# REVIEW OF AWARD PLANS FOR INVENTORS AND INNOVATORS

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By

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## **REVIEW OF AWARD PLANS FOR**

## INVENTORS AND INNOVATORS

## INTRODUCTION

The Treasury Board revised policy of awards for Public Service Inventors and Innovators, approved in June 1993, requires that departments and agencies of the Federal Government establish departmental award plans. The purpose of this review is to provide the Technology Transfer Office of Environment Canada with information that will enable them to finalize their proposed departmental award plan that will allow inventors and innovators to share in the financial benefits accruing from intellectual property developed or owned by Environment Canada.

#### METHODOLOGY

Government departments were surveyed to determine their policies and practices in rewarding scientists, engineers and other staff in accordance with the Treasury Board Policy of 1993. Information on reward programs for inventors and innovators in the private and university sectors in the U.S. and Canada was obtained by telephone interviews, from information available on the Internet and from literature on R&D management. Time constraints meant that the number of interviews was limited.

## AWARD POLICIES AND PRACTICES OF GOVERNMENT DEPARTMENTS OTHER THAN ENVIRONMENT CANADA

Government departments were surveyed to determine what their policies are on rewarding scientists, engineers and other staff in accordance with the TB policy of 1993, the range in percentage of licensing revenues used for awards, the number and dollar range of individual awards, the definitions used in determining potential recipients of awards, and the approval level for awards.

Detailed information on each department interviewed is given in Annex A and is summarized in the text below and in Table 1.

#### Policies

Natural Resources Canada (NRCan) units have finalized policies and guidelines on awards to inventors. Agriculture and Agri-foods Canada (AgCan), the National Research Council (NRC), the Department of National Defence (DND) and the Communications Research Centre (CRC)

	Policy Documents	Percent Range	Dollar Range	Number of Awards/Yr	Recipients	Approval
AgCan	Proposal in draft	15-35	\$1000- 20,000	25	Inventor Innovator	Mgr Resp. Centre
CANMET	Yes	15-35	\$100- 7,000	NA	Inventor Innovator	ADM
GEOMATICS	CANMET Policy		\$200- 9,000	None since 93	Broad	Small awards: DG Main awards: ADM
CFS	Yes	15-35	\$100- 2,500	10	Broad	DG
NRC	Proposal in draft	15-35	\$500- 20,000		Inventor TT Team	President
DND	Proposal in draft	\$1000: 35% Over \$1000: 25% for 2 yrs; 30% for 3yrs; 35% after 5yrs	\$100- 16,000	30-40	Inventor	DPatA
F&O	None	\$1000: 100% Over \$1000: 25%	\$,1000- 5,000	15	Inventor	DM
CRC	Proposal in draft	15%	\$2.50- 7,000	46	Inventor TT Team	President
AECL	None	None \$500 patent filing; \$500 when patent granted		12/yr	Inventor	Automatic
Health Can	In develop- ment	NA	NA	1	NRC defn	NA
DOE	Proposal in draft	15%-35%	\$100- 56,000	11-14	Broad	Mgr Resp. Centre

 Table 1. Summary of Government Award Practices

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have policies in draft form and emphasized that the policies are still being reviewed. Although Fisheries and Oceans (F&O) has not yet developed a departmental policy, they are applying the 1993 Treasury Board Policy. Atomic Energy of Canada Limited (AECL) is a Schedule III agency under the Financial Administration Act and is exempt from the 1993 Treasury Board Award Policy.

## Range in Percentage of Licensing Revenues used for Awards

Although there are some minor differences in the NRCan divisions (CANMET, Geomatics Canada and Canadian Forestry Service), the scope of the policies is basically the same. The range of licensing revenues used for awards is 15% to 35%, in accordance with the Treasury Board policy.

CANMET and Geomatics Canada guidelines suggest that within this range, 15% be allocated to "conception and reduction to practice" of the invention; an additional 10% be awarded for essential participation in the "development" stage; and a further 10% for essential participation in the "commercial validation and production preparation" stage.

Forestry Canada guidelines suggest that the first 15% should go to the named inventor(s) on the PSIA forms and the remaining 20% should be shared by significant team members, including the inventor and collaborators, with the actual amount each receives to be determined by the contribution of each in the various stages of development and participation in the commercialization and technology transfer efforts.

In effect, Natural Resources Canada suggests that the inventor(s) receive 15% of royalties and the remainder be shared by those involved in the development and commercialization of the invention. The latter group could, but does not necessarily include, the inventor(s).

