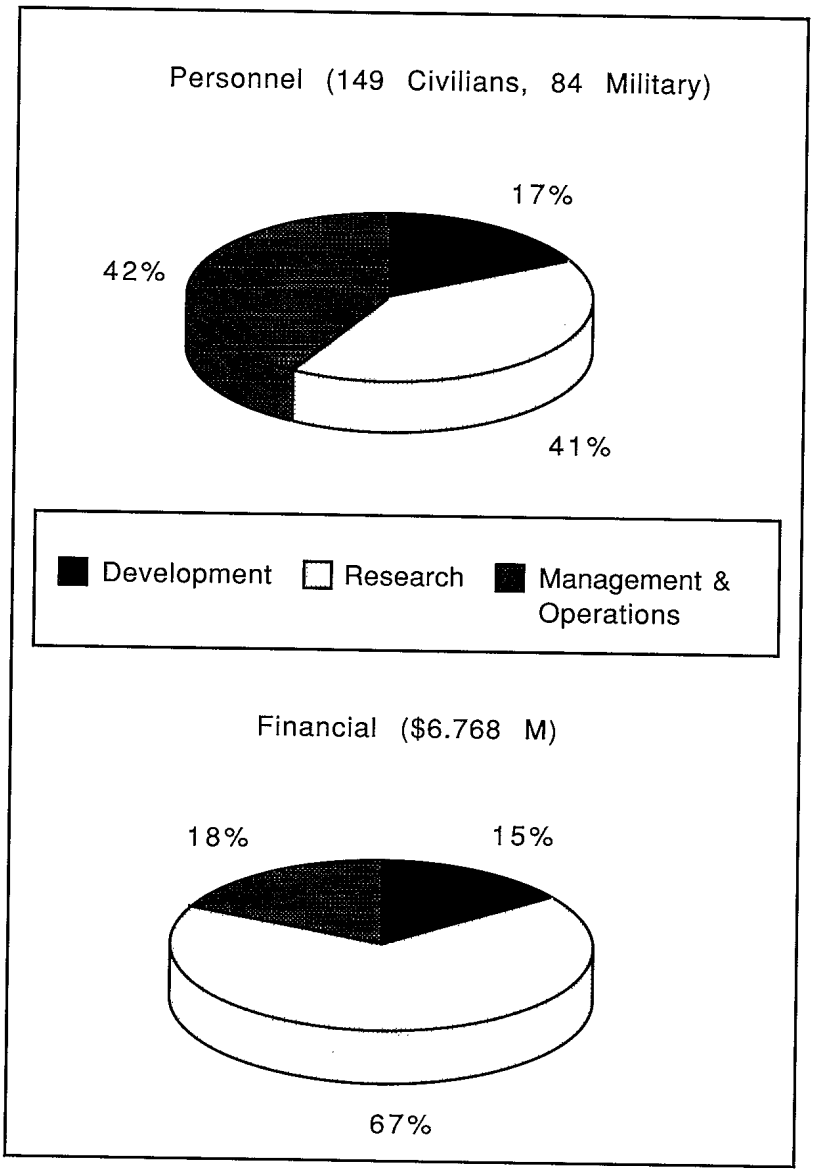
The changes in DCIEM's R&D program are evolutionary and incremental. They are meant to address the new international realities imposed by the end of the Cold War.

DCIEM's ability to meet CF needs for long-term R&D involving the human is dictated by several factors. These are:

- defence policy priorities and tasks;
- technological advancements and requirements;
- the ability to hire and maintain sufficient skilled personnel to carry out the work; and
- the cost and politics of conducting defence R&D in a changing geopolitical world.

