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ENGINEERING AND LAND SURVEY

Sub-Group Engineering

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CLASSIFICATION STANDARD

ENGINEERING AND LAND SURVEY Sub-Group Engineering

SCIENTIFIC AND PROFESSIONAL CATEGORY

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INTRODUCTION

This standard describes the classification plan to be used to classify jobs allocated to the Engineering Sub-group. It consists of an introduction, definitions of the Scientific and Professional Category, Engineering and Land Survey Group and Engineering Sub-group, the level descriptions for the Engineering Sub-group, and the bench-mark position descriptions for the sub-group.

Level Description Method

The level description method of classification is a non-quantitative method of determining the relative difficulty of jobs. The level descriptions, written in terms of the factor characteristics, are reflective of the demands of jobs found at each level. In progressing from lower to higher levels of work, job demands tend to be cumulative; the descriptions of successive levels of a level description plan usually include some factor characteristics of similar degree, with the significant differences in job demands being indicated by characteristics of a higher degree than those of the preceding level. A position is assigned that level which best corresponds on the whole with its duties and responsibilities.

Factors

The combined factors in the classification plan do not describe all aspects of jobs in the sub-group but deal only with those characteristics that can be defined and distinguished and that are useful in determining the relative value of jobs.

The Engineering Sub-group level description plan makes use of five factors: Scope for Initiative and Judgement; Responsibility for Recommendations, Decisions and Commitments; Knowledge and Skill; Responsibility for Contacts; and Responsibility for Supervision.

A definition and a list of characteristics are included for each factor. These characteristics, describing the lowest demand or requirement and the highest, are not exclusive, but indicate features of the work that are to be considered when evaluating a position.

Bench-mark Positions

The bench-mark position descriptions included in the classification plan are an integral part of the plan and are to be used to confirm evaluations of positions and to ensure consistency in applying the classification plan. Each description consists of a list of the principal duties and a specification for each factor used in the classification plan.

The bench-mark positions have been evaluated and for the Engineering Sub-group exemplify the level that best corresponds to the duties and responsibilities of the position. This level is shown on the first page of the bench-mark position description. The bench-marks that exemplify each level of the plan are identified in the level descriptions.

The specifications for the Engineering Sub-group bench-marks provide an analysis of the duties of the position in terms of the factor characteristics.

Use of the Standard

The following steps are to be taken in applying this classification standard.

1. The position description is studied to ensure understanding of the position as a whole. The relation of the position being rated to positions above and below it in the organization is also studied.
2. Allocation of the position to the category, group and sub-group is confirmed by reference to the definitions and the descriptions of inclusions and exclusions.
3. Tentative assignment of the position being evaluated to a level is made by comparing the duties and responsibilities of the position with the level descriptions. A position is assigned to the level that best corresponds on the whole with the duties and responsibilities of the position.
4. The descriptions of the bench-mark positions illustrating the level tentatively selected are compared with the description of the position being evaluated. Comparisons are also to be made with the descriptions of bench-mark positions for the levels above and below the level tentatively selected.
5. The position being evaluated is compared as a whole with positions that have been assigned to the same level, as a check on the validity of the level selected.

Determination of Levels

The ultimate objective of job evaluation is the determination of the relative difficulty of jobs. In the Engineering Sub-group, jobs are regarded as being of equal difficulty when the significant features of the positions evaluated best correspond, on the whole, with the factor characteristics of a level. Jobs regarded as being of equal difficulty will be assigned to the same level.

CATEGORY DEFINITION

Occupational categories were repealed by the Public Service Reform Act (PSRA), effective April 1, 1993. Therefore, the occupational category definitions have been deleted from the classification standards.

GROUP DEFINITION

For occupational group allocation, it is recommended that you use the [Occupational Group Definition Maps](#), which provide the 2005 group definition and their corresponding inclusion and exclusion statements. The maps explicitly link the relevant parts of the overall 2005 occupational group definition to each classification standard.

GLOSSARY OF TERMS

In the level descriptions and bench-mark position descriptions certain terms have limited or special meanings as follows:

"Associates" refers to persons other than colleagues with whom contacts are customarily established over long periods of time and in circumstances that develop an awareness of each other's requirements.

"Colleagues" refers to employees in the federal public service who are engaged in similar fields of work and who have no authority to control or affect the extent and scope of the department's programs.

"Officials" refers to professional, administrative and other personnel with some degree of executive authority who are not associates.

"Applied research" refers to work undertaken for the advancement of scientific knowledge with a specific practical application in view.

"Development" refers to the use of the results of basic or applied research for the purpose of creating new, or improving existing materials, devices, products or processes.

"Engineering Discipline" refers to Civil, Chemical, Mechanical, Mining, Marine or Electrical Engineering.

"Field of engineering" refers to an area of practice within an engineering discipline such as, in Civil Engineering, the design and construction of buildings or the design and construction of roads and bridges and, in Electrical Engineering, radio communications or power generation.

"Engineering specialty" refers to an area of practice within a field of engineering, such as, in the design and construction of buildings, the design of air-conditioning and ventilating systems; or, in radio communications, microwave systems.

"Policy" refers to a declaration of aims and intent established by legislation or ministerial authority to guide future courses of action.

"Program" refers to the general plan designed to achieve the objectives determined by a department or agency to meet the aims and intent of policy.

"Project" refers to a unit of work requiring one or more such engineering activities as planning, designing, developing, installing or constructing, defined by clear objectives and circumscribed by budgetary controls, time limitations and the availability of resources.

"Guidelines" refers to the directives, standard practices, methods and procedures, specifications and standards that provide guidance in performing the duties of a position.

"Engineering control" refers to the regulations, specifications and other guidelines established to ensure that a finished engineering product such as equipment, system, facility or structure conforms to design, materials, workmanship, location, and performance standards.

"Decisions" refers to decisions to take particular courses of action within the authority delegated to the position, to recommendations to superiors and users, and to shared decisions and recommendations in which the incumbent is an effective participant.

"Resources" refers to the money, material and equipment and the people with knowledge and skill required to work effectively on a job or project.

"Staff" refers to those positions in which the performance of applied research, development or innovative design work, or the provision of advice in an engineering field or specialty is of primary importance. *

"Line" refers to those positions in which the design, construction or maintenance of engineering works, or the installation, maintenance or operation of equipment and systems is of primary importance. *

* The terms "line" and staff' are intended as a guideline. In most cases, the allocation of a position to one or other type will be self-evident, taking into account the duties of primary importance. In cases where a thorough review of the position fails to reveal a reasonable indication of primary importance, raters may select the definition more beneficial to the position under review. However, that selection should be consistent with positions of a similar nature in the organization.

EVALUATION PLAN
ENGINEERING SUB-GROUP
FACTORS

SCOPE FOR INITIATIVE AND JUDGEMENT
RESPONSIBILITY FOR RECOMMENDATIONS, DECISIONS AND
COMMITMENTS
KNOWLEDGE AND SKILL
RESPONSIBILITY FOR CONTACTS
RESPONSIBILITY FOR SUPERVISION

SCOPE FOR INITIATIVE AND JUDGEMENT

This factor is used to measure the difficulty of the work in terms of

- the requirement to identify and resolve problems,
- the freedom to take particular courses of action, and
- the availability of direction.

When evaluating positions under this factor, raters are to consider such characteristics as the following:

The guidelines provided, ranging

- from standards and specifications, and accepted engineering practice in performing straightforward tasks,
- to policy statements, directives, objectives and broad budgetary limitations.

The amount of guidance received, ranging

- from detailed instructions, with methods prescribed and unusual features and likely approaches indicated,
- to policy statements, directives and objectives broadly outlining program goals.

The extent to which work is checked by others, ranging

- from review of technical details of work as it progresses,
- to review only for results in terms of program objectives.

RESPONSIBILITY FOR RECOMMENDATIONS, DECISIONS AND COMMITMENTS

This factor is used to measure the difficulty and importance of the work in terms of

- the nature and diversity of problems concerning which recommendations, decisions and commitments are made,
- the extent to which the incumbent is the effective authority in making recommendations, decisions and commitments,
- the effect recommendations, decisions and commitments have on such matters as the expenditure of money, deployment of human and other resources, and the achievement of objectives.

When evaluating positions under this factor raters are to consider such characteristics as the following:

The responsibility for planning and conducting assignments, ranging

- from planning and performing straightforward engineering tasks following prescribed methods to meet defined objectives,
- to planning engineering activities within broad objectives.

The responsibility for advice given to others, ranging

- from presenting the results of straightforward studies and tests for review and approval by superiors,
- to giving specialist advice across organizational lines on complex engineering matters.

The responsibility for physical and financial resources, ranging

- from using and caring for equipment such as survey and other instruments, and controlling the expenditure of small sums of money,
- to controlling the use, deployment and care of significant quantities of expensive engineering equipment, or having significant input into the planning or control of a program budget.

The responsibility for improving, or devising new processes, techniques, standards and specifications, ranging

- from recommending improvements in designs and specifications, and in applying standards,
- to recommending the acceptability of novel engineering concepts and effectively participating in their development and implementation.

The responsibility for obtaining assistance from consultant, manufacturing or construction contracting firms, or own or other departments, ranging

- from informing superiors concerning the need for assistance,
- to confirming the need for, defining the requirements and selecting and recommending a consultant, research organization or contractor to design or construct a complex piece of equipment, process or structure of high cost or carrying out research having significant implications on a major industry or resource development.

The need to determine the acceptability of the advice of others, ranging

- from assessing the practicability of ideas received from specialists or engineers and others working in related fields,
- to determining the acceptability of advice from consultants on very significant matters, affecting a large project or a group of smaller projects.

KNOWLEDGE AND SKILL

This factor is used to measure the difficulty of the work in terms of the requirement

- to understand and apply the theories and principles of engineering science,
- to apply knowledge of one or more fields of engineering,
- to understand and apply the principles of management.

When evaluating positions under this factor raters are to consider such characteristics as the following:

The requirement for degrees of knowledge of the theories and principles of engineering science, which are described in the bench-marks as either "thorough" or "advanced".

The requirement for degrees of knowledge of the practices in a field of engineering, which are described in the bench-marks as "good", "thorough" or "advanced".

The requirement for knowledge of related fields of engineering, ranging

- from familiarity with related fields,
- to a good knowledge of specialties in related fields.

The requirement for skill in controlling engineering work, ranging

- from scheduling own work, scheduling and controlling the work of supporting technicians,
- to managing and coordinating the work of other professionals.

The requirement for knowledge of and skill in using management principles, ranging

- from familiarity with, and some skill in implementing, office and field administrative procedures,
- to a good knowledge of the departmental organization and programs and considerable skill in developing and implementing standards, guidelines and administrative processes.

RESPONSIBILITY FOR CONTACTS

This factor is used to measure the difficulty of the work in terms of

- the requirement to communicate with others,
- the requirement to represent the organization,
- the nature and purpose of the contact, when such contacts are an integral part of the work.

When evaluating positions under this factor raters are to consider such characteristics as the following:

The requirement to initiate and maintain contacts with persons, ranging

- from colleagues and associates in own and other organizations,
- to officials and colleagues in own and other organizations.

The kind of meetings at which the contacts take place, ranging

- from discussions between two persons with similar interests,
- to chairing formal meetings where a number of differing interests are evident.

The purpose of meetings, ranging

- from an exchange of information about the work,
- to exploring approaches and negotiating in matters of mutual concern.

The authority exercised by an incumbent of a position when participating in a meeting, ranging

- from carrying out specific instructions,
- to working within broad objectives and guidelines.

RESPONSIBILITY FOR SUPERVISION

This factor is used to measure the difficulty of the work in terms of the requirement -
to plan and improve communications, control and delegation of authority, - to
select and assign staff,

- to appraise work performance,
- to plan and assess training,
- to assign work and provide guidance,
- to review work of other, in progress or on completion, for accuracy, quality and conformance with instructions, standards and other directives.

When evaluating positions under this factor raters are to consider such characteristics as the following:

The responsibility for developing an effective working organization, ranging

- from the occasional requirement to organize a few technicians into an effective work group,
- to the continuing requirement to organize a large number of professional and technical staff into an effective working organization.

The responsibility for the effective use of staff, ranging

- from occasionally supervising support staff,
- to selecting and developing professional and technical staff, appraising their performance and performing other personnel administrative duties.

The responsibility for assigning work and providing guidance, ranging

- from assigning straightforward tasks and providing guidance to a small group of technicians or tradespeople,
- to assigning projects or segments of large projects to staff and providing to them technical and administrative guidance.

The responsibility for reviewing work of others, ranging

- from reviewing the technical details of work of a small group of technicians or tradespeople for quality and conformance with instructions,
- to reviewing work done in-house or under contract on complex, major projects, for quality and conformance with standards, specifications and objectives.

NOTES TO RATERS

Scope for Initiative and Judgement

Responsibility for Recommendations, Decisions and Commitments

Knowledge and Skill

For positions at levels 1 to 5, the level determinants considered under the three factors Scope for Initiative and Judgement, Responsibility for Recommendations, Decisions and Commitments, and Knowledge and Skill are concerned primarily with the requirement for initiative, judgement, knowledge and skill in making recommendations, decisions and commitments on engineering matters.

For positions at level 6, the level determinants considered under these three factors are more concerned with the requirement for initiative, judgement, knowledge and skill in making recommendations, decisions and commitments involving the management of an engineering organization, or difficult and important contracts.

In evaluating positions under the factor Responsibility for Recommendations, Decisions and Commitments, raters are to consider the effect of decisions, recommendations and commitments on internal resources, contractors, consultants and industrial and other organizations, and the accountability of the position, which is usually related to the degree of responsibility assigned to the position and the level of authority properly delegated. In some of the bench-marks resources affected may be described in terms of numbers of staff and amounts of money. These references are included to illustrate the size and nature of the resources that are affected. The size and nature of resources is only one of many criteria to be considered in evaluating positions under this factor. Raters are also to consider the responsibility of the position for those decisions, recommendations and commitments that are shared with others, as well as those borne directly.

Best Correspondence Principle

Raters are to consider carefully the duties of the position and are to compare them for correspondence with the level descriptions under the factor headings. A position is allocated to a level by application of the "best correspondence" principle.

Situations exist where the demands of the duties and responsibilities of the position being rated may not meet the level descriptions for one or other of the factors of the level tentatively selected for assignment to the position. This does not preclude allocation of the position to a level provided that the "best correspondence" principle is satisfied.

It is very important that raters consider this aspect of the plan when evaluating positions allocated to this sub-group.

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LEVEL DESCRIPTIONS

Level 1 - Engineer 1

Reporting to a more senior engineer, performs a variety of engineering tasks selected to develop knowledge and skill in the practices of a field of engineering. The work includes preparing simple plans and designs, costing and making up bills of material in accordance with established codes, standards, drawings, and other specifications. The work occasionally includes checking the work of drafters and other technicians.

Level 2 - Engineer 2

Performs varied engineering tasks and individual studies of problems requiring application of prescribed methods, accuracy in analysis and calculations, and completeness of data and test observations.

Scope for Initiative and Judgement

Initiative and judgement are used in resolving problems, obtaining and analysing data, designing or modifying equipment or equipment components, determining the intent of a specification or instruction, and determining effective ways of presenting engineering information.

Problems are solved by applying standards, following detailed instructions, and scheduling and organizing work. Methods are prescribed and approaches indicated. Work is assigned in terms of problems to be investigated and tasks to be performed. Difficult problems and unusual features are indicated by the supervisor. Guidance is normally provided on work in progress; completed work is reviewed in detail.

Responsibility for Recommendations, Decisions and Commitments

Solutions to individual problems and the conclusions drawn from test results and studies are put forward as recommendations. Recommendations are also made on the acceptability of materials supplied and work completed by contractors or others. Decisions are made in performing own work, in scheduling the work of a contractor, and occasionally in guiding the work of a junior engineer or supporting technicians. Commitments are normally limited to the expenditure of own time but may include contractor's staff and resources. Ineffective work results in remedial work of a senior engineer and may cause higher costs and delay in completing work.

Knowledge and Skill

A thorough knowledge of the theory and principles of engineering science, a good knowledge of the practices in a field of engineering, and familiarity with related fields is required. Skill is required in obtaining and analysing data and devising solutions to individual problems. Familiarity with and some skill in implementing office and field administrative procedures is also required.

Responsibility for Contacts

Contacts are made with associates in own and other organizations and representatives of contractors to exchange information and to check on the quality of work in progress.

Responsibility for Supervision

Guidance is occasionally given to assisting technicians or a more junior engineer assigned to work on a common task.