The proposed AgCan guidelines state that the Responsibility Centre Manager shall determine the amount of the award, which must be within the 15% to 35% limits as outlined in the Treasury Board policy. The preamble notes that "eliminating the flexibility could minimize the 'cost' to the department, if the percentage were fixed toward the lower end of the allowable range".

NRC would not supply us with a copy of their draft policy but stated that the percent range would comply with the Treasury Board policy. Another NRC respondent stated that they are considering increasing the percentage of royalties shared with the innovation team to 50%.

At present DND pays 15% of royalties to the inventor. The draft policy proposes that 35% percent of revenues be paid for royalties up to \$1000; for royalties over \$1000, payment be \$350 plus 25% of royalties over \$1000 for the first two years; \$350 plus 30% for the next three years and \$350 plus 35% after five years.

F&O pays the inventor 100% of the first \$1000 of royalties and 25% of royalties over \$1000.

CRC's proposed policy is to pay a maximum of 15% of royalties.

Atomic Energy of Canada Limited does not pay a percentage of royalties to inventors. They award \$500 to the inventor on patent filing and another \$500 when a patent is granted.

#### Dollar Range for Awards

The actual dollar amounts paid to individuals range from \$100 to \$20,000. AgCan and NRC said their highest single awards were in the \$20,000 region; DND's largest award was about \$16,000; the other departments' maximum individual payments were under \$10,000.

#### Number of Award Recipients

Most departments provided 'best estimates' of the numbers of award recipients. The numbers are given in Table I.

#### Definition used in Determining Potential Recipients

With the exception of F&O and AECL the actual and proposed policies and guidelines for the departments contacted all use broad definitions for potential recipients. The proposed AgCan policy and the NRCan division policies all state that awards may be given to inventors and innovators. The proposed AgCan policy states that technology transfer and commerce officers would only qualify under the definition of innovator if their contributions far exceed the scope of their normal duties. The NRCan guidelines suggest that persons involved in commercialization activities may be considered as potential recipients of a part of the reward. NRC and CRC are proposing that inventors and members of the technology transfer team be eligible for awards.

The DND definition of "inventor" includes producers of software and other work that can be copyrighted, but does not extend to marketing personnel.

#### Approval Level for Awards

Approval levels for awards varied from division manager to deputy minister.

#### Effect on Morale

Managers in a number of government laboratories were contacted to obtain their opinions on the effects of the federal government's award plan for inventors and innovators on the morale and work of their laboratories.

In general, the awards under the plan are not viewed as a primary motivator for scientists and engineers. Scientists and engineers invent things in the course of their work and if there is an award they are prepared to accept it. However, the amount of the award is usually not significant enough to be a motivator. Most respondents said that recognition of an achievement is more of a motivator than the actual sum of money involved.

Most respondents do not believe there is any jealousy among co-workers of award recipients. There is admiration and probably some envy in that some people work in areas where technology development is possible and others work in areas where the possibility of technology development is non-existent.

One respondent suggested the reward might be a demotivator because the amount of the award is not worth the effort involved in commercialization.

One Fisheries and Oceans respondent, who is a recipient of an award under the TB policy, said that recipients should be told what percentage of total revenues they are receiving. Inventors and developers of the technology generally keep in touch with the companies commercializing the technology and know how many "widgets" the company has sold and the selling price. They may perceive the awards to be out of line with company sales. The respondent therefore recommends that financial records related to licenses and royalties be available to the award recipients, and that recipients be told what percentage of royalties they are receiving.

An Agriculture Canada award recipient agrees that the financial details of the awards should be made available to recipients. In his case, he is aware that he receives 15% of the royalties, of which he shares 3% with the technician who assisted him in developing the product. He mentioned that 10% of the royalties, which he believes to be around \$100,000 this year, is retained by the DG for Western Canada to be used to fund high risk projects. Seventy-five percent of the royalties are given to the originating agricultural station. How these funds are distributed is decided at the station. The respondent noted that his present lab does not benefit from his royalties, as he did the work in another lab. He also said that his award is treated as low-key as he just receives a cheque in the mail. He agreed that adequate explanation of the awards program is necessary to head off jealousy among colleagues, i.e., that the laboratory in general benefits. He thought that problems might occur if royalty cheques were very large. Despite this potential problem, he feels that the award is a good idea and acts as a solid form of recognition for the inventor. He also pointed out that it costs the government nothing.