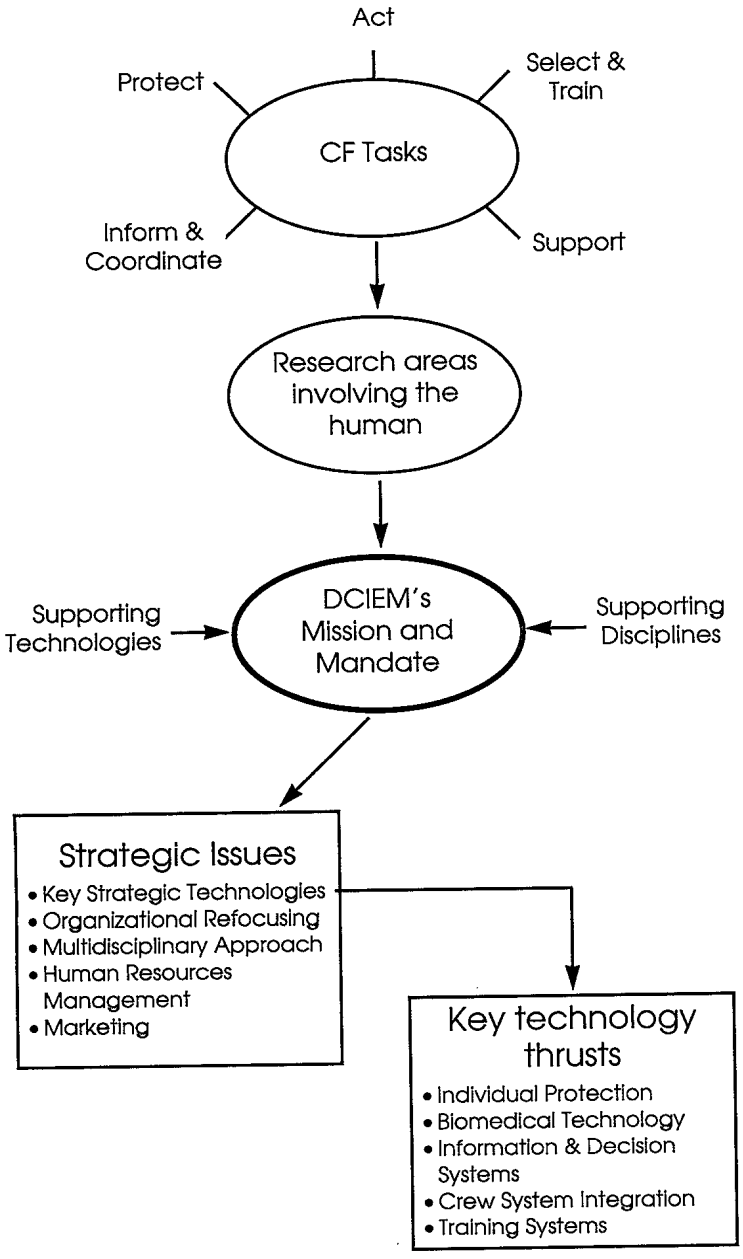
All of these factors have been taken into consideration in addressing the key technology thrusts considered essential for DCIEM to maintain its leadership in defence R&D in human factors and health sciences for the next 15 to 20 years.

Resources



Current resource allocation in terms of personnel and funding to meet strategic plan objectives are shown in the figure.

Framework for achieving strategic issues



A framework for achieving DCIEM's strategic issues was conceptualized at the second DCIEM Strategic Workshop held in March 1992 and used in the development of this strategic plan. This framework is shown at the left.

CF tasks according to the new defence policy, and **CF activities**—what the CF must do in support of these tasks—are listed in Annex A. Also listed are **research areas that involve or affect the human**. The research areas identified include critical technologies required by the CF for meeting mission demands in the next 15 to 20 years, or those that could be used by potential adversaries.

DCIEM plans to fulfill its mission and mandate in defence R&D through the five **strategic issues** defined earlier. The **supporting technologies** and **supporting disciplines** for DCIEM's research programs are also listed in the Annex.

Finally, the **key technology thrusts** that DCIEM could conduct, given technological changes, administrative constraints and DND priorities, in aid of CF tasks in terms of the new defence policy, are listed. Research areas are categorized according to these technology thrusts.

The Annex ends with a proposal for a reorganization of DCIEM's R&D Divisions. This suggested DCIEM organization is structured along product/ application lines to more effectively conduct the R&D program.