BENCH-MARK POSITION DESCRIPTION REFERENCE

<u>Bench-mark Position No.</u>	<u>Descriptive Title</u>	<u>Page</u>
1	Junior Engineer, Building Construction and Maintenance	1.1

Level 3 - Engineer 3, Line

Plans and performs independent studies, engineering work as part of a project or, as engineer-in-charge, performs resident engineer's duties on a project, often assisted by one or more junior engineers and technical support staff.

Scope for Initiative and Judgement

Initiative and judgement are used in resolving problems, in interpreting engineering specifications, investigating design and field engineering difficulties, developing and co-ordinating work schedules, interpreting test results, and identifying, reporting and recommending on defects and deficiencies in work done by others. Judgement is also required as a member of a team preparing plans and estimates and developing specifications to meet requirements.

Problems are solved by adapting and applying standards and other guidelines in accordance with accepted engineering practices, and applying methods developed in other assignments. Work is assigned in terms of specific objectives. Critical areas, unusual features and approaches likely to produce required results are normally indicated. Plans are reviewed, and guidance on unusual features and problems is provided by the supervising engineer or staff specialists; completed work is normally accepted as technically accurate and is reviewed for soundness of judgement and achievement of objectives.

Responsibility for Recommendations, Decisions and Commitments

Recommendations are made on proposed changes in plans and specifications or the substitution of materials to suit special conditions, on progress payments for work completed and on changes to improve departmental standards and specifications. Decisions are made in evaluating test results, in investigating defects and deficiencies and on the acceptability of materials and work methods being used. Commitments are made in allocating own time and staff and resources, and those of contractors working on a project, to achieve objectives. Ineffective work results in higher costs and delay in completing work and may result in an inferior design or installation.

Knowledge and Skill

A thorough knowledge of the theory and principles of engineering science and of the practices in a field of engineering and a knowledge of related fields is required. Familiarity with and skill in implementing office and field administrative procedures is also required. Skill is required in identifying problem areas, obtaining and analysing data, and devising and implementing effective solutions. Skill is also required in establishing effective working relations with colleagues and associates.

Responsibility for Contacts

Contacts are made with associates in other branches and representatives of client departments and agencies to discuss and advise on requirements and with consultants and contractors to interpret specifications and other contract criteria and to check quality and progress of work.

Responsibility for Supervision

Responsibility is normally for own work. May, from time to time, provide guidance to employees, contractors, or consultants and may check their work for accuracy and conformance with quality and quantity standards.

BENCH-MARK POSITION DESCRIPTION REFERENCE

<u>Bench-mark Position No.</u>	<u>Descriptive Title</u>	<u>Page</u>
2	Electronic Systems Engineer	2.1
3	Structural Design Engineer	3.1

Level 3 - Engineer 3, Staff

Plans and performs applied research, development or innovative design work in an engineering specialty or field of engineering, and carries out experiments and tests.

Scope for Initiative and Judgement

Initiative and judgement are used in analysing problems, investigating causes of failures, carrying out innovative design work and reviewing that done by others, or developing novel engineering techniques or modifications to equipment. Initiative and judgement are also required in recognizing the implications of the work on other assignments and in combining and adapting standard practices or methods developed in previous work. Judgement is used in selecting or determining approaches to experiments and tests.

Problems are solved by applying theoretical and practical knowledge to devise experiments, evaluate data and validate conclusions. Work is assigned in terms of specific objectives; critical areas and unusual features are normally indicated. Plans are reviewed, and guidance on unusual features and problems is provided by the supervising engineer or senior specialists; completed work is normally accepted as technically accurate and is reviewed for feasibility, soundness of judgement and achievement of objectives.

Responsibility for Recommendations, Decisions and Commitments

Recommendations are made on scheduling work, approaches to problems, experimental methods, and the need for and extent of tests and trials, and the acceptability of design work done by others. Decisions are made on the sequence of the work, assignment of staff to tasks, instruments required and other apparatus to be used, and the acceptability of observed data. Commitments are made in allocating own time, support staff and resources to achieve objectives. Ineffective work results in higher costs and delay in completion of projects and may result in an inferior design or installation.

Knowledge and Skill

A thorough knowledge of the theory and principles of engineering science and of the practices in an engineering specialty, and a knowledge of related specialties is required. Familiarity with and skill in implementing office administrative procedures are also required. Skill is required in identifying problem areas, obtaining and analysing data, and devising and implementing effective solutions. Skill is also required in establishing effective working relations with colleagues and associates.

Responsibility for Contacts

Contacts are made with colleagues and engineers in other departments and in other research and development organizations to exchange information and discuss requirements and tentative solutions.

Responsibility for Supervision

Responsibility is normally for own work. From time to time, may provide guidance to employees, contractors or consultants and may check their work for accuracy and conformance with quality and quantity standards.

BENCH-MARK POSITION DESCRIPTION REFERENCE

<u>Bench-mark Position No.</u>	<u>Descriptive Title</u>	<u>Page</u>
4	Environmental Engineer	4.1
5	Metal Forming Mechanical Engineer	5.1
6	Test Methods Development Engineer	6.1
7	Microwave Electronics Development Engineer	7.1
8	Compliance Engineer	8.1

Level 4 - Engineer 4, Line

Plans and conducts engineering work, and co-ordinates and supervises engineering projects and related work performed under contract or by subordinate engineers and technical support staff.

Scope for Initiative and Judgement

Initiative and judgement are used in resolving problems, developing improved specifications and design standards, investigating and advising on unusual design and field engineering problems, developing, approving and co-ordinating work schedules, developing guidelines and initiating investigations by junior engineers, and determining and scheduling the most effective approach to ensure that quality standards and objectives are met. Initiative and judgement are also required as a team leader in preparing project plans and estimates, and developing specifications to meet project requirements.

Problems are solved by adapting and applying standards, other guidelines and precedents, and by devising new approaches or applying existing criteria in novel ways. Work is assigned in terms of project objectives, budget limitations, definitions and objectives and general guidelines; advice is available on critical areas that have implications on the work of others. Completed work is normally accepted as accurate, and recommendations are reviewed for soundness of judgement and conformance with assignment objectives.

Responsibility for Recommendations, Decisions and Commitments

Recommendations are made on changes to standards and specifications to lower costs, improve work quality and facilitate maintenance. Decisions are made in determining and recommending on the acceptability of completed work in conformance with quality standards and objectives, and on the acceptability of proposals for change in design, materials and work methods in accordance with accepted engineering practices. Decisions are also made in assigning work to suit workloads, schedules, priorities and objectives. Commitments are made in estimating costs and other resource requirements, and allocating staff and resources to implement decisions in accordance with objectives. Ineffective work results in higher costs and delay in completing work and may result in an inferior design or installation or in embarrassment to a technical service of the department.

Knowledge and Skill

A thorough knowledge of the theory and principles of engineering science and of the practices in a field of engineering, and a knowledge of related fields is required. A knowledge of and skill in implementing personnel, financial and other administrative procedures is also required. Skill is required in identifying unusual problems and critical areas that may affect other work and in effectively applying standards, specifications, precedents and resources. Skill is also required in establishing effective working relations with colleagues, associates and officials.

Responsibility for Contacts

Contacts are made with officials of client departments to advise on their proposals, and with engineers and officials of other branches, contractors and other government departments, municipalities, industry and private organizations to exchange information, discuss design problems, explain design features, specifications, and other project control criteria, and discuss quality and progress of work.

Responsibility for Supervision

Supervision is a continuing responsibility at this level. Work is assigned and instructions, advice and guidance are given to other engineers and senior technicians. Work of consultants, contractors or employees is reviewed in progress and on completion for accuracy, achievement of objectives and conformance with accepted engineering practice.

BENCH-MARK POSITION DESCRIPTION REFERENCE

<u>Bench-mark Position No.</u>	<u>Descriptive Title</u>	<u>Page</u>
9	Project Engineer, Vessel Development	9.1
10	Senior Field Engineer	10.1

Level 4 - Engineer 4, Staff

Plans and performs applied research, development, or innovative design work in an engineering specialty or field of engineering, carries out experiments and tests, and investigates unusual and difficult problems to determine causes of failure and to devise effective solutions.

Scope for Initiative and Judgement

Initiative and judgement are used in analysing problems, organizing investigations and experiments to obtain data, to develop and test new engineering methods or to develop new applications of engineering knowledge. Initiative and judgement are also required in recognizing the implications of experimental results on other problems and in devising new approaches and novel applications of existing criteria. Judgement is used in evaluating and selecting the most likely approaches to problems and in determining and advising on the most effective of alternative solutions.

Problems are solved by applying theoretical and practical knowledge in determining and evaluating significant factors and devising new approaches. Work is assigned in terms of project objectives and definitions and budget limitations. Projects and problems are discussed with senior specialists and colleagues to determine relative priorities and implications on the work of others. Completed work is accepted as accurate. Plans and recommendations are reviewed for feasibility, soundness of judgement and conformance with assignment objectives.

Responsibility for Recommendations, Decisions and Commitments

Recommendations are made on changes in priorities or objectives and for increased resources and special equipment. Solutions to assignments are put forward as recommendations. Recommendations are also made to delay, cut short or discontinue an experiment or investigation. Decisions are made in scheduling work, allocating staff, and determining extent of tests and validity of conclusions based on experimental data. Commitments are made in accepting projects, agreeing on completion dates, estimating resources required and allocating staff and resources to achieve objectives. Ineffective work results in higher costs and delay in completing work and may result in an inferior design or installation or in embarrassment to a technical service of the department.

Knowledge and Skill

A thorough knowledge of the theory and principles of engineering science and of the practices in an engineering specialty and a knowledge of related specialties is required. A knowledge of and skill in implementing administrative procedures is also required. Skill is required in resolving unusual problems that may affect work in other areas, effectively applying precedents and resources, and devising novel methods of using existing engineering knowledge. Skill is also required in establishing effective working relations with colleagues, associates and officials.

Responsibility for Contacts

Contacts are made with colleagues and engineers in other departments, industry and other research and development organizations to exchange information, discuss requirements and explore tentative solutions.

Responsibility for Supervision

There is normally a continuing responsibility for the work of other professionals. Responsibilities including assigning work, issuing instructions, giving advice and guidance. Work of others is reviewed in progress and on completion for accuracy, achievement of objectives and conformance with acceptable engineering practice.

BENCH-MARK POSITION DESCRIPTION REFERENCE

<u>Bench-mark Position No.</u>	<u>Descriptive Title</u>	<u>Page</u>
11	Radio Spectrum Engineer	11.1
12	Real-Time Computer Systems Engineer	12.1
13	Systems Engineer, Light Armoured Vehicles	13.1
14	Maritime Electrical Systems Engineer	14.1

Level 5 - Engineer 5, Line

Plans, organizes and co-ordinates work on a number of projects in two or more related fields of engineering performed under contract or by own engineering and technical support staff.

Scope for Initiative and Judgement

Initiative and judgement are used in solving problems, developing guidelines to plan and carry out projects, assessing proposals for projects or services in relation to departmental objectives, advising on project requirements, approving changes in plans or specifications, and assessing the effect of new techniques or administrative requirements on standards, directives and organizational structure. Initiative and judgement are also required in identifying and co-ordinating activities in areas of concern with other branches or departments, and in participating in program planning.

Problems are solved by devising effective approaches based on sound engineering practices. The work is assigned in terms of objectives to be achieved and the financial limitations and administrative requirements involved. Completed work is not normally subject to review. Recommendations involving long-range plans or significant resources are usually referred to a senior authority for approval.

Responsibility for Recommendations, Decisions and Commitments

Recommendations are made on program planning, objectives and priorities, and the development of standards to reduce costs or include new ideas and requirements. Recommendations are also made on projects to be implemented or delayed and on changes in organization to improve administration. Decisions are made in determining project priorities, assigning work and delegating authority to subordinates, determining if projects completed or being carried out achieve stated objectives, and approving significant changes in plans or specifications for materials. Commitments involve estimating costs and other requirements for projects, allocating staff and other resources to carry out projects or to solve urgent problems, and approving progress payments on contract work. Ineffective work results in higher costs, seriously affects the completion of projects, and may cause embarrassment to a department of government.

Knowledge and Skill

A thorough knowledge of the theory and principles of engineering science and of the practices in a field of engineering and a good knowledge of related fields of engineering is required. A good knowledge of departmental organization, directives, programs, standards and administrative procedures is also required.

Skill is required in assessing proposals for engineering work as they affect related projects and activities, in planning, organizing and co-ordinating projects, and in implementing departmental directives and administrative procedures. Skill is also required in establishing effective working relations with colleagues, associates and officials in government and other organizations.

Responsibility for Contacts

Contacts are made with colleagues and engineers in other branches, officials of federal and provincial governments and of industry and other organizations to discuss requirements, schedules for projects, division of responsibility, provision of support and the development of resources.

Responsibility for Supervision

The work requires assigning projects to professionals, co-ordinating related activities, suggesting effective approaches to solve engineering or administrative problems, assessing the performance of subordinates and making recommendations on establishments and the selection, training, disciplines and promotion of engineering staff.

BENCH-MARK POSITION DESCRIPTION REFERENCE

<u>Bench-mark Position No.</u>	<u>Descriptive Title</u>	<u>Page</u>
15	Regional Superintendent, Systems Engineering	15.1

Level 5 - Engineer 5, Staff

Plans and conducts applied research, development, or innovative design work in an engineering specialty or field of engineering to investigate and advise on unusual and difficult problems encountered in engineering practice.

Scope for Initiative and Judgement

Initiative and judgement are used in analysing problems, selecting critical factors for investigation, deciding on the most effective approach, organizing and conducting investigations, and devising experiments to provide data or information. Initiative and judgement are also required in appreciating the practical uses of data discovered through investigations and experiments, informing engineers in government and industry, and advising on the development of new engineering methods.

Work is assigned in terms of objectives and priorities in accordance with departmental directives and budgets. Details of problems to be solved or objectives to be achieved are discussed with client departments and senior engineers. Problems are unique or complex and their solution requires an imaginative approach to develop and apply new theoretical knowledge, experimental data and advanced engineering practices. Decisions are not normally subject to review. Recommendations involving long-range plans or significant resources are usually referred to a senior authority for approval.

Responsibility for Recommendations, Decisions and Commitments

Recommendations are made on the practical application of theories and data derived from engineering research, and on projects to solve specific problems and long-term research plans. Decisions are made on which problem areas and factors are to be investigated, the best approaches to problems, to priorities of projects in relation to progress being made, and the suitability of standards and laboratory methods for full-scale industrial use. Commitments are made in estimating costs and staff required, and allocating staff and resources to carry out projects, recommending acceptance of projects and agreeing on priorities, undertaking investigations and other research, and providing expert advice on design, physical or chemical data, manufacturing processes or construction methods. Ineffective work results in higher costs and may seriously affect the completion of projects, adversely affect the development of engineering technology, and cause embarrassment to a technical service of the department.

Knowledge and Skill

The work requires an advanced knowledge of the theory and principles of engineering science and of the practices of an engineering specialty and a good knowledge of related specialties. A good knowledge of departmental organization, directives, programs, standards and administrative procedures and of industrial research techniques and engineering practices and standards is also required. Skill is required in implementing departmental directives and administrative procedures and in assessing problems and choosing approaches most likely to produce results by an effective combination of theoretical and experimental research. Skill is also required in establishing effective working relations with other engineers, scientists and officials to investigate problems and explain the practical applications of experimental results.

Responsibility for Contacts

Contacts are made with colleagues and officials in other departments and associates in industry and scientific organizations such as the National Research Council, industrial laboratories and science faculties of universities, to exchange information in the area of specialization and to provide consultant services to clients.

Responsibility for Supervision

The work normally requires continuing responsibility for the work of a few professionals. This includes assigning work and providing guidance on methods or procedures to be used and specific objectives to be achieved, and reviewing work in progress and on completion.

BENCH-MARK POSITION DESCRIPTION REFERENCE

<u>Bench-mark Position No.</u>	<u>Descriptive Title</u>	<u>Page</u>
16	Manager, High Reliability Laboratory	16.1
17	Head, Technical Development, Harbours and Ports	17.1

Level 6 - Engineer 6, Line

Directs an engineering program involving interrelated projects which may be implemented through regional and district headquarters with delegated authority. The organization typically will consist of professional, technical and administrative support groups.

Scope for Initiative and Judgement

Initiative and judgement are required in determining total demands on the organization, advising on program proposals and long-range plans, developing and defining the program, establishing project objectives and priorities, developing guidelines and approaches for planning and estimating costs of projects, and in co-ordinating work with related activities. Initiative and judgement are also required in advising senior officials in own and other departments and organizations on program activities. Judgement is also required in delegating authority for projects and determining staff and resources needed to ensure that the organization can meet program objectives effectively.