He feels strongly that while the inventor(s) should receive a significant percentage of the royalty stream, the whole team should also receive some of the financial rewards.

In Fisheries and Oceans, the royalties received by the department for licensed technologies are not returned to the laboratory where the technology was developed. Therefore colleagues of award recipients perceive the rewards to individuals as unfair because the laboratory does not benefit from the royalties accruing to the department.

One respondent suggested that an award system presents some problems for managers in that the manager assigns personnel to a project based on the person's skills. People not assigned to potential "money-making" projects may harbour some resentment.

One mentioned that the possibility of an award may make people more aware of technology transfer and speed up the commercialization program.

#### Grievances

A grievance has been filed in one of the departments contacted. It resulted from a departmental employee finding out through the media that a technology he had developed in the late 80s had been commercialized and was being marketed by a private company. Neither the department nor the individual were receiving royalties from the company. The group in charge of patenting departmental inventions told the inventor that they did not have time to monitor the market place. The lack of action by the department resulted in the grievance. The status of the grievance is unknown.

The respondent noted that the lack of interest by the Crown with respect to monitoring the market place, was a powerful demotivator.

#### Mission Drift

Respondents did not believe that an award system leads to mission drift. The actual money involved is not usually large enough to change the direction of the research. Individuals are not in a position to become wealthy on royalties.

Respondents also noted that ensuring the work of the laboratory stays on course is a managerial issue. Managers should know where resources are being expended and have a continuous review process to keep projects on track. A well managed system should quickly identify any mission drift.

## VIEWS OF ENVIRONMENT CANADA PERSONNEL ON AWARD PLAN

Four directors/managers within Environment Canada were contacted to obtain their views on the effects of awards to inventors and innovators on the morale of employees, whether they have any concerns about mission-drift, and the appropriate decision-making and approval level for awards.

The managers interviewed noted that the units in Environment Canada had different mandates and different opportunities for commercialization of technology. Units that conduct research in support of their regulatory mandates do not have the same opportunities for technology commercialization as units with technology development mandates. Within each unit, opportunities for technology development and commercialization differ, depending on the types of projects the different laboratories and scientists are engaged in.

#### Effect on Morale

The general opinion is that the award program to date has had no negative effect on the morale of other employees in the organization. Two respondents did add the caveat that to date, the awards to most members of their units have been small and that if individuals receive larger awards in the future the situation could change.

Two interviewees said that the award program has had a positive effect in that the royalties on inventions benefit both the laboratory and the individual, and that other members of the laboratory are aware of the benefits accruing to the unit as a whole. In one unit, the inventors eligible for an award asked that their personal share of the royalties be returned to the laboratory for at least two years.

When the Treasury Board Policy on awards was instituted in 1993, and following information provided by the Technology Transfer Office, at least one manager held briefing sessions for employees to make them aware that returns to the individual could be as high as 35% and that the rest of the unit would benefit from the royalties being returned to the unit. At award presentation ceremonies, the benefits accruing to the organization, as well as to the individuals, were also emphasized.

All respondents said that, in general, they believe that the scientists are motivated by the work they do, not by the possibility of awards. They are interested more in obtaining money for their own research than in money to take home. Therefore monetary returns to the laboratory are probably more important than personal awards, as they can be used to subsidize or reinforce the research money of other personnel who work in areas that do not afford the opportunities for technology development. In one unit, where individual awards have been relatively high, the laboratory's share of the royalties has been reinvested widely throughout the unit so that everyone is seen to benefit from the commercial success of the technology. The manager noted that in this

case, he feels that there is resentment about the awards in other parts of Environment Canada, rather than in the unit of the persons receiving the awards.

#### Definition of Inventor

Two of the interviewees believe that a wider definition of inventor should be used to accommodate those involved in the technology development and transfer stages. At the suggestion of the Technology Transfer Office, one unit did broaden the definition for an award and held discussions with team members to determine what they perceived as their share in the technology development/commercialization process. The team members were reported as being satisfied with the share of the award they received.

One manager suggested that a percentage of the 35% could be put into a "bonus fund" to be used to award scientists who make a significant contribution to overall value and productivity of the unit, but who work in areas where technology development is not possible.