Technology

Of the five strategic issues, three (key strategic technologies, organizational refocusing and multidisciplinary approach) have a common focus: technology.

The ability to conduct R&D will depend greatly on the technology available to support it. Although some of the supporting technologies exist in-house, most will be developed and obtained elsewhere through contracting out and information exchanges.

Other factors

Administrative and other non-technical factors will affect DCIEM's ability to achieve its strategic issues. These factors include:

- Organizational structure
  - three R&D divisions
  - interdisciplinary
- Resources
  - financial
  - personnel
  - contractual
- Time scale
  - e.g., availability of technology
- Risk of failure
- Benefit to Canada
  - technology transfer
  - international programs
  - dual use
- Political considerations
- Public relations
- Ethical considerations
- Environmental impact

Summary

This strategic plan reflects the importance DCIEM places on defining strategic objectives for conducting defence R&D. The approach outlined in this plan will assist the Institute in meeting the anticipated requirements of its clients and stakeholders for the next 15 to 20 years.

DCIEM can best fulfill its mission and mandate by employing five strategic approaches:

- emphasizing key strategic technologies,
- organizational refocusing,
- multidisciplinary approach to problem solving,
- human resources management, and
- marketing.

The reorganization of DCIEM's operations into three R&D Divisions and one support Division will enhance the ability of the Institute and its staff to focus R&D efforts on key technology thrusts identified as important to meeting CF needs in human factors and health sciences. These key technology thrusts are:

- individual protection,
- biomedical technology,
- information and decision systems,
- crew system integration, and
- training systems.

DCIEM can best fulfill its R&D obligations to the CF by:

- *employing five strategic approaches*
- *reorganizing into three R&D Divisions and one support Division*
- *focusing on five key technologies in human factors and health sciences*

Annex A: Strategic technology thrusts – research issues and requirements

Contents

- CF tasks
- CF activities in support of tasks
- Research areas for the CF that involve the human
- DCIEM key technology thrusts
- Supporting technologies for DCIEM
- Supporting disciplines for DCIEM
- Suggested DCIEM organization

CF tasks (New Defence Policy)

Defence
- Collective (e.g., NATO)
- Continental (e.g., NORAD)
- Total Force concept

Aid to Civil Authorities
- Search and rescue
- Surveillance of airspace
- Coastal patrols

Peace and Security
- Stability (e.g, peacemaking)
- Peacekeeping
- Humanitarian assistance
- Arms control verification

Sovereignty
- Emergency preparedness
- Civil disobedience
- Drug interdiction

CF activities in support of tasks

Act
- Move and rapidly deploy
- Fight
- Communicate and negotiate

Inform and Coordinate
- Provide surveillance
- Gather intelligence
- Plan
- Make decisions
- Communicate

Select and Train
- Groups
- Individuals
- Reserves

Protect
- Equipment
- Personnel

Support
- Logistics
- Medical
- Maintenance
- Technical assistance

Research areas for the CF that involve the human

Information and decision-making

Computation and communication
- high-speed computing
- massive parallel computing
- wide-band communication
- signal processing
- photonic processing
- mass storage devices
- software engineering

Data acquisition, interpretation and presentation
- sensor systems
- night vision aids
- imaging
- data fusion
- display systems

Decision support
- decision aids
- computer-supported group work

Knowledge handling
- databases
- artificial intelligence
- hyper- and multi-media
- multimodal manipulation

Biomedicine/ biotechnology

Operational medicine
- blood substitutes
- trauma
- contingency medical responses
- motion sickness
- enhanced immune response
- casualty/vital sign monitoring

Preventive/prospective medicine
- health hazard assessment
- immunology
- biological drug targeting

NBC medical defence
- decontamination
- treatment/prophylaxis
- antidote/anticonvulsants
- antiemetics

Training

Training technologies
- distributed training
- training devices
- mission rehearsal
- preparedness

Research areas for the CF (cont'd)

Protection

Physical protection
- thermal extremes
- impact
- materials & textiles
- NBC
- noise
- directed energy
- ballistic