Normally, work is undertaken to develop and implement a program to meet objectives in accordance with directives and budgetary controls. Technical recommendations and decisions are normally accepted as authoritative; work is reviewed for implementation of the program.

Responsibility for Recommendations, Decisions and Commitments

Recommendations are made on program planning, the establishment of program objectives, budgets, and starting and finishing dates, and changes in the established schedule of project starts. Recommendations are also made on economic, financial and other implications of proposals making up the planned program. Decisions are made in establishing project objectives; assigning and delegating authority for portions of the program to subordinates; approving project plans and schedules; approving approaches to planning; developing and proposing changes to the organization to cope with changing workloads. Decisions are also made in approving conclusions or recommendations based on investigations conducted by subordinate or other engineers. Commitments involve estimating costs and other requirements for a program, allocating acceptability of advice from consultants or others and implementing such advice, and approving changes in departmental engineering standards. Ineffective work may seriously affect the completion of the program and result in criticism of and embarrassment to a department of government.

Knowledge and Skill

A thorough knowledge of the theory and principles of engineering science and of the practices in a field of engineering, and a good knowledge of related fields of engineering is required. A good knowledge of management practices and of departmental organization, directives, programs, standards and administrative procedures is also required. Skill is required in assessing the engineering, financial and economic, and managerial implications of program proposals and in co-ordinating and implementing a program. Skill is also required in establishing effective relations with colleagues and officials of industrial organizations and federal, provincial and foreign governments.

Responsibility for Contacts

Contacts are made with engineering and administrative officials of departments of federal and provincial governments, industrial organizations and departments of foreign governments to discuss matters of mutual concern and to seek solutions to engineering and administrative problems. There is also a requirement to chair meetings called to discuss engineering problems and to reach a consensus on effective solutions, and to attend and periodically address seminars, courses and other meetings and conferences.

Responsibility for Supervision

Includes delegating authority, interpreting directives, issuing instructions and other guidelines, appraising the work of senior subordinate staff members, making recommendations on organization changes, and making decisions on selecting, training, and promoting senior staff and on serious discipline problems.

Note: No bench-marks are provided at the EN-ENG-6 (line) level. The vast majority of positions appearing to meet the level 6 (line) criteria should be considered for inclusion in the Senior Management Category.

Level 6 - Engineer 6, Staff

Directs an engineering staff or organization engaged in carrying out applied research, development or innovative design work, or the provision of advice, analysis and evaluation of engineering briefs and development of engineering standards.

Scope for Initiative and Judgement

Initiative and judgement are required in determining total demands on the organization, recognizing the need for investigation and research, developing long-range plans, establishing project objectives and priorities, issuing directives, providing guidance and determining the need to improve departmental standards and practices. Initiative and judgement are also required in assessing the capability of research organizations and the feasibility of proposals and in advising senior officials in own and other departments and organizations. Judgement is required in such matters as delegation of authority, changes in organization, and determination of requirements for and allocation of resources.

Work is undertaken to meet program objectives in accordance with directives, budgetary controls, and other requirements. Recommendations and decisions are normally accepted as authoritative and subject to review only for conformance with program objectives.

Responsibility for Recommendations, Decisions and Commitments

Recommendations are made on long-range planning, objectives, priorities and budgets and on the economic and other implications of proposals. Recommendations are also made to change the organization to cope with changing workload. Decisions are made in establishing and defining project objectives, approving project plans, delegating authority, and approving conclusions or recommendations based on investigations. Commitments involve estimating costs and other requirements for a program, allocating staff and other resources, determining acceptability of advice from consultants and others and applying such advice. Commitments are also made in providing expert advice on designs, physical or chemical data, manufacturing processes or other engineering methods. The work has a significant influence on long-range planning, the applied research, design and development capability of the department, the development of new engineering methods and standards and their acceptance and application by engineers and scientists in other departments and industry. Ineffective work may seriously affect the completion of a program and the development of engineering technology and may cause embarrassment to a department of government.

Knowledge and Skill

The work requires an advanced knowledge of the theory and principles of engineering science and of the practices in an engineering specialty, and a good knowledge of related specialties. A good knowledge of departmental organization, programs, standards and administrative procedures and of industrial research techniques and engineering practices and standards is also required. Skill is required in assessing the engineering, economic and other implications of program proposals, co-ordinating and implementing a program, recognizing the need for improvement of established practices, and developing concepts and combinations of theoretical and experimental research most likely to produce effective results. Skill is also required in establishing effective working relations with engineers, scientists and officials in industry and national or international organizations.

Responsibility for Contacts

Contacts are made with colleagues and officials in other departments of government and with associates in industry and national or international scientific organizations to exchange information, to explore possible approaches and to reach agreement in matters of mutual concern.

Responsibility for Supervision

There is a continuing responsibility for the work of professionals including assigning work, issuing directives and providing technical and administrative guidance, arranging for training, appraising performance, and performing other personnel administrative duties.

BENCH-MARK POSITION DESCRIPTION REFERENCE

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BENCH-MARK POSITION DESCRIPTION

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BENCH-MARK POSITION DESCRIPTION

Bench-mark Position Number: 1

Level: ENG-2

Descriptive Title: Junior Engineer,
Building Construction and Maintenance

Reporting to a Senior Construction Engineer:

Develops detail designs and specifications to be used in planning for new construction of, or major alterations to buildings in accordance with architectural, engineering and other standards. Designs and drafts simple elements such as beams, columns and footings of large buildings and for fixed plant; checks design drawings made by other engineers and drafters and verifies computations and technical data; writes technical sections of specifications for straightforward alterations or repair. Extracts technical data from files and reports and obtains information from senior engineers to support recommendations for modifying standards, established designs and construction plans.

Assists the engineer or architect in charge in planning a project and coordinating construction work to ensure that work and materials are in accordance with standards and contractual agreements. Analyses and devises solutions to problems encountered by support personnel in drafting, estimating and other preparatory work. Refers unusual or difficult problems to the engineer or architect in charge. Investigates and reports on construction problems and contractors' proposals for design deviations, overtime work or payment for unforeseen additional work. Provides information to be included in 'as built' drawings. Outlines proposed plans to landowners and others affected by the progress of work and discusses uncomplicated areas of designs or specifications with contractors.

Performs activities such as planning and overseeing preconstruction soil tests on proposed construction sites, comparing test results with material standards, gathering and compiling technical data in a prescribed form, performing and checking preconstruction and control survey work at construction sites, and estimating costs for new work.

Specifications

Scope for Initiative and Judgement

The work is performed in accordance with standard engineering techniques and is co-ordinated with that of other engineers and technicians by the supervisor. Initiative and judgement are required in collecting engineering data, checking design work and investigating problems, and determining the acceptability of work and materials. Work is usually reviewed in progress and checked for technical accuracy on completion. Difficult problems are referred to the engineer or architect in charge; advice and guidance are readily available. Regulations, departmental directives and other guidelines are also available.

Responsibility for Recommendations, Decisions and Commitments

The work requires making recommendations on solutions to field and design problems encountered by support personnel, and on changes to standards and specifications to reduce costs or improve designs. Decisions are made in relating requirements to design criteria, standards and construction methods, laying out and checking survey work, and comparing test results with specifications and material standards. Commitments involve own time and the time of support staff. Errors will normally be detected within the work group, but their correction may take up some time of senior engineers and support staff.

Knowledge and Skill

The work requires a thorough knowledge of the theory and principles of civil engineering and a good knowledge of the techniques of building design, survey and construction. Familiarity with such related fields as lighting, heating and air conditioning and the provision of utilities is also required. Skill is required in establishing effective relations with contractors and other individuals and in gathering and analysing data to identify and resolve problem areas.

Responsibility for Contacts

The work requires contacts with contractors to discuss specifications and work quality and progress, and with landowners or municipal agencies regarding projected work.

Responsibility for Supervision

The work may require occasionally guiding a few technicians and drafters, performing survey and layout work on construction sites, and drafting work in the office. There is a limited requirement to check work performed under contract with respect to work quality.

LINEAR ORGANIZATION CHART

Junior Engineer, Building Construction and Maintenance

Head, Construction Engineering and Maintenance

- Senior Construction and Maintenance Engineer (3)
- Engineer, Building Construction and Maintenance (5)
- **Junior Engineer, Building Construction and Maintenance EN-ENG-2 (3)**

BENCH-MARK POSITION DESCRIPTION

Bench-mark Position Number: 2

Level: ENG-3 (Line)

Descriptive Title: Electronic Systems Engineer

Reporting to the Supervisor, Electronic Engineering, and working in the specialty of radar systems:

Prepares engineering designs and cost estimates for capital projects in support of the regional Air Navigation Services program. Evaluates the performance of existing systems and makes proposals for modification or replacement which will satisfy the user's operational requirements. Conducts feasibility studies of new equipment to assess its usefulness in future or existing systems. Collects and analyses cost data and other technical information to prepare design drawings and data sheets for engineering briefs used to explain and justify new projects.

Prepares contracts for procurement of electronic equipment and for engineering consulting services, including technical specifications or statements of work and requisitions to solicit bids. Prepares evaluation plans to assess proposals and recommend contract awards. Reviews work in progress and final product to verify conformance with specifications and to recommend payment of progress claims. Reviews and recommends engineering change requests and contract amendments.

Plans, organizes and conducts studies to select sites for the installation of new facilities and to assess the interference with existing facilities that might result from proposed new structures or electronic systems. Defines, collects and analyses the necessary data such as maps, aerial photographs, surveys, flight check reports and protective zoning requirements. Prepares reports making recommendations for new sites or improvements required to protect existing facilities from interference.

Provides engineering advice and guidance to field maintenance staff for changes in installation procedures or resolution of system performance problems. Provides occasional supervision to technicians, technologists, more junior engineers and university engineering students. Provides reports on financial status of assigned projects and makes recommendations for budget adjustments.

Scope for Initiative and Judgement

The work requires initiative and judgement in analysing operational requirements and obtaining clarification and elaboration from users; translating operational requirements into technical requirements and specifications; identifying unusual or complex project related problems for the review of and guidance by senior engineers; establishing and analysing project schedules and work plans and recommending corrective measures; analysing and interpreting test results and the effects on work progress; reviewing and identifying the need for changes to specifications and standards; briefing construction and installation staff, consultants and contractors; and checking design work done by others. Judgement is required in recommending the scope of the work required to support a project, preparing specifications for work to be done by contract, determining the acceptability of contractors' proposals, assessing contractors' capabilities, identifying implications of courses of action which may not be obvious from previous experience, and estimating equipment and labour costs.

The work requires an overall awareness of the entire program in the radar specialty area and the existing and potential problems which may require action which lies outside of the area of responsibility of the Electronic Engineering Section. Initiative and judgement are required in preparing recommendations pertaining to equipment procurement and fabrication, new sites and facilities required, and financial programming actions required in response to changes in the overall program.

Designs are prepared by using accepted engineering practices and standards, selecting and applying Headquarters' standards and guidelines, and modifying approaches as required to meet project tasks. Problems are resolved by adapting and applying standard engineering practices and precedents. Unusual or complex problems may be reviewed with senior engineers, usually for confirmation of proposed approaches and solutions. New approaches and procedures are developed from existing policies and standards.

Projects are assigned on the basis of stated scheduling objectives and target completion dates, and from this, detailed project schedules and work plans are prepared. Recommendations for schedule and priority changes are made when requested objectives cannot be met. Work in progress is reviewed regularly, however, work methods and results are checked on an exception basis only, usually after a problem has been identified.

Responsibility for Recommendations, Decisions and Commitments

Recommendations are made concerning changes to plans, specifications and standards, acceptance of consultants' designs, tender proposals and contractors' capabilities for satisfactory work, deviations from specifications during the construction, installation and contractual stages of work underway, and organization and composition of work plans.

Project plans and designs are reviewed in broad terms for compliance with established objectives. Unusual or problem areas may be reviewed in detail with a senior engineer. Decisions are made in planning, organizing and scheduling assigned projects and in recommending target completion dates. Decisions are also made in determining the need for additional data and analysis, the adequacy of designs and specifications, and the need for modifications to existing methods to accomplish project objectives.

Commitments resulting from the work affect other phases of projects and the overall work program by delaying scheduled activities, restricting the time available for the activities of others, imposing additional work on other members of the project team, and creating carryovers, slippages and deferrals. Project schedule and content objectives are agreed at the outset, and deviations from these objectives are brought to management's attention together with recommendations for corrective measures. Considerable discretion must be exercised in accepting work not directly assigned and in becoming involved in unrelated work.

Knowledge and Skill

The work requires a thorough knowledge of engineering principles and practices in the specialty of Radar Systems, plus a general knowledge of related engineering disciplines such as civil, mechanical and electrical (power) engineering. The work requires skill in planning, organizing and scheduling, identifying requirements, interpreting policies and standards, establishing effective working relationships with peers and colleagues in other Branches and Departments, preparing written correspondence and reports, making oral presentations, and presenting and justifying work plans.

Responsibility for Contacts

The work requires contact with engineers, architects, lawyers and property agents of own and other departments, officers and staff of consulting firms, equipment manufacturers and university faculties, and peers and colleagues at the supervisory and managerial levels, to discuss requirements and clarify technical details during the design stage, explain technical requirements to non-technical personnel, obtain cost estimates, define the scope, terms and conditions of proposals and contracts, and obtain technical information and advice.

Responsibility for Supervision

Work of more junior engineers, technologists and technicians, when assigned, and that of consultants and contractors, when engaged, is reviewed for accuracy and conformance with quality and quantity standards.

LINEAR ORGANIZATION CHART

Electronic Systems Engineer

Regional Superintendent, Engineering Services

- Supervisor, Electronic Engineering
 - **Electronic Systems Engineer EN-ENG-3 (3)**
 - Supervisor, Drafting Services
 - Drafter (4)
 - Engineering Technical Assistant
- Regional Electronics Maintenance Engineer

BENCH-MARK POSITION DESCRIPTION

Bench-mark Position Number: 3

Level: ENG-3 (Line)

Descriptive Title: Structural Design Engineer

Reporting to the Manager, Professional Resources (Building):

Develops structural designs for buildings, or for parts of buildings to meet architectural, engineering and user requirements; analyses loads and calculates stresses and selects suitable structural shapes, fastenings and materials; checks design layout and drawings prepared by junior engineers and technicians or computer assisted drawings (CAD), and reviews structural design drawings and engineering data prepared by consultants for accuracy and conformance with accepted engineering standards and practices; evaluates and classifies material proposed for use, interprets physical test results, and compares the relative qualities of substitute materials for their applicability to immediate design problems; selects and reviews precedents closely related to assignments and determines to what extent they may be modified for specific applications.

Participates, as a member of a team led by a senior engineer or architect, in the planning and developing of building projects; collects and collates information such as user requirements, the purposes of the planned structures and its anticipated useful life, for use by staff or consultant architects; analyses survey data and information to determine such on-site conditions as the location of the planned structures in relation to other structures, existing communication and services systems and the characteristics of soil structure and bearing surfaces; reviews engineering drawings and other data prepared by consultants and other design authorities to ensure departmental requirements are satisfied; reviews proposed changes in design plans to determine their feasibility, reporting the effects of changes in terms of time and cost and the implications on services such as heating, ventilating and power, reviews and recommends on design-change orders requiring approval for expenditures of small amounts of funds.

Develops specifications in accordance with accepted engineering practices and departmental standards; assembles drawings, lists of material, estimates and other engineering information about planned work; writes assigned sections of building construction specifications, detailing construction processes, and obtains advice on unusual items from a senior engineer; reviews and amends, when required, specifications prepared by contractors or other agencies in order to ensure their adequacy and conformance with accepted engineering practices and departmental requirements.

Estimates labour and material costs of proposed projects for use by management and for budgeting purposes; extracts material quantities from design plans, classifying and listing materials and fixtures, and applying unit costs to estimate material costs; analyses planned work procedures, referring to cost records of similar projects, listing labour time by trade and established work performance standards to estimate project costs; reviews budget and cost estimates to provide management information; reviews cost estimates prepared by contractors to prepare opinions on their adequacy; relates project plans to records of completed projects to estimate the construction time required for their accomplishment.

Supervises a few drafters or technicians and transfers design changes to master drawings.

Specifications

Scope for Initiative and Judgement

The work is performed in accordance with accepted engineering practices and requires initiative and judgement in reviewing and checking design work done by others, selecting and applying precedents, and analysing survey and test data. The work requires judgement in developing specifications, estimating material and labour costs, and recommending on substitute materials and work methods.