#### Mission Drift

Mission drift was not seen as a problem by any of the interviewees. The awards are, in general, not very large. The possibility of mission drift is also seen as a managerial issue rather than a problem at the level of the individual scientist. The general opinion was that managers are responsible for ensuring that the work performed in the unit supports the mandate of the unit. Everybody looks for opportunities to commercialize technology but most managers believe that it is easy to manage things to avoid mission drift.

One manager mentioned that they do not enter into research partnership or co-operative research arrangements unless the research supports the mission of the unit.

#### Decision and Approval Level

Three of the respondents believe that the decision and approval level for awards should be at the institute level (the fourth did not respond to this question). Research managers and directors of the institutes are much more knowledgeable about the work of the scientists in their units and the contributions of personnel to successful technology transfer. People in Ottawa are not close to the projects and do not have the knowledge required to make informed decisions on awards.

One suggested that a broader definition of award recipients be used, to include all members of the team working on a project, and that directors be given substantial discretion and be issued guidelines to assist in determining the percentage of the total award that should be given to each member of the team.

## **REWARD PRACTICES AT CANADIAN AND U.S. UNIVERSITIES**

Information on reward practices at Canadian and U.S. universities to recognize commercialized innovations was obtained from telephone interviews, policy documents provided by the institutions or available through the Internet, and from a literature review of practices at major U.S. universities (Katterman 1995). The amount of detail therefore varies. Information obtained is given in Annex B and summarized below.

#### Canadian Universities

At most Canadian universities contacted, including the University of Toronto, University of Waterloo, Queen's University, University of Calgary, Simon Fraser University and the University of Alberta, ownership of an invention vests with the inventor. At the University of British Columbia and McMaster University, as a condition of employment, ownership of inventions is vested with the university. McMaster University is, however, moving to a policy similar to that of the University of Toronto.

At the universities where ownership is vested with the inventor, the inventor can patent and license the invention him/herself or may use the technology transfer related facilities of the university. The latter are usually called Industrial Liaison or Technology Transfer offices. At the University of Toronto, the Innovations Foundation, a subsidiary corporation of the university, facilitates transfer of technology to the private sector. At the University of Calgary, an independently incorporated company, University Technologies International Inc., (UTI) in which the university is a major shareholder, has been set up to provide intellectual property services to university personnel and to other institutions (e.g., Foothills Hospital).

If the researcher decides to use university or university-related facilities, and if the university decides the invention is worth pursuing, the inventor assigns the patent to the university in return for a percentage of any revenues. The technology transfer office then files for a patent, markets the invention, arranges licenses, royalties etc.

Arrangements with the inventor vary, but normally the technology transfer offices recover their costs, retain a percentage of the royalties, and pay the inventor the remaining royalties. The inventor's share can range from 25% to 50% of net royalties.

At the University of Toronto, if the inventor retains rights to and commercializes an invention, the university must receive 25% of net royalties; at UBC, where the university automatically retains rights, the net income is split 50:50 between the inventor and the university.

At the University of Calgary, UTI is now tending to negotiate deals where a percentage of the royalties go to the researcher's faculty and a percentage to the researcher.

The universities have various arrangements for distribution of their share of net royalties. Funds can be put in a fund under the authority of the VP Research (e.g., Simon Fraser) or can be distributed among the inventor's department and faculty and to general revenues (e.g., Toronto, U.B.C.). The University of Calgary receives income as a shareholder of the University Technologies International Inc. but it was unknown how the university uses the income.

#### American Universities

The arrangements for distributing royalties at universities in the U.S. are similar to those at Canadian universities. If the inventor uses the university's facilities for patenting and licensing inventions, the rights are assigned to the university. In most cases, the university recovers the costs involved in patenting, marketing and licensing the technology and the net revenues are distributed among the inventor for personal use, and the inventor's faculty/department and special president/deans accounts to be used for research and academic purposes. A portion may go into general university operating accounts. In the University of California system, funds are also remitted to the State of California.

Some universities base percentages of royalties on gross income, but provisions for recovering costs associated with patenting and licensing are incorporated into agreements.

The percentage to the inventor for personal use is either a fixed percentage (e.g., one-third of net royalties at Iowa State University and Stanford University); or based on a sliding scale depending on the amount of the royalties (usually a lower percentage to the inventor and a higher percentage to the university and/or departments/faculties as the revenues increase.

## AWARDS IN THE PRIVATE SECTOR

Six companies contacted provided information about their awards plans for inventors and innovators. The responses of interviewees reflect North American practices. Subsidiaries in France and Germany must adhere to local laws that require revenues from intellectual property to be shared with the inventor.