Life support technology
- hypoxia
- oxygen systems
- survival systems
- nanotechnology
- hypo- and hyperbaric
- G-protection

Human performance

Cognitive
- work/rest schedules
- situational awareness
- tactical decision-making
- sleep quality
- sleep deprivation
- drug enhancement

Physiological
- exercise
- load carriage
- biomechanics
- drug enhancement
- spatial disorientation

Platforms and weapons

Platforms and weapons
- vehicle design
- remote systems
- fire control systems
- navigation technology

Support

Support technologies
- maintenance
- logistics

DCIEM key technology thrusts

Individual protection

Protective clothing & equipment

thermal stress countermeasures
head protection
noise attenuation
hearing and vision conservation
(load carriage)
(impact protection)

Life support systems

safety systems
altitude protection
G-suit development
oxygen systems/equipment
diving systems/equipment/decompression
spatial disorientation countermeasures
(survival systems)

Biomedical technology

Preventive/ prospective medicine

immune enhancement
pressure adaptation
drug targeting
medical selection and retention
pharmacological aids
occupational health
physical fitness
(aeromedical & diving training)
(aircraft/diving accident investigation)

Operational medicine

blood substitutes
trauma
burns/wounds
infection
motion sickness
(antimicrobial treatments)

- Items in brackets indicate areas of less emphasis.

DCIEM key technology thrusts (cont'd)

Information and decision systems

decision support and aids
knowledge bases
displays
neural networks
group dynamics
(data fusion and interpretation)