Responsibility for Recommendations, Decisions and Commitments

The work requires making recommendations on the acceptability of completed designs, proposed changes to standard designs to meet unusual conditions, design change orders involving minor expenditures, and substitute materials. The work also requires making decisions in determining the accuracy and adequacy of design plans, cost estimates and specifications prepared by consulting firms and the feasibility and cost of proposed design changes, the need for survey data and engineering information, the location of new structures in relation to utilities and other structures, and the acceptability of materials proposed for use; in applying or adapting precedents to solve specific problems; and in interpreting physical test results.

The work requires making commitments in accepting estimates, designs made by others, and proposals for substituting materials. Responsibilities for administration include such matters as supervising a few technicians, reviewing budgets and cost estimates or recommending changes to improve administrative procedures.

Ineffective work is not readily apparent and may affect other phases of the work, causing waste of resources, or loss of time to review and correct.

Knowledge and Skill

The work requires a thorough knowledge of the theory and principles of structural engineering and practices as applied to the design and construction of buildings. It also requires a knowledge of engineering practices concerned with mechanical and electrical systems associated with buildings. The work requires skill in meeting with consultants, contractors and user units to determine, explain and co-ordinate requirements and assess progress. It requires the ability to present and explain completed designs and cost estimates.

Responsibility for Contacts

The work requires contacts with other engineers and architects concerning mechanical and electrical design work for structures and with officials of user units to discuss the purpose and requirements of projected works. Contacts are also made with departmental architects, construction authorities, consultants and contractors to exchange information about, and to interpret, plans and specifications and to discuss the progress of work.

Responsibility for Supervision

The work requires supervising a few drafters or technicians who perform supporting tasks such as drafting, illustrating, listing materials and taking off quantities. The work also requires discussing and reporting on the progress of work performed under contract and the conformance of that work with accepted engineering standards and practices.

LINEAR ORGANIZATION CHART

Structural Design Engineer

Manager, Professional Resources (Building)

- Senior Engineer, Structural Design Section

- **Structural Design Engineer EN-ENG 3 (2)**

- Drafters/Technicians

BENCH-MARK POSITION DESCRIPTION

Bench-mark Position Number: 4

Level: ENG-3 (Staff)

Descriptive Title: Environmental Engineer

Reporting to the Head, Mining and Milling Section:

Coordinates the collection of data on "in place" pollution abatement equipment used by Canadian mines and mills engaged in mining and milling base and precious metals, and iron and uranium, and on the effluent, air emissions and solid wastes they generate. Prepares the technical portion of Status of Compliance reports on the industry, indicating their degree of compliance with federal environmental regulations.

Coordinates the collection of operational, performance and cost information on existing or emerging air, water or solid waste pollution abatement equipment or processes and analyses same. On occasion, tests and evaluates new equipment or participates in overseeing tests and evaluations carried out under contract and evaluates results. Prepares reports for review by own organization or for the use of federal/provincial/ industrial working groups engaged in identifying cost effective pollution control technologies upon which national pollution abatement standards can be based.

Reviews engineering reports, plans, specifications and drawings pertaining to physical, chemical and biological waste treatment processes and the installation and operation of such pollution abatement equipment and systems as reagent mixers, thickeners, filters, tailings dams and impoundment structures, liners, bag houses, electrostatic precipitators, venturi scrubbers, and solid waste disposal sites, submitted by industry in support of applications for federal or provincial licenses or permits and provides technical commentary and/or recommendations to assist in senior level decision making.

Through plant visits and the review of technical reports, identifies areas and proposes modifications that could be made to pollution abatement equipment and industrial processes which would result in reduced contaminant releases to the environment.

Gives guidance to junior engineers or students when assigned.

Specifications

Scope for Initiative and Judgement

The work requires initiative and judgement in analysing the causes of pollution problems, selecting approaches and methods to be used in pollution control equipment performance tests and related tests and studies, and in recognizing the environmental or cost implications of findings. Initiative and judgement are also required in adapting standard practices and methods developed in previous work to current activities and situations. Judgement is required in determining approaches to testing a variety of existing and new equipment.

Problems are solved by applying theoretical and practical knowledge to specific situations and devising methods of testing and sampling, analysing results and validating same. The work is assigned in terms of specific objectives; critical areas or unusual features are normally indicated. Plans are reviewed and guidance on unusual features and problems are provided by the section head or a senior specialist.

Completed work is normally accepted as technically accurate and is reviewed for feasibility, soundness of judgement and achievement of objectives.

Responsibility for Recommendations, Decisions and Commitments

The work requires making recommendations on the use or modification of pollution abatement equipment and the selection and sampling of equipment and techniques. The work requires making decisions on the results of analyses, determining effective solutions to technical problems, and evaluating work performed under contract, or technical data submitted by the industry sector in support of applications for licenses and permits.

Ineffective work may result in increased cost and delays to branch projects and activities and increased time and material costs.

Knowledge and Skill

The work requires a thorough knowledge of engineering principles and practices as applied to mining and mill plant operations, and a good knowledge of environmental protection technologies and practices common to the industrial sector.

The work also requires a knowledge of federal and provincial policies and regulations with respect to the industrial sector, the economic state of the industry and the likely financial and environmental impact of pollution control technology.

The work requires skill in identifying sources of pollution, quantifying their release and assessing their environmental impact; in identifying and evaluating existing or proposed abatement technologies. The work also requires skill in developing contacts with experts in own or other departments whose expertise can contribute to the program.

Responsibility for Contacts

The work requires contacts with colleagues and engineers in own and other government departments, provincial agencies and industry to exchange information, discuss requirements and explore possible solutions to technical problems.

Responsibility for Supervision

The work requires giving guidance to junior engineers, students and technical staff when assigned, and checking their work and that of contractors, when engaged, for accuracy and conformance with quality and quantity standards.

LINEAR ORGANIZATION CHART

Environmental Engineer

Chief, Mineral and Metallurgical Processes Division

- Head, Mineral and Metal Fabricating and Processing Section
 - Environmental Engineer (3)
- Head, Mining and Milling Section
 - **Environmental Engineer EN-ENG 3 (3)**

BENCH-MARK POSITION DESCRIPTION

Bench-mark Position Number: 5

Level: ENG-3 (Staff)

Descriptive Title: Metal Forming Mechanical Engineer

Reporting to the Head, Metal Forming Section:

Plans, organizes and develops pilot-scale experiments to evaluate metal deforming processes, metal forming equipment and facilities for the thermomechanical deformation treatment of steel and non-ferrous metal alloys, especially steels for primary and secondary manufacturing processes, to develop materials of superior mechanical and service life quality. Determines the mechanical engineering parameters of the various processes. Discusses with section research scientists the results of their bench-scale experiments to be upgraded to pilot-scale, and the range of anticipated metal deforming process variables required. Determines the extent to which existing metal forming equipment and facilities can be modified or whether new equipment and facilities are required. Designs metal forming equipment capable of applying the required range of process variables and which is compatible with existing equipment and facilities. Selects components for pilot scale experiments. Designs integrated data gathering systems to record processing parameters. Recommends contracts, when necessary, with consulting engineers for equipment design and monitors same. Consults with internal staff and manufacturer's representatives on instrumentation for process control. Develops specifications for equipment. Selects equipment from among suppliers and recommends the manufacture or purchase of equipment components.

Plans and organizes the work of a number of assigned technicians, depending on study size. Coordinates the assembly of equipment. Develops and designs tests for equipment; applies the tests and evaluates the results; devises and schedules experiments on thermomechanical deformation of metal processes, and analyses and evaluates the mechanical properties, the metallurgical development and the process engineering.

Analyses and interprets the results of pilot-scale experiments to identify problems with and opportunities for transferring the new technology to full-scale industrial processes. Participates in discussions of experimental results with representatives of the metal forming industry to exchange information on anticipated problems in establishing new or modified technology in industry.

Prepares preliminary flowcharts incorporating the process steps, equipment and facilities required for full-scale industrial application. Recommends and monitors contracts and cost sharing agreements with private industry for full-scale trials. Provides advice to other federal departments which act as granting agencies for industrial research and development.

Specifications

Scope for Initiative and Judgement

The work is performed in accordance with accepted mechanical engineering standards and practices. Initiative and judgement are required in analysing failures in experimental processes, in designing equipment for experiments and in scheduling experiments. Initiative and judgement are also required in interpreting results and in suggesting possible full-scale applications in industry.

Problems are resolved by devising experiments, evaluating results and in adapting precedents, existing methods and accepted engineering practices to particular requirements of individual experiments. Unusual problems can be discussed with the supervisor or research scientists. Completed work is normally accepted as technically sound, but is reviewed for feasibility of approach and soundness of judgement.

Responsibility for Recommendations, Decisions and Commitments

Recommendations are made on approaches to problems in transferring bench-scale experiments to pilot-scale, on the need for new or modified equipment needed to enhance experiments, on particular tests and on approaches to transferring laboratory technology to industry. Decisions are made in designing pilot-scale experiments, analysing results, determining solutions to experimental problems and determining the capability of consultants to perform particular experiments.

Commitments are made in scheduling own work and that of technicians, accepting priorities, and making recommendations and decisions on which senior personnel take action.

Ineffective work can result in delays, waste of effort and material and increased costs.

Knowledge and Skill

The work requires a thorough knowledge of the theory and principles of mechanical engineering and good knowledge of metallurgical engineering, as applied to metal deformation processes and metal forming equipment, together with a knowledge of process control instrumentation and use of micro-computers in process control and monitoring. Also required is a good knowledge of current industrial deformation processes, especially in the steel industry. Skill is required in devising and setting up experiments, designing metal forming equipment, analysing the results of experiments and drawing conclusion on the industrial viability of pilot-scale technology. Organizational skills are required in scheduling work, overseeing technicians and work performed under contract. The work also requires familiarity with and skill in implementing office administrative procedures pertaining to arranging for the purchase of equipment, and the maintenance and repair of equipment, and the monitoring of contracts. Skill is also required in establishing effective working relations with colleagues and associates in the outside technical community.

Responsibility for Contacts

Contacts are made with colleagues in own branch and associates in other federal government departments and agencies to exchange information and to discuss research and technological transfer objectives, experimental results, and equipment design requirements. There are also contacts with consulting engineers to discuss and monitor design contracts and with representatives of the metal forming industry to discuss technology transfer and cost-sharing research projects.

Responsibility for Supervision

The work requires planning and organizing the work of assigned technicians and reviewing it in progress and on completion for conformance with quality and quantity standards. The work also requires reviewing work performed under contract in progress and on completion for conformance with quality and quantity standards.

LINEAR ORGANIZATION CHART

Metal Forming Mechanical Engineer

Laboratory Manager, Metal Processing Laboratory

- Head, Metal Forming Section

Metal Forming Mechanical Engineer EN-ENG 3

- Technician (10)

Programmer, Process Control Analysis

Research Scientist (4)

Metal Forming Scientist (1)

- Head, Foundry Section

- Head, Non-Destructive Testing Section

- Head, Welding Section

BENCH-MARK POSITION DESCRIPTION

Bench-mark Position Number: 6

Level: ENG-3 (Staff)

Descriptive Title: Test Methods Development Engineer

Reporting to the Head, Electrical Laboratories:

Designs and develops testing systems and techniques for use by the Electrical and Electronic Laboratories in measuring the electrical and physical characteristics of electric and electronic systems, devices and components to ensure their satisfactory operation and reliability in a military environment. Analyses engineering specifications; determines test requirements; reviews existing measurement methods and adapts or modifies them to suit requirements. Determines the most effective measurement methods and selects the proper material, components and equipment for the testing system being developed and devises solutions to instrumentation problems.

Provides engineering advice to Canadian Forces engineering design authorities and others on such matters as the measurement of electrical, physical and electronic characteristics, engineering specifications and the suitability of equipment, systems and components for use in military equipment. Devises and carries out special tests to determine suitability of equipment and identifies the reasons behind the failure of equipment.

Discusses and evaluates such test results with Canadian Forces design authorities and manufacturers to determine the acceptability of proposed and recommended changes to the design of equipment and material to improve and increase reliability of the equipment at hand and to establish valid test methods, conclusions, parameters, limits and solid test criteria.

Supervises a small group of technicians and a junior engineer providing a test design, development and proving support activity. Establishes work schedules, explains approaches and requirements, indicates characteristics as well as constant and variable values to be measured; gives instructions in the use of new or otherwise unfamiliar test equipment and review the work in progress and upon completion.

Reviews test schedules submitted by manufacturers and recommends approval or changes if necessary; assesses the capabilities of the manufacturers' test staff and facilities in relation to specific test requirements, and provides appraisals of facilities for contract testing and for in-plant qualification approval, on which management can base its selection.

Specifications**Scope for Initiative and Judgement**

The work is performed in accordance with accepted engineering practices. The work requires initiative and judgement in identifying essential test criteria, determining the most effective approach to the problems encountered, designing tests, developing testing techniques and test schedules, and evaluating laboratory facilities to carry out specific tests. The work also requires initiative and judgement in interpreting test results and identifying, reporting and recommending on equipment and system failures and defects.

The work requires resolving problems by devising experiments, evaluating observed data, analysing test results, and adapting precedents, existing methods and accepted engineering practices. Unusual problems are discussed with the supervisor and can be discussed with design engineers; critical areas and unusual features are indicated when work is assigned. Completed work often results in improvements to equipment and is normally accepted as technically sound, but is reviewed for feasibility of approach and soundness of judgement.

Responsibility for Recommendations, Decisions and Commitments

The work requires making recommendations to change specifications of equipment and material to correct reported failures, to change test schedules proposed by manufacturers, on the testing facilities and capability offered by manufacturers to perform specific work, and on requirements for additional laboratory equipment needed for special tasks or to improve own laboratory facilities. Decisions are made in developing and designing testing systems, analysing the results of tests, determining effective solutions to measurement and other engineering problems, and evaluating test schedules and testing capabilities.

The work requires making commitments in scheduling work of the group, accepting priorities, and making recommendations and decisions on which senior personnel take action.

Ineffective work can result in delayed test completions, some waste of effort and material, and increased costs.

Knowledge and Skill

The work requires a thorough knowledge of engineering principles and practices as applied to the design of tests, experiments and test schedules, and the analysis and testing of electronic and electrical systems, equipment and material. It also requires a good knowledge of the departmental engineering organization and administrative procedures as they pertain to quality assurance work. It requires skill in analysing problems, determining effective approaches to resolving problems, conducting tests and experiments, guiding and assisting own staff and advising other engineers, and developing satisfactory working relations with engineers in departmental design directorates and other organizations. The work also requires skill in determining the capabilities of manufacturers' laboratory staff and facilities offered to perform specific tests.

Responsibility for Contacts

The work requires contacts with engineers in own branch, departmental design directorates and manufacturing organizations to discuss problems, determine requirements, obtain information, and evaluate testing capabilities of a manufacturer's organization as it relates to specific test requirements.

Responsibility for Supervision

The work requires supervising a junior engineer and several technicians. Work completed by staff is checked for conformance with standards and instructions.

LINEAR ORGANIZATION CHART

Test Methods Development Engineer

Chief, Electrical and Electronic Laboratories

- Head, Electrical Laboratories
 - Test Methods Development Engineer
 - Test Methods Development Engineer
 - **Test Methods Development Engineer EN-ENG 3**
 - Junior Engineer
 - Technicians

BENCH-MARK POSITION DESCRIPTION

Bench-mark Position Number: 7

Level: ENG-3 (Staff)

Descriptive Title: Microwave Electronics Development Engineer

Reporting to the Project Leader, Microwave Components and Circuits:

Identifies, defines and analyses both general and specific requirements for microwave and millimeterwave component and subsystem development for use in satellite systems. Establishes priorities, schedules and resources appropriate to these various development tasks in order to maintain an effective workflow. Reviews the technical publications and commercial literature to maintain a current knowledge of microwave and millimeterwave technology and the characteristics and availability of the latest components, devices and test equipment.

Designs and develops required microwave and millimeterwave components and subsystems including devices such as propagation media, filters, couplers, matching networks, oscillators, amplifiers, modulators, demodulators and phase shifting networks. Devises, implements and evaluates both standard and novel experimental measurement and calibration systems and procedures to evaluate components and subsystems developed in-house and under contract. Documents the results of work in the form of in-house reports and papers suitable for publication in open literature.

Identifies research and development (R&D) tasks suitable to be contracted out to Canadian universities and industry in the area of microwave and millimeterwave systems and subsystems for space communications applications. Prepares and supports necessary contractual documentation in accordance with internal departmental policies. In conjunction with Supply and Services Canada (SSC), negotiates appropriate statements of work and acts as scientific authority on resulting contracts. Maintains a detailed knowledge of the capabilities of Canadian universities and industry in this area to assist in the placing of contracts.

Provides engineering consultation and advice to other engineers and scientists in own and other government departments and agencies, covering such areas as microwave and millimeterwave circuit design, test methodologies, component performance and availability, and the capabilities of Canadian contractors conducting research and manufacturing in this area.