In industry, more emphasis is placed on recognition for achievement than on financial awards. Recognition is usually in the form of a commemorative plaque, and sometimes a gift, presented at a special awards ceremony such as a luncheon or dinner with senior company officials present.

Two of the companies (MacDonald Dettwiler Associates (MDA) and 3M Corporation) have a peer award program where nominations for the award are made by peers of the employees in recognition of their work.

MDA has a number of categories for this award including Impact of Innovation, Star Performer and Team Player. The spokesperson said that the recipients value the fact that the awards are from their colleagues.

3M's Peer Recognition Program for personnel in R&D and engineering is one of their most popular award programs. This is a thirteen year-old company-wide program in which anyone can nominate a person for an award. Three categories of nominations are Individual Technical Achievement; Service and Support; and Championing a Product, Process or Technology.

Approximately 400 divisional recipients of the 3M peer awards from across North America and other countries attend, at corporate expense, a banquet and overnight stay in St. Paul, Minnesota to which their spouse/guest are also invited. Winners receive a "Technical Circle of Excellence" plaque as well as a gift worth between \$200 and \$300. At the banquet, 24 corporate winners of awards are announced. Corporate winners are selected by peers, senior scientists and previous corporate winners. These recipients receive a "Technical Circle of Excellence Corporate Globe Award" and they and their partners spend three days at 3M's corporate resort in Park Rapids, Minnesota. Due to budget constraints, 3M anticipates reducing the number of divisional recipients to 200 next year.

In addition to the Peer Award Program, 3M has a Corporate Patent Recognition Program. Patent recipients receive a wooden plaque. Once a year, the patent recipients for that year are invited to a luncheon. A special luncheon with senior R&D management is held for recipients of 20 or more patents.

3M is also famous for its policy of encouraging the more creative members of its scientific staff to use up to 15% of corporate time and resources on personal research projects.

3M's Genesis Grant Program provides between \$25,000 and \$50,000 for researchers to pursue promising research ideas, Although it was not originally envisioned as an award program, it has become a powerful recognition program for grant recipients.

Alcan believes in giving inventors recognition rather than monetary awards. In a research organization, some projects are in areas that do not provide opportunities for patenting, whereas others are in new areas for the company and provide many potential opportunities for patents. If there was a significant income component for inventive activity, people could be reluctant to work in areas that do not afford opportunities for patenting. In addition, giving an award to the named inventor is not good from a team approach as only one or a few people receive credit for the invention.

When a patent is granted, the inventor assigns the patent to the company in exchange for one dollar. A silver dollar in a presentation case is given to the inventor by the lab manager, with colleagues of the recipient present. In addition, plaques with an engraving of the front page of the patent are presented at a dinner attended by the president of R&D, the vice-president of research and technology and senior company personnel.

If the patent results in more than a million dollars of revenue for the company, a copy of the plaque is hung on the "million dollar wall of fame".

Alcan also has a President's Award, which is a substantial monetary award for technical excellence. This award, which has only been given a few times, recognizes extraordinary work. For example, a group that had developed a new casting method that was very important to company operations received the award.

IBM Canada, Xerox Canada and Hewlett Packard in the U.S. have monetary award programs tied to patents.

IBM has a company-wide program for personnel who file for patents, and for those who receive them. Under the patent filing award program, \$1500 is given for the first patent filing, and \$750 for the second and subsequent patents filed. Under the Patent Issue Award Program, \$500 is awarded to each person, up to four, named on the patent. If more than four persons are listed, \$2000 is shared among them.

IBM are now instituting a portfolio for patents that are top producers for the company. A reward ranging from \$2500 to \$25,000 is given to the inventor with the highest 'money-maker' patent during the year. In addition inventors of the top 25% money making patents receive approximately \$1000 each.

In another program, the Plateau Awards, points are assigned for each patent application (three points) and for work that was initially intended for patenting but ended up as a published paper (one point). When an employee has accumulated 12 points, he/she receives the Plateau Award of \$1200. Half of the points must come from patent applications.

IBM does not have a parallel program for software development, nor does it have a royalty sharing program.

Xerox Canada participates in a company-wide program that awards US\$500 to the inventor when a patent is granted. If there is more than one named inventor, each person receives US\$300. In addition, the inventor(s) receive a framed copy of the patent at an annual luncheon, and a second copy is hung in the research facility's hallways. On average, the Xerox Research Centre in Ontario receives between 70-80 patents per year.