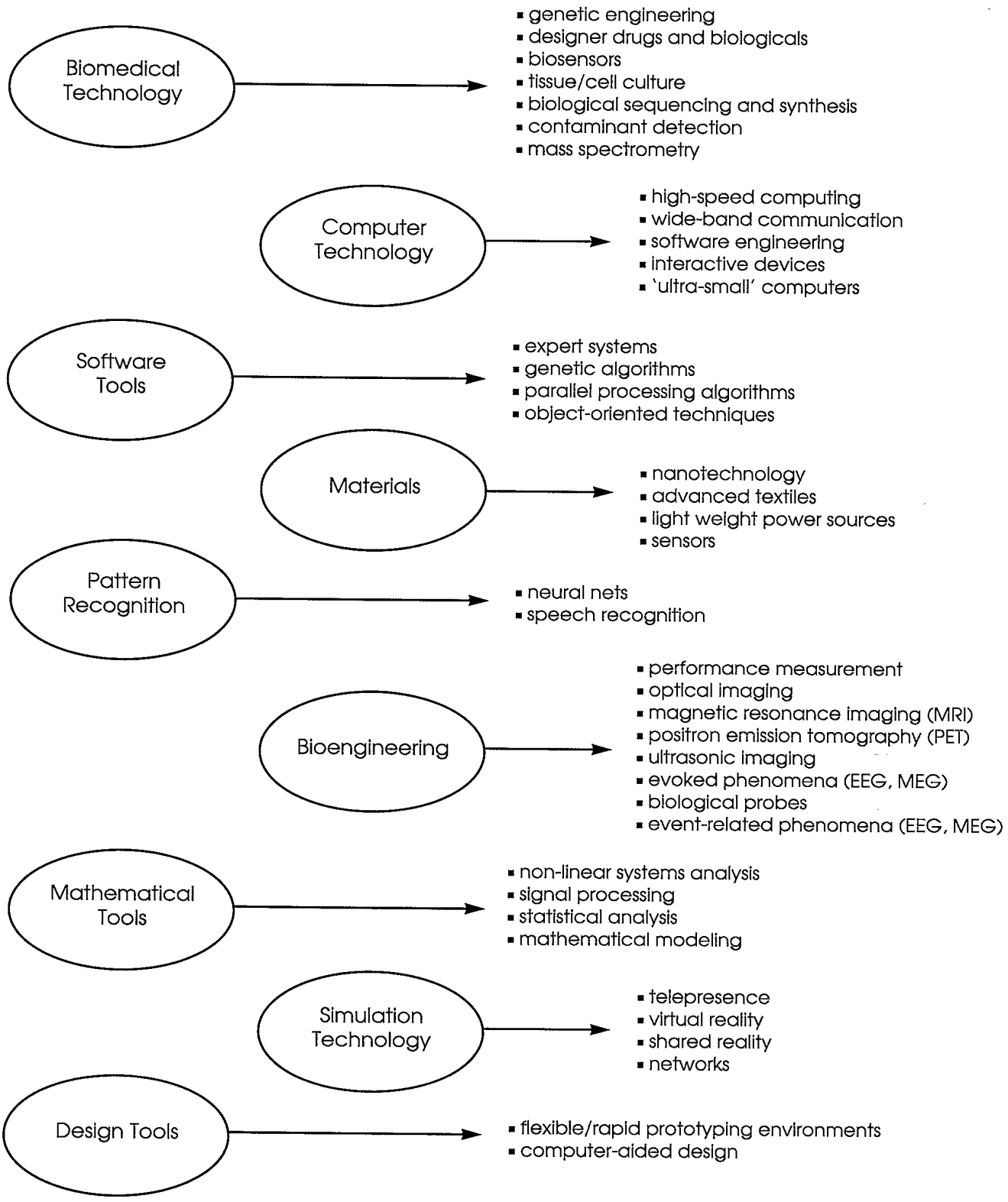
Crew system integration

crew interface technology
crew station design
teleoperation
workload and cognitive assessment
enhanced perceptual systems
robotic actuation