Oversees the work of assigned technicians carrying out tests and evaluation work.

Specifications

Scope for Initiative and Judgement

The work requires initiative and judgement in proposing and investigating solutions or approaches to microwave problems; identifying, analyzing and defining requirements; establishing priorities, schedules and appropriate resources. Judgement is required in determining and selecting the most appropriate microwave or millimeterwave transmission medium, devices or design approach vis-à-vis the application or function to be met. Judgement is also required in selecting the optimum experimental approach or procedure to be used in order to eliminate unnecessary resource utilization. Judgement is required in dealing with other government departments or agencies and with industry.

The work requires solving problems by devising and implementing necessary experiments, evaluating observed data, analyzing results and determining required modifications to designs or procedures being followed.

Work is assigned in terms of experimental objectives. Protocols are reviewed by the Project Leader, who also provides guidance on unusual features of the work. Work is accepted as technically accurate, and is reviewed for feasibility, soundness of judgement and achievement of objectives.

Responsibility for Recommendations, Decisions and Commitments

The work requires making recommendations on the scheduling and extent of research and development tasks, approaches to resolving specific problems and methodologies to be used. Recommendations are also made on the choice of outside organizations to perform work. Decisions are made on experimental steps, assignment of staff to particular tasks, selecting devices and material for application; and selecting most appropriate test equipment for purchase and/or use.

Commitments are made in scheduling own work and that of technical staff, accepting priorities, and making recommendations and decisions upon which senior personnel take action.

Ineffective work can result in delayed experimental results, some waste of resources, and increased costs.

Knowledge and Skill

The work requires a thorough knowledge of engineering principles and practices applied to the design, development, and testing of microwave and microwave related systems, components, and circuiting. It also requires a good knowledge of departmental service sectors such as procurement, circuit fabrication and the model shop.

The work requires skill in analysing requirements, identifying and analyzing problems and determining effective approaches to their solution, guiding and assisting assigned staff and providing advice to other engineers. The work also requires skill in determining the ability of departmental staff or consultants/contractors to carry out specific experiments and tests.

Responsibility for Contacts

Contacts are made with engineers in own department and with consulting or contracting firms to discuss problems, determine requirements, obtain information and evaluate capabilities of an organization to carry out specific tests or experiments.

Responsibility for Supervision

The work requires giving guidance to technicians when assigned; checking their work and that of contractors or consultants, when engaged, for accuracy and conformance with quality and quantity standards.

LINEAR ORGANIZATION CHART Microwave Electronics Development Engineer

Chief, RF Components and Subsystems

- Project Leader, Microwave Components
 - **Microwave Electronics Development Engineer EN-ENG 3 (3)**
 - Technologist
 - Technician (5)
- Project Leader, Microwave Circuit Technology
- Project Leader, IF Components and Subsystems
- Project Leader, Antenna Technology

BENCH-MARK POSITION DESCRIPTION

Bench-mark Position Number: 8

Level: ENG-3 (Staff)

Descriptive Title: Compliance Engineer

Reporting to the Senior Compliance Engineer, Compliance Engineering and Vehicle Testing:

Plans, develops and implements motor vehicle testing to ensure automotive safety. Collects and analyses letters of complaint, accident and defect investigation reports, previous test data, and motor vehicle design data to select representative vehicles for testing. Consults with specialists in other Canadian and foreign government departments to exchange technical information. Selects government and commercial laboratories and arranges and manages contractual agreements to perform required testing. Witnesses testing, evaluates test results and makes recommendations for corrective action to be taken by the manufacturer.

Evaluates motor vehicle designs and manufacturer's test results to confirm automotive safety. Reviews public complaints and recommendations for investigation of defects to select vehicles for further evaluation. Evaluates design changes and manufacturing processes which reflect recall modifications under the Notice of Defect Regulations and correction of non-compliance to safety standards. Submits recommendations to the Senior Compliance Engineer for follow-up audits or additional testing of selected vehicle and components.

Reviews existing motor vehicle safety standards and test methods to determine their effectiveness and practicality and to make recommendations for changes. Evaluates the probable impact of proposed new or changed standards or regulations and makes recommendations on the technical feasibility, practicality and desirability of introducing such changes. Prepares and maintains suitable reference test procedures for use both by government and commercial testing laboratories.

Provides engineering advice to federal inspectors, test engineers and standards development engineers. Evaluates the suitability of quality control procedures and manufacturing processes to produce vehicles which meet design specifications related to safety standards. Arranges testing and investigation of manufacturing processes to explain reasons for failure to meet design specifications. Compiles documentation and provides expert technical evidence during legal proceedings concerning alleged non-compliance with safety standards.

Oversees the work of more junior engineers and technicians when assigned.

Specifications

Scope for Initiative and Judgement

The work is performed in accordance with accepted engineering practices and engineering quality control procedures applied to automotive safety. The work requires initiative and judgement in identifying significant details of questionable compliance with the Canada Motor Vehicle Safety Standards and in proposing projects worthy of detailed evaluation of engineering design and testing. Judgement is particularly required in recommending and implementing the most effective approach to the problems encountered, designing special studies and tests, and in recommending testing procedures and testing schedules. The work also requires initiative and judgement in recommending proposed refinements in the detail of existing and proposed safety standards in order to meet changing industry practices. Initiative and judgement are required in assessing established regulations enforcement procedures and in

proposing practical improvements. Judgement is exercised in developing engineering details for presentation to senior industry engineers and legal representatives of the manufacturers, and in reviewing whether compliance documentation indicates a degree of non-compliance which is unacceptable within the meaning and intent of the safety regulations and standards.

Problems are resolved by devising special evaluation projects and studies, evaluating testing results and data, and adapting precedents, existing methods and accepted specialized automotive engineering practices. Unusual problems are discussed with the Senior Compliance Engineer and other directorate engineering specialists, and critical areas and unusual features are usually indicated when work is assigned by the supervisor. Completed work and proposals are normally accepted as technically sound but are reviewed for feasibility of approach and consistency with objectives. Proposals will result in improved regulations and standards, more effective regulations enforcement programs including more efficient and improved testing programs and, after review by the Senior Compliance Engineer, may result in industry recalls of motor vehicles for correction of deficiencies in construction of vehicles or components.

Responsibility for Recommendations, Decisions and Commitments

Recommendations are made to ensure continuing compliance with safety standards by manufacturers, more effective regulation enforcement programs and improved safety regulations and standards. Specific recommendations will frequently involve arranging for vehicle and laboratory test procedures and equipment and the planning of comprehensive engineering evaluations of motor vehicle design and construction. Based on these recommendations and engineering evaluations, decisions are made with respect to the adequacy of the test documentation of manufacturers, the quality control of vehicle assembly and the degree of compliance achieved by the manufacturer and importer. Where the vehicle does not comply with these standards, the work requires providing information to assist the Senior Compliance Engineer in decisions to order the seizure and forfeiture of offending products under legislation and assisting in developing recommendations for prosecution which carry penalties in law of up to \$200,000 on conviction.

Ineffective compliance programs may result in potentially hazardous vehicles being marketed in Canada, and much of the safety programs to reduce fatalities, injuries or impairment of health may be negated. In cases where the application of standards appears to be unrealistic, the work requires making comprehensive engineering evaluations of both the intent of the standards and the related compliance procedures to assist in determining probable impact on costs to the manufacturer and to the public, and making recommendations reflecting these considerations of cost and benefits derived. Such costs can amount to millions of dollars in design and construction of both domestic and imported vehicles.

Knowledge and Skill

The work requires a thorough knowledge of engineering theory and techniques as applied to motor vehicle engineering and the principles of quality control and vehicle testing. It also requires a knowledge of departmental administration and of the legislation governing motor vehicle safety. Skill is required in identifying potential hazards in automotive construction and making recommendations for changes in existing safety standards and their application in such a way that safety may be increased without impractical engineering demands on manufacturers. Skill is required in analysing problems of vehicle design and construction, assisting in selection of effective test methods and procedures, discussing problems with other engineering specialists, and developing satisfactory working relations with engineers, technical personnel and inspectors in the directorate and in related government departments

and agencies, as well as in industry. Also needed is the ability to evaluate changes made in safety standards and enforcement procedures by other organizations whose actions affect or are affected by federal action in the safety field, and to recommend changes for bringing federal standards and compliance procedures to accord with these when considered desirable. Skill is required in effectively communicating with these organizations.

Responsibility for Contacts

Contacts are made with senior engineers of motor vehicle manufacturing companies during engineering audits for compliance; with other engineers in the Road Safety and Motor Vehicle Regulation Directorate, and with associates or colleagues of other federal government departments and agencies, ranging from customs officers to vehicle research engineers of the National Research Council; with engineering representatives of foreign, Canadian and provincial governments and private agencies concerned with motor vehicle safety, in order to keep abreast of changes in both safety standards and regulations enforcement programs supported by these organizations and in order to advise the Senior Compliance Engineer of details related to or affecting the objectives of regulations enforcement programs of this directorate.

Responsibility for Supervision

Guidance is given to technicians and junior engineers when assigned to a project. Work of assigned staff and consultants is reviewed for accuracy and conformance with quality and quantity standards.

LINEAR ORGANIZATION CHART

Compliance Engineer

Chief, Compliance Engineering and Vehicle Testing

- Senior Compliance Engineer

Compliance Engineer EN-ENG 3 (2)

Compliance Auditor

- Head, Fleet Operations
- Vehicle Technician
- Vehicle and Equipment Inspector
- Senior Technologist Inspector
- Mechanic-Technician
- Junior Engineer (3)

BENCH-MARK POSITION DESCRIPTION

Bench-mark Position Number: 9

Level: ENG-4 (Line)

Descriptive Title: Project Engineer, Vessel Development

Reporting to the Head, Vessel Development:

Plans and conducts the design and construction of new ships and ship systems for the road and rail link ferry systems and coastal services that are the responsibility of the federal government. Analyzes and evaluates traffic forecasts, trends in freight handling and problem areas in existing operations to prepare a statement of requirements for the ship and ship/terminal interface. Initiates and administers contracts for conceptual design studies. Prepares cost estimates and submissions to Treasury Board for project approval. Evaluates tenders and recommends award of contracts for design and construction. Monitors work in progress to approve all design drawings, construction schedules, design changes and prototype and final acceptance tests.

Plans and conducts the conversion or modification of existing ships to meet changed requirements. Discusses with the vessel operators the deficiencies in the existing ship to prepare a statement of requirements and cost estimate for changes. Evaluates tenders and recommends award of contracts. Monitors work in progress to approve all design drawings, work schedules, design changes and final acceptance tests.

Plans and arranges the chartering of ships to meet emergency and seasonal demands. Prepares an inventory of available ships and inspects selected vessels to determine their suitability. Negotiates charter agreements and changes required to meet service requirements. Monitors work in progress to approve design drawings, work schedules and design changes. In approving final acceptance, ensures that all survey certificates, warranty clauses, obligations of the Crown and outstanding work are properly documented.

Provides a marine engineering consultant service to the branch, the East Coast Marine and Ferry Service, other marine agencies and design contractors. Analyses and proposes solutions to problems encountered with operational ships and ship/terminal interfaces. Provides design parameters and guidance concerning marine engineering and owner requirements to design contractors. Proposes technical approaches and develops cost estimates for use in transportation studies and long-range planning.

Specifications

Scope for Initiative and Judgement

The work requires initiative and judgement in analysing requirements, establishing project objectives, determining the best approach and initiating studies. Judgement is required in accepting tenders for design and construction of ships or ship systems, approving designs and work schedules, identifying the need for and making changes to proposed designs, evaluating tests results and approving acceptance of the final product. Initiative and judgement are required in investigating and resolving problems experienced in operational ships and in the conversion of charter vessels for use by the federal government. Problems are solved by applying accepted engineering practices, sometimes adapting these in novel ways. Unusual problems are discussed with senior engineers, colleagues and consultant firms.

Work is assigned in terms of project objectives and budget limitations. Technical work is normally accepted as accurate, but is reviewed for soundness of judgement and conformance with objectives.

Responsibility for Recommendations, Decisions and Commitments

Recommendations are made on the award of contracts for design studies, ship design and construction and ship modifications. Decisions are made in determining requirements, establishing specifications to meet the requirements and developing modifications to meet changing requirements and overcome operational difficulties. Decisions are also made on the nature and extent of changes to ship designs during construction or modification and on the acceptability of the final product. Commitments are made in establishing project costs and schedules. The consequence of error could be considerable financial loss, unnecessary additional expenditure, problems for vessel operators and ineffective or unsafe service to users of the ferry and coastal services.

Knowledge and Skill

The work requires a thorough knowledge of the theory and principles of marine engineering and practices applicable to the design and construction of ships and ship systems. The work also requires a good knowledge of the related fields of vessel systems design, naval architecture and ship operations. The work requires skill in determining the detailed requirements of a project, developing specifications, identifying and correcting design error and in evaluating the technical adequacy of proposals. Skill is required in negotiating with contractors for design changes and with ship owners for charter agreements.

Responsibility for Contacts

The work requires contacts with procurement officers to clarify contract requirements and to review proposals. Contacts are also required with naval architects and senior engineers of ship design contractors to explain requirements, provide guidance and resolve problems. Contacts are made with owners of charter vessels to negotiate charter agreements and ship modifications. The work also requires contacts with departmental colleagues and ship operators to discuss problems.

Responsibility for Supervision

The work requires the review of the work of consultants and contractors in progress and on completion for accuracy, achievement of objectives and conformance with accepted engineering practice. This work is carried out on a continuing basis.

LINEAR ORGANIZATION CHART

Project Engineer, Vessel Development

Chief, Operations Division

- Head, Vessel Development

- **Project Engineer, Vessel Development EN-ENG 4 (2)**

BENCH-MARK POSITION DESCRIPTION

Bench-mark Position Number: 10

Level: ENC-4 (Line)

Descriptive Title: Senior Field Engineer

Reporting to the Supervising Engineer at regional headquarters:

Conducts, or directs the conduct of feasibility studies and investigations of proposals for new construction, or the alteration or extension of existing facilities. Improves design and installation methods to facilitate maintenance and develops the construction and major maintenance program for the locality concerned. Discusses requirements with the supervising engineer and officials of the departmental organization or agency requesting changes or new construction. Recommends solutions to unusual problems, determines the preparation of site plans and preliminary design and cost estimates. Evaluates and reports on items in the construction program and their impact on capital and maintenance costs as well as their operational effectiveness. Initiates and guides investigations related to the inspection of buildings, access roads and other structures and facilities in order to determine their condition. Recommends to the supervising engineer on requirements for construction or the modification or extension of buildings, roads, aprons and runways. Assesses the long-term effectiveness of maintenance techniques and reports on operating and maintenance problems.

Plans and organizes the construction and alteration of buildings and facilities in order to facilitate the control of work quality and the coordination between own staff, contractors, users of facilities and other agencies. Schedules, sets and assigns project priorities to subordinate engineers and technical staff with respect to construction or major installation or maintenance projects. Discusses the contractor's or consultant's plans and designs with senior officials to ensure they meet the department's engineering standards. Communicates to public utilities companies, municipal agencies the effects of construction work on access roads, relocation or provision of gas, water, electrical and other services.

Advises departmental officials, consultants, contractors and private companies providing services or leasing space, on engineering requirements and related departmental standards for new facilities, zoning restrictions and the location and construction of buildings, roads, runways and other facilities. Discusses project proposals with consultants, contractors, leaseholders and others. Assesses the need for and recommends proposals on construction methods and schedules to avoid possible difficulties with day-to-day operations.

Controls the quality and progress of the work of contractors as it regards buildings and facilities. Reports on the development and use of leased sites by industrial or commercial organizations and advises on construction schedules to ensure that work is completed in accordance with contractual agreements and priorities. Assigns engineers or technical support staff to monitor the quality and progress of the work and in the process coordinates the work of consultants and contractors. Discusses problems, such as overlapping of responsibilities, with consultants, contractors and officials of client organizations and assesses the work being done through progress reports, making the necessary adjustments if required. Assesses changes in design, suggests solutions to problems involving conflicting requirements and suggest changes in construction methods or work schedule to ensure that requirements are met. Inspects completed work and recommends acceptance or rejection of completed work in accordance with the terms of the contract.

Organizes and administers a small engineering office to maintain and control engineering records and contractual documents relating to the planning and control of contracts. Supervises engineers and technical support and administrative staff engaged in surveying sites for proposed construction, preparing plans and cost estimates, maintaining records and contract documents and inspecting the work of contractors.