Xerox also has an "Eagle Award" which consists of a trophy and US\$1000. for personnel who have been granted ten patents. These are awarded at an ceremony in Rochester, NY. Because they have so many long service technical staff, Xerox is considering implementing another award for recipients of 20 or more patents.

Hewlett Packard's basic program consists of a non-monetary award when a patent is granted. Divisions have flexibility in granting monetary awards. Some divisions give a monetary award on disclosure to their legal departments before any decision is made to file a patent. Some departments also provide a cash award on patent filing. Cash awards tend to be in the region of \$500.

Hewlett Packard programs have been targeted at specific areas of interest to the company to encourage activities in those areas. Decisions on areas to target are made at the local level.

Although the companies contacted do not use royalty compensation plans, they clearly spend a considerable amount of money, directly or indirectly, on their recognition programs.

## OTHER AMERICAN LABORATORIES OR AGENCIES

#### <u>Oak Ridge National Labs</u>

The Oak Ridge National Laboratories (ORNL) in Oak Ridge, Tennessee are a government owned, contractor operated research facility.

At ORNL, each person who is named on a patent application receives \$500, regardless of whether the patent is ever issued.

ORNL also has a Royalty Distribution Program. Twenty five percent of all royalties are shared among employees. Fifteen percent of the royalty received from any one license goes to the inventor(s). The 15% is divided among inventors if there is more than one.

The other ten percent goes into a pool and is distributed among two groups: people who invented something but for some reason their inventions cannot be licensed (e.g., used by government); and people who provided some significant technical or other support to the commercialization process, e.g. a technician who works closely with a company who licenses the technology. Payments can also be given to personnel involved in marketing the technology whose efforts go beyond that normally expected. This ensures that a large number of people benefit from the royalties. A formula, based on a person's contribution to technologies, is used to determine the amount of a reward. Royalty payments continue to be made to retirees but not to people who leave and take another job.

If a patent is issued, there is an inventors forum. For a first patent, the inventor receives a pin in the form of a silver acorn. Another award is given to recognize five patents and a gold pin is presented to recipients of 25 or more patents. An awards night is held annually. This consists of a dinner, award presentation and recognition of the Inventor of the Year.

Lockheed Martin, the private sector contractor, also has a major dinner and awards presentation at which ORNL personnel are well represented among award recipients.

## National Institute of Standards and Technology

A spokesperson in the NIST Office of Technology Commercialization in Gaithersburg, Maryland, said that NIST awards 30% of the revenue stream from licensed technology to the inventor. The remaining revenues go into general NIST overhead. They are not returned to the originating laboratory.

Recipients continue to receive royalties after they leave the government. There is an award ceiling of \$100,000 per year per patent. A Bill before the U.S. Congress proposes raising this ceiling to \$200,000, and returning some of the revenue stream to the originating laboratory.

The dollar value range of the awards is \$200 to \$25,000. This latter amount was a one time payment based on a one time license fee.

## **REVIEW OF THE R&D MANAGEMENT LITERATURE**

Reward and recognition for scientists and engineers has been a popular topic for many years (Clarke and Reavley, 1993). The alignment of an organization's reward and recognition system with corporate objectives is critical if the organization is to achieve those objectives in a timely and cost effective manner.

## DIFFERENT FORMS OF RECOGNITION AND REWARD

#### Recognition

## Rewards

#### Praise

Feedback Private praise Not taking scientists for granted Enthusiasm/support from top mgmt Appreciation Company praise Public praise

## More Responsibility and Authority

Freedom to develop solutions Freedom from red tape Increased responsibility Authority that matches responsibility Budget control Expense account New position

Income

Salary Merit salary Profit sharing Promotion Performance based pay Bonus Patent royalties Bonus for patents Equity position Cost of living adjustment Stock purchase plan Gainsharing Stock options Cash awards Incentive award

### Professional Recognition

Authorship on papers Association awards Fellows program Honours Dinner Plaque/trophy Title Certificate

#### Work Situation

Meeting personal goals Sense of accomplishment Challenging research Interesting/meaningful research Setting joint objectives Team membership Dual promotion ladder Personal interaction with upper management Special parking

## Improved Working Conditions

Satisfying scientists' needs Flexible schedule Adequate resources for projects Earned time off Personalized office redecorating

#### Professional Development

Trip to meeting Membership in prof. association Paid education

#### Benefits

Fringe benefits Retirement plan Membership in country club

#### Source: Koning Jr., 1993

John Koning Jr. (1993) notes that, "managers motivate their scientists and engineers by the work environments they create". An important element in the shaping of a creative work environment is the reward and recognition system. Reward and recognition can take many forms in an organization. In an R&D organization some of most powerful motivators for scientists and engineers involve recognition which does not incorporate any large, direct financial payments to the employees.