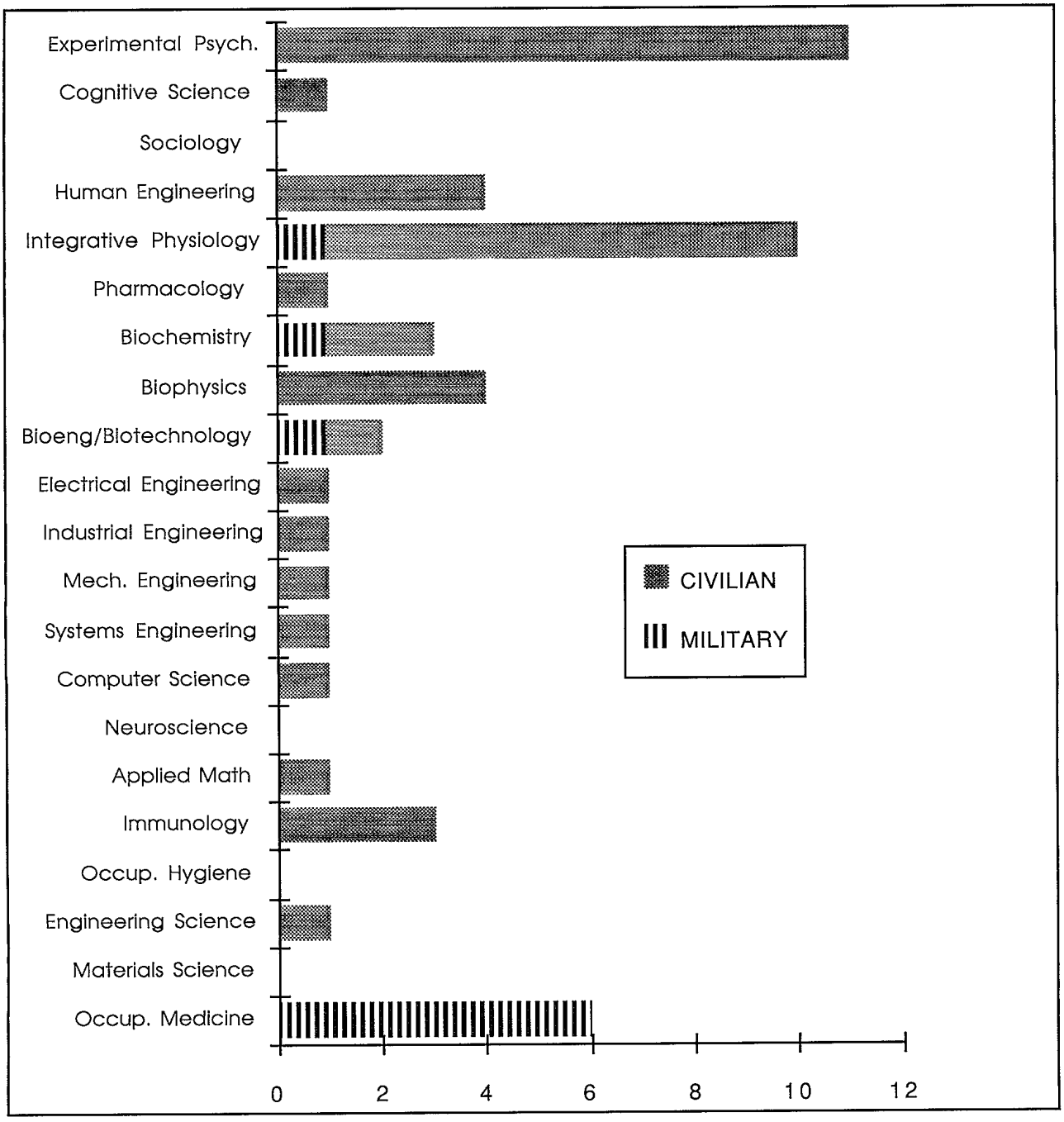
Training systems

training devices/methodology
distributed simulation and training
intelligent tutoring systems

Supporting technologies for DCIEM



Supporting disciplines for DCIEM

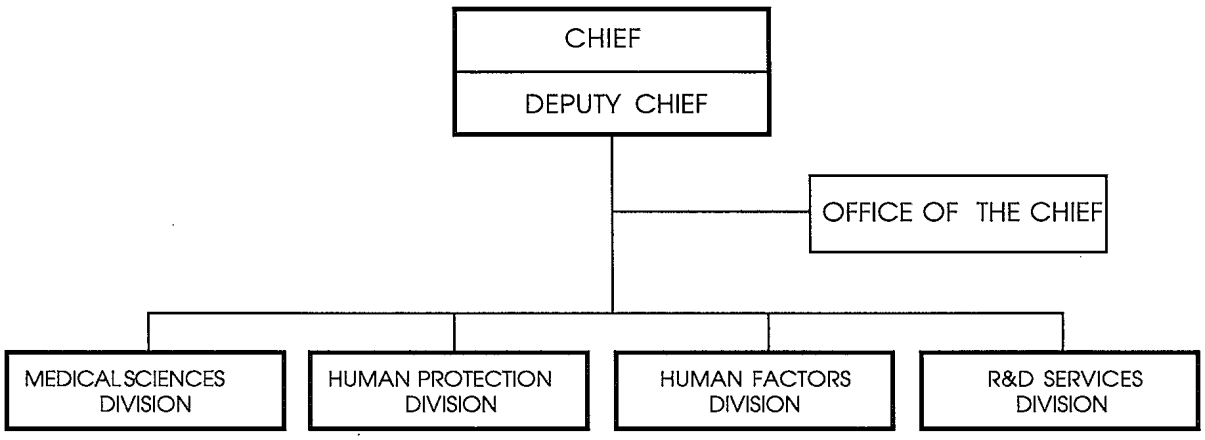


Suggested DCIEM organization

The reorganization was considered from the points of view of:

- decreasing the number of managers (PS 2000)
- creating units more in line with DCIEM's revised functions
- enhancing military/civilian interaction
- enhancing interdisciplinary cooperation
- developing product/application lines
- ease of marketing DCIEM
- awareness of military relevance
- addressing requirements of Surgeon General
- directly relating Divisions to missions
- achieving "critical mass" on projects/tasks
- enhancing multidisciplinary problem solving through matrix management methods

DCIEM's new organization is envisioned as three integrated R&D Divisions and one support Division. The suggested organization chart is shown below.



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