Specifications

Scope for Initiative and Judgement

The work is performed within general guidelines concerning operational requirements, budgetary controls and departmental standards for construction and major maintenance work. The work requires initiative and judgement in planning and conducting engineering investigations and assessing the condition and adequacy of buildings, roads and other facilities, obtaining and interpreting test data and evaluating anomalous results, initiating and studying proposals for construction work and discussing and determining the need for replacement, major alterations or more effective maintenance to meet changing operational requirements and to make optimum use of construction and maintenance resources. Initiative and judgement are also required in recognizing unusual conditions and deciding if changes should be made in plans, schedules or methods; assessing the feasibility of changes in plans or specifications proposed by consultants, contractors or subordinate engineers; deciding on the need for and nature of quality control measures or inspections of construction material; co-ordinating construction schedules to minimize interference with day-to-day operations; and ensuring the work of contractors and others meet departmental standards, budgets and other requirements. Guidance is received through departmental directives concerning new construction or major maintenance projects to be included in the budget and on the application of criteria in evaluating the operational effectiveness of project proposals. Assistance is available from headquarters specialists on such matters as design, installation and maintenance of electrical and mechanical systems, property administration and legal implications arising from contract work.

Proposals for new construction and other major projects are discussed with the supervising engineer to confirm their necessity and decide on the relative priorities of items in the work program.

Responsibility for Recommendations, Decisions and Commitments

The work requires assigning construction and maintenance projects and investigations to subordinate engineers and technical support staff, with instructions concerning engineering criteria, departmental standards and requirements to be applied; reviewing, appraising or rejecting or recommending for approval or rejection cost estimates, reports and proposals made by subordinate staff, user organizations, consultants and other engineers; recommending suitable consultants or contractors to design and carry out the work, in accordance with departmental directives and general instructions from the supervising engineer.

The work requires giving advice to senior officials of the user organization on the condition and adequacy of structures, systems and related facilities in use in the locality and on the costs and priorities of proposed construction projects. Recommendations are made on maintenance problems and on the requirements and priorities of construction projects to be submitted for approval and on the need for changes in specifications or construction methods to suit unusual conditions. Advice is also given to consultants and contractors designing and carrying out construction work. The work also requires making recommendations to planning committees, users and other organizations on the location of access roads and other systems or utilities, on the adequacy of plans and designs prepared by consultants or staff specialists and on the acceptability of cost estimates for construction projects.

Commitments are made by participating in the planning and recommending of new construction or major alterations and by managing significant construction contracts. Commitments are also made in assigning subordinate staff to investigate and develop project proposals, recommending projects for inclusion in the construction program and in approving or recommending progress payments and the final acceptance of contract work.

The work also requires assessing the effectiveness of maintenance techniques and the suitability of departmental standards for design and construction in relation to local resources and requirements or unusual conditions. Decisions involve the acceptability of designs and cost estimates for modifications and minor construction prepared by own staff, or changes in the specifications for construction materials. Recommendations are made to improve methods and to modify departmental standards or the specifications in contractual agreements.

The work requires deciding on the need for assistance from staff specialists in investigating problems and making recommendations on the need for and selection of consultants or contractors, with advice on their ability to perform design and construction work. Local requirements are defined and information is given to consultants and staff specialists and completed work is reviewed for conformance with instructions and local requirements.

The work requires reviewing reports of investigations and project plans prepared by consultants or staff specialists in relation to the construction workload and resources available. Additional investigation or on-site inspections are initiated if necessary, and plans are accepted, or recommended for acceptance or modification to suit local requirements or cost limitations. Designs or specifications prepared by own staff may be reviewed for conformance to good engineering practice and to ensure they are in accordance with departmental standards and approved requirements.

Knowledge and Skill

The work requires a thorough knowledge of civil engineering theories and principles as applied in surveying, designing and constructing buildings and roads, water, drainage and sewer systems and other facilities. The work also requires skill in assessing the condition and adequacy of such installations. A thorough knowledge of construction methods and practices, a good knowledge of related electrical and mechanical engineering requirements and practices and familiarity with the operational procedures and requirements of the user organization is also required in planning, coordinating and controlling the progress and quality of construction work.

A knowledge of personnel, contractual and other administrative procedures and departmental standards and directives, and skill in personnel management is required in briefing consultants, controlling the work of contractors, negotiating with municipal officials and property owners, organizing the work of engineers and support staff and administering a small engineering office.

Responsibility for Contacts

The work requires discussing operating requirements with the manager and officials of the station or base, and with staff specialists and officials using the facilities to discuss new construction or major maintenance activities. The work also requires briefing consultants on departmental standards and requirements for the design and operation of new facilities, and meeting with contractors to provide information on administrative and financial requirements and to discuss and agree on schedules of work. Priorities, schedules and proposed changes in specifications and arrangements for inspecting or testing construction materials and the inspection for acceptance of completed work are discussed with officials of consulting and construction firms.

Contacts are also required with officials and engineers of municipalities, public utility companies and the provincial highways department for such purposes as discussing local ordinances concerning the use of land, arranging for access roads and explaining the proposed construction and development program to local property owners and other interested parties.

Responsibility for Supervision

The work requires organizing and administering an engineering office and responsibility for the work of engineers and a group of technical and administrative support staff. Projects are assigned and guidance is given on the approach to engineering and survey problems and the kind of inspection or testing to be performed in the control of contract work. The work of consultants and contractors is reviewed in progress and on completion to ensure it is in accordance with instructions and departmental standards.

Recommendations are made on the selection, training and promotion of subordinate engineers and members of the supporting staff. Instructions are issued to register and control the attendance of staff members, to obtain office and other supplies and to ensure the proper maintenance and use of instruments and technical equipment. This work is carried out on a continuing basis.

LINEAR ORGANIZATION CHART

Senior Field Engineer

Senior Engineer

- **Senior Field Engineer EN-ENG-4**

- Engineer (3)
- Technical / Clerical Staff (Approximately 20)

BENCH-MARK POSITION DESCRIPTION

Bench-mark Position Number: 11

Level: ENG-4 (Staff)

Descriptive Title: Radio Spectrum Engineer

Reporting to a Radio Spectrum Manager:

Develops Standard Radio System Plans (SRSPs) detailing the technical requirements and preferred frequency channeling arrangements for VHF (Very High Frequency), UHF (Ultra High Frequency) and microwave systems to promote efficient use of the spectrum in both the public and private domains. Prepares Radio Specifications Standards (RSS's) and prepares Radio Standard Procedures (RSP's) which set forth the minimum performance standards required for the type-approval of radio transmitters and receivers in Canada, and various reports to set technical standards for efficient spectrum usage. Evaluates the needs of radio spectrum users through the review of user organization requests and by participation at meetings and conferences and discussions with technical experts from the radio manufacturing industry (the Electrical and Electronic Manufacturers Association of Canada), the user community (the Radio Advisory Board of Canada), government and universities, to examine system applications and technical characteristics of necessary system parameters. Conducts cost/benefit analyses of alternative solutions to channeling plans and technical standards to ensure radio frequency spectrum users and manufacturers are not financially penalized. Formulates the documentation (SRSP, RSS, guidelines, etc.) to be issued by the Department under the authority of the Minister of Communications to set technical standards and parameters for efficient spectrum usage.

Identifies the need for, plans, organizes and conducts special studies required for the development of SRSP's etc., and required for the resolution of unusual technical problems and specific interference and compatibility problems related to the management of the radio spectrum. Writes reports and papers featuring the findings of these studies for both departmental use and for presentation to such bodies as the International Study Groups of CCIR (Comité Consultatif International de la Radio). Verifies existing mathematical models of propagation, interference and compatibility. Where appropriate, revises, modifies or develops new ones. From these, develops computer-aided tools for spectrum management.

Where appropriate, recommends performing aspects of the work under contract. Generates the statement of work, oversees work performed and appraises completed work.

Serves on a number of committees and working groups, ranging from departmental standing committees to international working groups, to provide technical expertise on the management of the radio spectrum.

Specifications

Scope for Initiative and Judgement

The work requires initiative and judgement in recognizing and analysing spectrum management problems: in co-channel, adjacent channel and image interference; in on-going investigations into Radio Equipment Standards and Radio System Plans; and in solving technical problems, such as electromagnetic compatibility, that arise in spectrum management. The work also requires initiative and judgement in recognizing the implications of studies on related spectrum problems and in recognizing their cost implications.

The work requires solving unusual technical problems by application of spectrum management practices in unique or novel ways.

Plans and unusual features are reviewed for feasibility, approach, conformance with project directives and the supportability of recommended courses of action when exposed to thorough public scrutiny. Technical work is usually accepted as accurate, guidance is available for review of unusual features.

Responsibility for Recommendations, Decisions and Commitments

The work requires making recommendations on studies undertaken, based on technical and, if appropriate, cost/benefit grounds. The work also requires making recommendations on required changes in engineering rules, standards and procedures. Such recommendations are subject to public consultation prior to official publication.

The work requires making decisions on the use and choice of consultants or contractors to carry out aspects of the work. Commitments are made in terms of support and input to various national and international study groups involved with spectrum management.

Ineffective work results in higher costs, delays and inefficient spectrum utilization. Inaccurate work, where interference and compatibility consideration are paramount, can be highly embarrassing to the department.

Knowledge and Skill

The work requires a thorough knowledge of the theory and principals of radio communications, including modulation techniques, radio propagation, and RF electronics. The work also requires a practical knowledge of the usage and practices of fixed terrestrial communications systems, a detailed up-to-date understanding of modern spectrum management techniques, electromagnetic interference and compatibility analysis, and the application of the Canadian Radio Act.

The work requires skill in resolving unusual problems that may affect the efficient utilization of the radio spectrum and in aiding in the development of appropriate departmental radio spectrum usage and allocation policies and computer-aided tools for spectrum management.

The work also requires skills in establishing effective working relations with colleagues, associates, representatives of Canadian radio users and radio manufacturers and with officials of a variety of national and international organizations.

Responsibility for Contacts

The work requires extensive contacts with colleagues and associates in own department engaged in similar work, with engineers and other representatives of the Canadian radio manufacturing and radio user communities and with officials of a variety of national and international organizations. These contacts are for the purpose of gathering information on user requirements, manufacturers', constraints and system performance and national and international allocation plans.

Responsibility for Supervision

The work requires reviewing studies performed under contract in progress and upon completion for accuracy, achievement of objectives and conformance with accepted engineering practice. This work is performed on a continuing basis.

LINEAR ORGANIZATION CHART

Radio Spectrum Engineer

Director, Spectrum Engineering

- Manager, Spectrum Engineering
 - **Radio Spectrum Engineer EN-ENG 4 (3)**
- Manager, Spectrum Engineering
 - Spectrum Engineer (4)
- Manager, Spectrum Engineering
 - Spectrum Engineer (4)

BENCH-MARK POSITION DESCRIPTION

Bench-mark Position Number: 12

Level: ENG-4 (Staff)

Descriptive Title: Real-Time Computer Systems Engineer

Reporting to the Senior Avionics Systems Engineer:

Is the engineering authority on specialized embedded aircraft control systems computer hardware, interfaces, their specialized operational software and necessary support requirements.

Is the design authority for systems and provides engineering support to project managers. Reviews and recommends approval of or changes to: statements of requirements and specifications for systems hardware and software development, configuration management, quality assurance and system test plans, procedures and reports; software support and qualification test plans; and engineering changes proposals for integrated system hardware and software.

Provides direction and engineering guidance to own and other government departments and industry on system hardware and software matters. Develops statements of requirements for hardware, software and systems support. Evaluates and assesses contractors' proposals and facilities. Evaluates software support alternatives and determines and recommends the most appropriate approach.

As systems Life Cycle Manager (LCM), analyses System Trouble Reports (STRs) and Software Change Requests (SCRs) and develops solutions to problems identified. Prepares, reviews and recommends changes to technical specifications, Statements of Work and other documentation to address new requirements and system modifications. Attends foreign software change review boards and Operational/Maintenance Advisory Group meetings. Initiates in-house and consultant studies and assesses resulting proposals, recommendations and alternatives.

As the focal point for system Configuration Control, maintains an up-to-date knowledge of system hardware, software, support and training. Maintains and controls drawings and specifications related to system Interface Control, programming, timing and memory resource utilization. Reviews and recommends approval of or changes to hardware and software engineering change proposals and statements of requirements to ensure compliance with system interface, integration and test parameters. Identifies criteria for Automated Data Processing resources required to support the identification, status accounting and configuration control of operational software.

Maintains a state-of-the-art expertise on embedded real-time digital computer systems, system software, systems integration and support, and life cycle management. Monitors current developments in automated control systems, display systems, multiplexed bus systems and human factors engineering. Liaises, consults and visits with engineering and research specialists in government and industry. Attends seminars, symposia and courses.

Supervises technical staff and provides direction, guidance and advice to other engineering staff on a project basis and to contractors. Reviews work for accuracy and conformance with standards.

Specifications

Scope for Initiative and Judgement

The work requires initiative and judgement in analyzing project requirements, establishing objectives for the component parts of the project, determining likely approaches to problems, and initiating investigations and studies. Judgement is required in accepting contractors' proposals for specialized computer hardware and software systems design and development, identifying the need for modifications to proposals to ensure project objectives are achieved, evaluating the results of tests, and providing advice to other engineers and officials on the implications of new systems.

Problems are resolved by applying accepted engineering practices in novel ways. Unusual problems are discussed with senior engineers, colleagues, or officials of consulting and contracting firms.

Responsibility for Recommendations, Decisions and Commitments

The work requires making recommendations on the acceptability of contractors' proposals on new or modified to existing computer hardware/software systems and in determining approaches to the evaluation of these proposals. Recommendations are also made on projected costs of projects and on changes in design during the project; and in operating, maintenance and replacement activities during the system life cycle. Decisions are made in determining system requirements, establishing specifications, and developing system and component modifications to improve reliability and overcome operating problems. Decisions are also made on the nature and extent of changes needed to bring the proposals of contractors and others up to specifications. Commitments are made in approving plans and specifications and in assigning project resources to specific activities. The results of ineffective work can be delays in the aircraft procurement and life cycle management program, the acceptance of inferior avionics control equipment, over-expenditure of funds and the misuse of staff resourced for the project from other organizational components.

Knowledge and Skill

The work requires a thorough knowledge of the theory, principles and practices related to computer systems' hardware and specialized software engineering applicable to the design, development, installation and maintenance of embedded aircraft control systems computers, associated components and systems. The work requires a good knowledge of large-scale software development processes and of the development and integration of support requirements and the operating characteristics of modern aircraft. A good knowledge is also required of project management principles and departmental administrative processes, particularly with respect to systems acquisition. Skill is required in developing specifications, analyzing proposals from contractors and others, and devising innovative solutions to technical problems. Skill is also required in administering activities across organizational lines and in developing effective working relations within and outside the department and government to achieve project objectives.

Responsibility for Contacts

The work requires contacts with engineers and scientists in own and other departments and those of foreign governments to exchange information on problems, procedures, techniques and approaches. The work also requires contacts with senior staff of consulting or contracting firms to discuss and resolve problems concerned with such matters as requirements, specifications and other contractual arrangements.

Responsibility for Supervision

The work requires reviewing work performed by own project staff and work performed under contract in progress and upon completion for accuracy, achievement of objectives and conformance with accepted engineering practice. This work is performed on a continuing basis.

LINEAR ORGANIZATION CHART

Real-Time Computer Systems Engineer

Senior Avionics Systems Engineer

- Real-Time Computer Systems Engineer* EN-ENG 4

- Technical Support
- Clerical Support
- Engineer (2) (Military Positions)

* Project Staff not shown.

BENCH-MARK POSITION DESCRIPTION

Bench-mark Position Number: 13

Level: ENG-4 (Staff)

Descriptive Title: Systems Engineer, Light Armoured Vehicles Reporting to the Manager, Tracked Light Armoured

Vehicles:

Plans, controls and performs the work involved in the design and acquisition of Tracked Light Armoured Vehicles. Evaluates options and recommends promising developmental areas. Performs engineering and feasibility studies to determine if existing components can be modified to meet new requirements. Formulates cost estimates used as a basis for decisions and budgets. Provides engineering advice to Supply and Services Canada (SSC) and contractors. Develops specifications and documentation for contract purposes. Specifies and directs tests and trials to ensure equipment acceptability.

Manages fleet retrofit activities. Identifies those Product Improvements (PIs) which should be considered for fleet retrofit. Develops, plans and conducts engineering trials and evaluations to ensure compatibility of selected PIs with existing equipment. Develops design modifications to proposed PIs to improve their usefulness. Writes proposals to obtain approval for PI fleet implementation. Liaises with workshops to ensure scheduling and completion of retrofits. Maintains an up-to-date knowledge of new combat vehicle systems.

Provides engineering guidance and advice to operations staff, user and land maintenance units and supply managers. Assists SSC in the selection of suitable potential contractors. Reviews patent applications and Suggestion Award proposals to determine their potential military application.

Develops and implements modifications to existing systems and equipment. Studies and investigates performance and failure reports to establish probable causes. Conceives and proposes engineering solutions and formulates specifications and drawings covering required modifications. Specifies, organizes and directs tests and trials to verify satisfactory performance. Formulates revisions to operating and maintenance procedures manuals and support documentation.

Maintains fleet configuration control. Directs the revision of Technical Data Packages to incorporate design changes. Provides technical data to specify procedures and methods for repair and rebuild of systems and sub-systems by contractors. Develops and maintains a data bank of design changes, defects, malfunctions, tests, maintenance and other technical data to ensure information availability.

Supervises one subordinate engineer and provides direction, guidance and advice to other engineering staff on a project basis. Reviews work for accuracy and conformance with standards. Manages an engineering services contract.

Specifications

Scope for Initiative and Judgement

The work requires initiative and judgement in analysing project requirements, establishing objectives for project components, determining likely approaches to problems, and initiating investigations and studies. Judgement is required in evaluating and accepting or rejecting tenders for the design or fabrication of components and systems, identifying the need for, and making changes to manufacturers'

proposals and specifications to ensure project success, evaluating test results, and providing advice to other engineers and officials on the implications of new components or systems. Problems are resolved by applying accepted engineering practices in novel ways. Unusual problems are reviewed with senior engineers, colleagues and engineers and officials of manufacturing or consulting firms.

Plans and unusual features are reviewed for feasibility, approach, and conformance with project directives and budget limitations. Technical work is usually accepted as accurate, guidance is available for review of unusual features.

Responsibility for Recommendations, Decisions and Commitments

The work requires making recommendations on such matters as the type of components and/or systems to be installed in new vehicles or for vehicle retrofits. Recommendations are also made on anticipated project costs, on changes in design, and operating and maintenance procedures for existing vehicles, the acceptability of tenders and the award of contracts. Decisions are made in determining requirements, establishing specifications to meet the requirements, and developing modifications to components and systems to improve reliability and overcome operating problems. Decisions are also made on the nature and extent of changes needed to bring contractors'/manufacturers' proposals up to project specification standards. Commitments are made in estimating, making recommendations on equipment, specifications, acceptability of tenders and contractors' proposals, and establishing courses of action to be taken. The result of ineffective work can be delays in the vehicle procurement program, the acceptance of inferior components or systems, the overexpenditure of funds or poor operation of current vehicles. These results are unlikely to become apparent until the systems, components, or vehicles are ready for trials, or the cost becomes excessive.

Knowledge and Skill

The work requires a thorough knowledge of the theory and principles of mechanical engineering and in particular automotive engineering and the practices applicable to the design, production and installation of components and systems for military vehicles. The work also requires a good knowledge of related fields such as electrical/electronic engineering to identify and resolve problems in interfacing vehicle components when developing or retrofitting vehicles; of contract administration and of the operational and mission requirements of military vehicles. The work requires skill in determining detailed requirements of a project, developing specifications, identifying and correcting engineering errors in contractors proposals, and evaluating proposals or tenders in terms of their technical adequacy and conformity to specifications. The work also requires skill in consulting with contractors and consultants to ensure departmental requirements are met.

Responsibility for Contacts

The work requires contacts with procurement officers to clarify requirements and to explain engineering considerations. The work also requires contacts with departmental colleagues in other engineering fields to plan and coordinate activities and to resolve mutual problems, with engineers and officials of manufacturing firms to resolve problems; and with engineers in general to remain current on automotive and related engineering concepts and practices.

Responsibility for Supervision

The work requires assigning tasks to a subordinate engineer. The work also requires reviewing the work of own subordinate, defence contractors and project staff in progress and on completion for accuracy, achievement of objectives and conformance with accepted engineering practice. This work is carried out on a continuing basis.

LINEAR ORGANIZATION CHART

Systems Engineer, Light Armoured Vehicles

- Director, Light Combat Vehicles
- Manager, Tracked Light Armoured Vehicles (Military Position)
 - **Systems Engineer, Light Armoured Vehicles* EN-ENG 4**
 - Engineer (Military Position)
 - Engineer (2)
- Manager, Northland Vehicles
- Manager, Wheeled Light Armoured Vehicles

* Project staff not shown.

BENCH-MARK POSITION DESCRIPTION

Bench-mark Position Number: 14

Level: ENG-4 (Staff)

Descriptive Title: Maritime Electrical Systems Engineer

Reporting to the Head, Generators and Motors Section, Directorate of Maritime Equipment:

Plans, organizes and directs projects for the design, procurement and installation of shipboard electric power generating, control and transmission systems and associated equipment. Determines the requirements of the proposed system or changes to a system, which constitutes the project. Identifies the separate parts of the project, evaluating objectives and determining likely approaches to problems. Initiates studies to determine design criteria and essential features to be specified in a design contract and makes cost estimates to provide a basis for project funding by departmental financial authorities. Writes, in accordance with project objectives, specifications for system and equipment construction, performance and testing as a basis for Supply and Services Canada contract preparation. Reviews and comments on tenders in terms of technical adequacy, adherence to specifications and comparative acceptability. Examines the contractor's drawings and associated design data for sound engineering practice and adherence to specifications, indicating any necessary changes, and releasing them for the manufacture and installation of equipment. Oversees testing of prototype systems and associated equipment at place of manufacture, test laboratories and aboard ship. Discusses contractual, developmental and production matters with manufacturers and other interested parties to resolve problems encountered during project implementation. Reports on meetings and project progress, outlining any problems that have arisen and that requires resolution by higher authority, and recommends acceptance or rejection of the systems and equipment. Determines the effect the project has on other shipboard systems and ensures that all specifications, as-fitted drawings and support publications are brought up to date. Informs logistics and training authorities of the requirements raised by the new systems and equipment; sets test limits for the inspecting authority.

Provides engineering advice and guidance to construction, maintenance, logistic and quality assurance authorities and to other departments and agencies on all aspects of shipboard electrical systems involving motors and generators and their associated equipment. Establishes construction features, performance standards and other characteristics to ensure that operational and environmental demands are met. Submits projects plans and recommendations for approval and discusses their implications with the supervisor and other authorities concerned. Reviews proposals for systems and equipment to ensure compliance with sound engineering practices. Studies systems and equipment in use or proposed for use in merchant ships and other navies to identify features that may be of interest or value to the department.

Develops modifications to existing equipment and installations to overcome operating problems or improve reliability. Studies performance and failure reports to establish the probable cause of trouble and selects the corrective action to be taken and arranges for trial modification. Assesses reports of trial modifications and making further changes if necessary. Recommends changes in design or operating and maintenance procedures. Initiates revisions and amendments to specifications, standards, drawings and support publications.

Supervises the activities of three subordinate engineers. Assigns and schedules work, reviews work for accuracy and conformance with standards and specifications. Gives advice and guidance on engineering and other problems, and approves leave, appraises performance, and resolves other administrative problems.

Specifications

Scope for Initiative and Judgement

The work requires initiative and judgement in analysing the requirements of a project, establishing objectives for the component parts of a project, determining likely approaches to problems, and initiating investigations and studies. Judgement is required in accepting tenders for design and construction of a system or equipment, identifying the need for, and making changes in manufacturers' proposals and specifications to ensure achievement of objectives, evaluating the results of tests, and providing advice to other engineers and officials on the implications of new installations.

Problems are resolved by applying accepted engineering practices in novel ways. Unusual problems are discussed with senior engineers, colleagues and engineers and officials of consultant firms and manufacturers.

Plans and unusual features are reviewed for feasibility, approach, and conformance with project directives and budgetary limitations. Technical work is usually accepted as accurate, guidance is available for review of unusual features.

Responsibility for Recommendations, Decisions and Commitments

Recommendations are made on such matters as the type of equipment or combinations of equipment to be installed in new construction or in ships undergoing refit. Recommendations are also made in estimating project costs, on changes in design, and operating procedures of existing installations, the acceptability of tenders and the award of contracts. Decisions are made in determining requirements, establishing specifications needed to meet the requirements, and developing modifications to equipment and systems to improve reliability and overcome operating problems. Decisions are also made on the nature and extent of changes needed to bring the manufacturer's proposals up to the standards established by the project specification. Commitments are made in estimating costs, making recommendations on equipment, specifications, acceptability of tenders and contractors' proposals, and establishing courses of action to be taken. The results of ineffective work can be delays to the ship building program, the acceptance of inferior systems and equipment, and over-expenditure of funds.

Knowledge and Skill

The work requires a thorough knowledge of the theory and principles of electrical engineering and the practices applicable to the design, production and installation of shipboard electric generators and motors and their associated equipment. The work also requires a good knowledge of related fields such as naval architecture, sea logistics and contract administration, and of the demands placed upon electrical equipment by the sea environment and operational requirements of a warship. The work requires skill in determining the detailed requirements of a project, developing specifications, identifying and correcting engineering errors appearing in manufacturers' proposals, and evaluating tenders in terms of technical adequacy and conformity with specifications. The work also requires skill in consulting with manufacturers to ensure that the material requirements of the department are met.

Responsibility for Contacts

The work requires contacts with procurement officers to clarify design requirements and explain engineering considerations. The work also requires contacts with departmental colleagues in other engineering fields to plan and co-ordinate activities and to resolve mutual problems; with engineers in contracting firms to resolve problems; and with engineers in general to keep informed on new electrical engineering concepts and practices related to power-generating equipment, motors and associated equipment.

Responsibility for Supervision

The work requires giving assignments and instructions, advice and guidance to other engineers and senior technicians. Work of contractors and own staff is reviewed in progress and on completion for accuracy, achievement of objectives and conformance with accepted engineering practice. This work is performed on a continuous basis.

LINEAR ORGANIZATION CHART

Maritime Electrical Systems Engineer

Chief, Maritime Equipment

- Head, Generators and Motors Section

- **Maritime Electrical Systems Engineer* EN-ENG 4**

- Engineer (3)

* Project staff not shown.

BENCH-MARK POSITION DESCRIPTION

Bench-mark Position Number: 15

Level: ENG-5 (Line)

Descriptive Title: Regional Superintendent, Systems Engineering

Reporting to the Regional Manager, Facilities Engineering and Systems Development:

Plans regional electronic systems engineering projects, comprising a portion of the regional engineering program to meet demands on the Transport Canada Air Navigation System (ANS) as stated by the operational branches and the users of this system. Through continuing liaison with authorities of user branches, maintains a thorough knowledge of the operational requirements and explains technological advances which will provide cost or operational benefits. Reviews and discusses plans and needs of airlines and user branches to develop short-range and long-range plans for provision of electronic systems, equipment and resources. Develops cost estimates and prepares approval documents for projects included in the capital program plan. Negotiates and recommends cost-sharing agreements with provincial governments, commercial interests and other federal agencies.

Directs the engineering design of electronic systems to meet own portion of the planned program. Directs or undertakes cost/benefit analyses and studies in system design and installation to ensure the optimum engineering solution is provided to meet operational requirements. As the regional engineering authority, approves engineering designs, standards and installation practices for projects in the delegated regional program. Approves the statement of requirements, evaluates and accepts ensuing electrical, mechanical and architectural designs for site work to be done by other branches or agencies.

Establishes objectives and priorities, assigns staff, approves workplans and schedules and controls expenditures to ensure successful implementation of approved projects. Determines the requirement for, selects and hires consultants. Directs the analysis of proposals and the award of contracts. Arranges for necessary land and protective easement procurement and directs site development work done by other branches or agencies. Ensures the proper application of engineering standards to all project work and approves all design changes. Directs the final proof of performance testing of new systems and ensures all deficiencies are corrected prior to handover to maintenance and operational authorities.

Plans, directs, coordinates and controls maintenance engineering activities to ensure continuing operation of ANS electronic systems in the region. Directs studies and tests of new equipment and modifications to existing equipment in order to identify changes which will reduce maintenance costs or improve system performance. Establishes processes for data acquisition and analysis to assess system performance and the effectiveness of maintenance activities and to identify requirements for future systems which will correct engineering deficiencies. Coordinates and controls provisioning for new test equipment required for the design, testing and maintenance of equipment in the field.

As the regional authority, assesses plans for new structures such as hangars and transmission lines for interference they might cause with ANS electronic systems. Approves these plans when they comply with protection standards or identifies changes required to minimize any interference. Justifies decisions to municipal, provincial and private officials when such changes are expected to have major financial impact. Recommends to engineering authorities in Headquarters design changes and revisions of standards. Provides engineering advice and exchanges information with the other government agencies and industry to establish requirements for new systems and maintain currency with new developments in the engineering and managerial fields.

Implements an effective organizational structure, establishes goals and delegates responsibilities to ensure that the objectives of the engineering division are met. Appraises work performance, plans training, provides guidance and advice to develop engineering, management and technical staff abilities. Administers the provisions of several collective bargaining agreements and implements the departmental Occupational Health and Safety Program in the region.

Specifications

Scope for Initiative and Judgement

The work requires initiative and judgement in planning, organizing and implementing projects, including establishing an organization, setting project objectives, developing engineering work plans, establishing schedules and priorities, tasking regional office staff, negotiating with and hiring consultants, tendering for and awarding contracts, identifying and analyzing engineering problems and determining effective solutions to those problems. Approaches to problems are based on sound engineering and management practices. The work also requires judgement in determining optimum engineering designs and configurations in consideration of conflicting benefits of cost, operational performance, maintainability and safety to users and in determining workloads, delegating responsibilities, establishing budgets, approving engineering designs, evaluating and approving engineering design changes and accepting contracted work.

Work is assigned in terms of objectives. Budgets are also reviewed for conformance with direction and to ensure that objectives are achieved and budgets are adhered to.

Responsibility for Recommendations, Decision and Commitments

The work requires making recommendations to the Regional Manager on human and financial resource requirements and for approval of project budgets, own portions of program submissions, project plans, contract awards, changes in project plans and acceptance of works. The work also requires making recommendations on unique or unusual engineering designs and on deviations from regional or national standards where it is deemed essential to do so. The work requires making decisions on the selection of staff, applicability and feasibility of proposed operational, functional and technical requirements and specifications, scheduling and prioritizing of project funds.

The work requires making commitments in assignment of staff to various projects or phases of projects, delegating authority to staff, assignment of tasks to other work units, approval of plans, engineering designs, specifications and works, entering into contracts with consultants and contractors and approval of engineering change proposals. Ineffective work may not be detected until completion of work and may result in considerable slippage of schedules, cost overruns or deterioration in the operational usefulness of the facility.

Knowledge and Skill

The work requires a thorough knowledge of project management principles, practices and techniques and of engineering principles, practices and standards applicable to air navigation electronic systems. It requires a good knowledge of the Transport Canada Air Group policies and procedures, civil aviation requirements, Air Traffic Services and airports operations as related to electronic systems. It also requires a knowledge of engineering and construction principles and practices applicable to building and structure construction. The work also requires a knowledge of departmental operations and interfaces between headquarters, regions, sites and other departments. The work requires skill in developing work plans and schedules, organizing work, estimating costs, establishing priorities, delegating responsibility and authority, assessing the work of professional, technical and support staff and evaluating engineering proposals.

Responsibility for Contacts

The work requires contact with senior officers in other federal departments such as Environment Canada, Communications Canada, Public Works Canada, National Research Council, Department of National Defence, Supply and Services Canada and Treasury Board to obtain specialist advice, exchange information pertinent to the project or obtain concurrence or approval on proposals or submissions.

It requires contacts with heads of managerial, operational and technical sections at headquarters and region regarding network planning and scheduling, operational details, technical guidance and assistance, coordination with other projects and policy interpretations. Contacts are also made with provincial and municipal authorities regarding construction codes and unions and the public regarding project progress.

Responsibility for Supervision

The work requires directing the activities of engineers, electronic technicians, trades and administrative support staff, working both full-time in, or on a secondment or part-time basis to the Division. Planning, technical and administrative control is achieved through discussing project requirements, plans and schedules, delegating responsibility and authority for specific work, reviewing proposals and reports on progress or completion of work, advising on techniques and administrative procedures and evaluating and appraising work performance.

LINEAR ORGANIZATION CHART

Regional Director

- Regional Manager Facilities Engineering and Systems Development

- **Regional Superintendent, Systems Engineering* EN-ENG 5**

- Maintenance Engineer
- Supervisor, Installations
- Supervisor, Electronic Engineering
- Automation Maintenance Engineer
- Supervisor, Outside Plant

* Seconded and part-time staff not shown.

BENCH-MARK POSITION DESCRIPTION

Bench-mark Position Number: 16

Level: ENG-5 (Staff)

Descriptive Title: Head, High Reliability Laboratory

Reporting to the Chief, Advanced Devices, Power Systems and Reliability Group:

Plans, organizes and controls the activities of professional and technical staff engaged in electronic device reliability investigations, including destructive physical analysis, failure analysis and reliability analysis in a variety of electronic, electrical and electromechanical components, devices and materials to be used in space electronic applications. Defines and assigns tasks to appropriate professional and technical staff, provides guidance as required. Reviews and approves technical reports prior to their release.

Prepares estimates for budgetary purposes and controls the expenditure of allocated human and monetary resources. Makes recommendations to the Chief regarding the upgrading or purchase of new equipment. Is responsible for the HRL (High Reliability Laboratory) inventory and for the letting and overseeing of appropriate maintenance contracts. Negotiates and interacts with Canadian industries for the use of HRL equipment and services on a cost recoverable basis.

Initiates, plans and conducts applied research in the field of semiconductor devices, circuits and materials reliability for space applications. Maintains an expert knowledge of technologies, processes and materials related to the fabrication of semiconductor devices and circuits. Identifies areas of research which could be of potential benefit to in-house development projects, industrial development projects or to reliability aspects of space hardware. Investigates new methods and procedures for performing reliability analyses and identifies areas where new techniques are needed. Assesses and evaluates reliability aspects of fabrication processes where used in electronic devices.

Provides advice and consultation to own, other government departments and to Canadian industry in the area of electronic devices and component reliability operating in space or other harsh environments. Provides technical advice on industrial and university research contracts and participates in joint government/industry development projects such as those sponsored by the National Research Council.

Specifications

Scope for Initiative and Judgement

The work requires initiative and judgement in identifying and analyzing problems, determining likely approaches to their solution, and devising, directing and conducting tests and experiments. Judgement is required in selecting methods, equipment and materials most likely to give satisfactory solutions, evaluating test results, applying theoretical approaches to solve practical problems, and giving engineering advice. The work is reviewed for conformance with directives and for progress towards stated objectives; the Chief and other scientists are available for consultation; projects are established and are implemented within budgeting limitations and own resources; engineering decisions and recommendations are not usually questioned.

Responsibility for Recommendations, Decisions and Commitments

Recommendations are made to the Chief of the Group on the feasibility of proposed projects and on the desirability of committing the section to such projects, in terms of capacity, effects on other projects, and usefulness. Recommendations are also made on matters concerning procurement of new equipment, development plans for the section, contracting or service to industry and unusual administrative matters. Professional advice and guidance is given to engineers and scientists on technical problems associated with electronic solid-state devices and reliability. Recommendations and advice are also given on similar matters to technical committees.

Decisions are made in determining areas in the field of electronic device reliability which are suitable for investigation, determining the objectives of a project to carry out the investigation and defining the project, and determining the approaches to be taken, processes to be tested and equipment to be modified or purchased to attain the objectives established. Decisions are also made in regard to the selection of suitable areas for development contracts in industry, and the selection of suitable contractors to perform the work.

Commitment of resources to a project is made in conjunction with the Group Chief on the basis of such factors as the complexity of the problems involved, probability of achieving satisfactory solutions and availability of resources. Once the project is accepted, human resources, laboratory facilities and funds are committed to the device investigation, modifying or purchasing equipment, and devising methods and techniques to achieve objectives.

Ineffective work can result in delays to other projects within and outside the Directorate, or lead to erroneous conclusions and financial penalty. Underestimating a problem can result in a commitment of significant resources without success in reaching satisfactory results.

Knowledge and Skill

The work requires an advanced knowledge of the theory and principles of solid-state devices and technologies, metallurgical engineering, and the equipment used for reliability testing of advanced microelectronic devices and circuits. A good knowledge of interface properties as related to semiconductor devices is also required. Skill is required in the use of scanning electron microscopes, Auger electron microscopes, X-ray microprobes and other analytical equipment, as well as in interpreting results. The work also requires skill in recognizing and evaluating the magnitude of a problem, in selecting the course of action most likely to achieve satisfactory results, and in choosing the equipment and material resource most likely to lead to the solution of the problem. Skill in the management of research laboratories, report writing, personnel instructions, and project leadership is also required. Skill is also required in developing cooperative relationships with officials of other government departments, industrial firms and research organizations.

Responsibility for Contacts

The work requires contacts with senior scientists, engineers, and officers of other government departments and agencies (such as Department of National Defence, National Research Council, Supply and Services Canada and Ministry of State for Science and Technology), senior researchers in universities, and engineering managers in industry. These contacts are for the purpose of providing and exchanging specialist advice, recommendations, and consultant services in the field of device reliability and for the supervision of contract work.

Responsibility for Supervision

The work involves assigning work and providing guidance on methods or procedures to be used and specific objectives to be achieved to a small subordinate professional and technical staff. Work of subordinates is reviewed in progress and on completion. This work is carried out on a continuous basis. The work also requires the occasional direction of technical services such as drafting or machining and of contractors engaged to carry out maintenance work.

LINEAR ORGANIZATION CHART

Head, High Reliability Laboratory

Director, Space Electronics

- Chief, Advanced Devices, Power Systems and Reliability Group
 - **Head, High Reliability Laboratory EN-ENG 5**
 - Reliability Engineer (2)
 - Device Physicist (2)
 - Technician (2)
 - Project Leader, Advanced Devices Technology
 - Manager, Micro-electronics Facility Project
 - Leader, S/C Power Systems Research Scientist

BENCH-MARK POSITION DESCRIPTION

Bench-mark Position Number: 17

Level: ENG-5 (Staff)

Descriptive Title: Head, Technical Development, Harbours and Ports

Reporting to the Chief, Economic and Technical Development:

As the Transport Canada technical authority for ports development, develops national technical policies, standards and guidelines for the design, inspection and maintenance of public ports to ensure that adequate facilities are provided for the movement of domestic and international trade.

Conducts technical assessments of submissions for major projects to develop, improve and maintain public port facilities to ensure conformance to policies and standards. Determines the need for additional preliminary work such as site investigations or feasibility studies to obtain technical data essential for planning, designing and cost estimating. Assesses the technical feasibility and cost estimates and the environmental impact of proposed projects. Proposes alternatives and recommends changes to project proposals in order to avoid construction, maintenance, scheduling or cost problems. Recommends approval of project proposals for inclusion in program forecast or for submission to the Treasury Board.

Provides technical advice to operational, financial and economic planners to assist them in the development of effective plans and forecasts for construction and maintenance of port facilities. Examines strategic port development plans to determine technical requirements and the need for special studies. Defines terms of reference and selects consultants or other government agencies to conduct feasibility, research and development studies to ensure that the latest technological developments are available for use in public ports. Develops and maintains a system to identify, and collect technical data to assist in the preparation of public port policies and development plans.

Represents the branch on technical committees pertaining to ports development and in discussions with Public Works Canada concerning project priorities and contractual problems. Meets with representatives of other governments, port associations, consultants and contractors to explain technical policies, standards and specifications. Presents technical papers and reports to international organizations, engineering associations and other groups interested in the ports and shipping industries.

Provides functional direction to technical specialists in the regional offices to ensure that policies, standards and guidelines are properly applied. Reviews and approves major technical studies and significant changes to projects undertaken by the regions. Recommends appropriate training and development for regional technical specialists. Supervises two engineers and one drafter.

Specifications

Scope for Initiative and Judgement

Initiative and judgement are used in the development of technical policies, standards and guidelines for port equipment and facilities; in the development of policies for the inspection and maintenance of port infrastructures, equipment and facilities; in recommending the introduction of new technological criteria and standards; in the initial conduct of feasibility studies; in the assessment of the technical feasibility of capital and maintenance projects; and in the technical assessment of strategic port development plans. The work also requires initiative and judgement in advising senior officials in the Administration, related departmental agencies, provincial and municipal governments, ports and associations on technical proposals, construction and maintenance programs, and interpretations and explanations of policies, standards, guidelines and contractual arrangements.

Responsibility for Recommendations, Decisions and Commitments

Recommendations are made as to technical policies covering the development and maintenance of adequate public port facilities. Recommendations also are made on the selection of consultants and research organizations, on the feasibility and approval of construction proposals, on the priority to be assigned construction proposals and therefore in the make up of the public port program.

Decisions are made in the determination of national technical requirements for port facilities in a changing transportation environment and in the development of national technical standards and guidelines. Decisions are also made in the guidance of technical specialists and support staff in five public port regional offices.

Commitments are made in coordinating the views and requirements of varied and sometimes conflicting interests; in discussions at interdepartmental, regional and local conferences and in recommending acceptance of Harbour Commission and public port regional proposals.

The incumbent of this position must seek to make the most effective use of resources in a competitive industry which, because of the size and nature of its trade must constantly weigh large long-term investments for facilities against trade patterns which are subject to change at short notice. Ineffective work could cause the transfer to American ports of much of the international trade upon which major ports depend and result in major loss of employment opportunities and increased costs to Canadian consumers. Decisions and recommendations significantly affect the development and maintenance of about

560 public port facilities with a book value of \$750 million; and the expenditure of some \$30 to \$50 million annually on public port capital and major maintenance projects; and about \$10 million annually on the federally funded portion of Harbour Commission projects.

Knowledge and Skill

The work requires a thorough knowledge of port facility engineering and operations, or modern management principles and practices, and of current marine and engineering technology pertaining to the construction and maintenance of port facilities. It also requires a good knowledge of transportation systems and technology and experience in establishing effective working relations, communicating effectively, and managing technical organizations.

Responsibility for Contacts

The work requires contacts with port management, engineers and consultants to examine facilities and facility proposals, exchange views and opinions, and seek agreement on design concepts, priority and phasing. Contact also is required with representatives of provincial governments and local municipalities to seek agreement on technical concepts when provincial funding or municipal participation is involved and to exchange views on port facilities, with representatives of other federal departments to arrange contractual matters and to resolve interface problems and with consultants and associations to provide interpretations and clarifications of such matters as technical procedures, standards and guidelines and to discuss contractual arrangements.

Responsibility for Supervision

The work requires the supervision of a small professional and support staff at headquarters and the direction of technical specialists and support staff in five regional offices across Canada.

The work also requires giving guidance in interpretation of policies and application of standards. Proposals for major projects and significant changes to other projects, while originating in the region, are referred to the Head, Technical Development for review and approval. Contractual difficulties are also referred to this position for resolution.

LINEAR ORGANIZATION CHART

Head, Technical Development, Harbours and Ports

Chief, Economic and Technical Development

- **Head, Technical Development, Harbours and Ports EN-ENG 5**
 - Drafter
 - Engineer (2)
- Economic Studies and Development Officer (2)
- Port Operations Adviser

BENCH-MARK POSITION DESCRIPTION

Bench-mark Position Number: 18

Level: ENG-6 (Staff)

Descriptive Title: Manager, Central Utilities Division

Reporting to the Director, Mechanical Engineering:

As the federal government's authority on the planning, design, construction and operation of central utilities, directs, plans and organizes the activities of the Central Utilities Division to ensure the effective achievement of reliable, efficient and safe central heating and cooling plants servicing government complexes across Canada. Initiates and implements the overall philosophy, standards and criteria for design governing central plants (heating and cooling), including the distribution systems (telethermics). Initiates and directs long-term planning to ensure that current central utilities installations can meet future requirements or to assess the need for new or modified facilities in conjunction with government building or retrofitting programs. Oversees planning and design work carried out in-house or by consultants and provides consultation to other government departments and agencies with respect to central utilities.

Initiates, develops and implements engineering standards and specifications governing the economical design, construction, operation and maintenance of central heating and cooling plants including standards dealing with the design and operation of boilers, fuel burning equipment, fans, heat recovery systems, boiler and chiller controls, chemical water treatment and air pollution abatement equipment. Monitors the operation of all central utilities to ensure that operating and maintenance standards are modified or new ones developed to resolve problems and to maintain high standards of service and economy.

Provides an authoritative technical consulting service to government departments on all aspects of central heating and cooling plants and associated distribution systems. Maintains, within the Division, technical expertise in the field of plant operation control, particularly in the application of computers to automation and monitoring. Maintains an expert knowledge of provincial operating acts, Gas Utilization Codes, Fire Commissioner's requirements and Canada Labour Code regulations. Maintains an awareness of current technology and researches new technology through national and international contacts with engineers, manufacturers, contractors, government and other organizations concerned with central heating and cooling requirements and services, such as the International District Heating Association and the Instrument Society of America.

Defines objectives and allocates projects and studies to in-house engineering teams or consultants to implement the program. Directs in-house design teams. Directs the translation of program requirements into appropriate project briefs delineating required performance and engineering standards for the consulting firms hired to carry out design work and to prepare feasibility studies, reports and construction plans and specifications. Directs the selection and recommendation of consultants, their briefing and the monitoring of their performance and the review of their reports, studies, design work and plans and specifications. Provides expert technical advice to own and other government departments' program and project managers through all phases from long range planning to post construction evaluation.

Scope for Initiative and Judgement

The work requires making delegated engineering decisions for the short- and long-range planning, development and conduct of activities related to central heating and cooling plants. The Director, Mechanical Engineering, and directors of other engineering and architectural disciplines are available for consultation. Guidance is provided in the form of policy statements, directives, stated objectives and decisions made at senior staff meetings concerning action on proposed building programs. Initiative and judgement are used in analysing and evaluating the implications of programs and the availability of resources; defining projects, setting objectives, and establishing schedules or priorities within the intent of branch objectives; and devising adequate, methodical and economical courses of action to deal with problems as they arise. Design and construction costs must be kept as low as possible consistent with minimum life-cycle costs, trouble-free operation and minimum maintenance.

The work requires judgement in assessing advice and recommendations given by consultants and regional engineering staff to establish realistic program objectives in relation to policy, resources, priorities, costs and other implications. Own recommendations are reviewed for interpretation of directives, not for engineering content.

Responsibility for Recommendations, Decisions and Commitments

The work requires making recommendations to the Director, Mechanical Engineering and senior program and project managers in own and other departments on matters such as the technical viability of projected central utilities installations, their cost and anticipated completion date, and the resources required for their completion. Recommendations are also made on the optimum mix of resources and responsibilities between the Central Utilities Division, the regional organization and private consultants.

The work requires making decisions regarding the location and design of each central utilities plant, and its distribution system and on the selection of components to optimize system efficiency, and to lower maintenance costs. Decisions are also made on the adequacy of existing standards, design and construction criteria, systems and procedures, the best method of correcting inadequacies, the development of new or improved standards and procedures and their application.

The work requires making commitments in advising senior and principal officers in own and other departments and agencies, providing specialist advice and direction to regional construction engineering units, contractors, consultants and other supporting agencies.

The work has a significant influence on the cost and efficiency of multi-million dollar central utilities installations in government complexes across Canada. Ineffective work can lead to significant cost overruns, waste of resources, safety hazards and erosion of confidence among departments serviced.

Knowledge and Skill

The work requires a thorough knowledge of the theory and principles of mechanical engineering, and particularly of thermodynamics, engineering practices and other current practices as applied to the design, construction, location and operation of central heating and cooling plants and their associated distribution systems.

The work also requires a good knowledge of electrical and structural engineering, planning and construction management techniques, costing and building and related codes. The work requires skill in assessing proposals and determining their implications, determining the need for changes in design and construction standards, organizing divisional work and integrating it with regional design and construction centres. The work also requires skill in dealing with senior officers of client departments and agencies and negotiating with contractors.

Responsibility for Contacts

The work requires contacts with senior level officers in own and client departments and agencies, chief engineers of consulting or construction firms, and other organizations in Canada and abroad. These contacts are for the purpose of providing consultative services, and exchanging advice and information, obtaining agreement on central utilities designs, and keeping up-to-date on central heating and cooling technology.

Responsibility for Supervision

The work requires directing the activities of a staff of specialist mechanical engineers, technical support persons and design drafters in a specialist engineering division, providing consultant and design services to the department and other client departments and agencies and the direction of regional staff with respect to all central utilities matters. Additional staff may be added to the division to accommodate specific project demands. The work also requires overseeing the work of contractors and evaluating the results of their work on large, complex projects.

LINEAR ORGANIZATION CHART

Manager, Central Utilities Division

- Director, Mechanical Engineering
- **Manager, Central Utilities Division* EN-ENG 6**
 - Telethermic Specialist
 - Central Heating Plant Specialist
 - Technical Officer Utilities
 - Combustion Specialist
 - Burner Technologist (2)
 - Instrumentation Technologist
 - Drafter (2)
- Manager, Building Consulting Division
- Manager, Penitentiaries Mechanical Services Division

* Additional staff are added to accommodate specific project demands.