In their review of rewards for technical teamwork, Mower and Wilemon (1989) describe the following team recognition rewards:

Publicity in newspapers, company publications and other corporate media Commendation at a company gathering Plaques and certificates Letters of praise Gifts or honourific titles A night "on the town" A trip to a conference Dinner with the CEO Vacations with spouses Grants to charities of the team's choosing Scholarships in the team's name

Mower and Wilemon point out that the above extrinsic awards may not appeal to all members of a team. Some people value intrinsic rewards that come from within; from professional pride in a job well done. For that reason, they suggest that organizations must also put in place the following team awards that appeal to intrinsic motivations:

Being asked to take on difficult challenges Increasing scope of team assignments Increasing the variety of the work Seeking team advice on problems Top managers showing interest; visiting the team Increased freedom and flexibility Use of team outputs Using one team as consultants to other teams "Leadership" shared by team members Opportunity to master new technologies Working in a professionally stimulating environment

In North America, individual rewards are still the norm. Mower and Wilemon suggest that effective team managers balance individual rewards with team rewards to encourage and to show appreciation for productive and creative employees. They suggest the following balance of team and individual rewards:

#### Reward the Team as a Whole

At the start of a project To raise morale When destructive conflict breaks out To create team spirit and cooperation When a milestone has been reached When a tough problem has been solved After a crisis To create solidarity in the face of trouble At the beginning of every meeting Throughout the final stages of a project To celebrate completion

#### Reward Individual Members

When someone has clearly gone "the extra mile"

- To encourage the less assertive
- To encourage a newcomer
- To thank someone who is leaving
- When someone's contribution has been ignored by the team
- To recognize a truly outstanding contribution
- To stir things up when groupthink is beginning to set in
  - When team members vary greatly in the kinds of rewards they want

It is clear from this list that timeliness of the rewards is as important as the reward itself. A reward given too late may be considered a cynical gesture and result in de-motivation.

Given the wide range of reward and recognition approaches, what do companies actually do; what do scientists consider the most effective in motivating them.

In their review of reward strategies for R&D, L.W. Ellis and S. Honig-Haftel (1992) found the following to be the eighteen most frequently used reward systems: (in order of frequency of use)

Increased recognition Salary Small monetary rewards Accelerated promotion More autonomy Patent award program Informal or unpublicized award program Variable bonuses based on issue of patents Fixed bonuses for milestone achievements Increased research budget Options in parent company equity Award for published papers "Nobel-type" award program (inventors club) Large monetary awards Equity in the new venture Options in the new venture Royalty Participants share in venture return

In analyzing the effectiveness of these rewards in encouraging patenting activities, they found that large monetary awards, informal or unpublicized award programs and variable bonuses based on issue of a patent were the most effective stimulators of patent activity. They quote an earlier study of large firms that showed, "that small per-patent or per-application payments were of little value as incentives, while larger monetary awards and recognition have positive effects" on increasing patents (Smayling, 1987).

Ellis and Honig-Haftel conclude that, "whether managers use a people oriented approach or a monetary one, the intensity of application of a reward system is tied to its effectiveness". In the case of monetary awards, "the value of the reward and its method of application also need to be large enough to gain the attention of the scientific and engineering staff". In a review of royalty compensation programs, Shari Caudron (1994) believes that by sharing the commercial rewards that come from a successful product, firms will retain, and more effectively motivate their creative scientific staff to be involved in new product development.

In her article, she describes the royalty compensation programs of several organizations. She states that the Battelle Pacific Northwest Laboratory in Richland, Washington has had a royalty compensation program in place since 1989 partially in response to the 1986 U.S. Federal Technology Transfer Act which calls for a minimum 15% royalty payment to federal employee inventors from licensing income their government laboratory receives, and also from a desire to encourage staff to work harder at transferring technology to private clients. At Battelle, key researchers are entitled to share a pool of funds worth 10% of gross royalties or other proceeds derived from licenses and sales of intellectual property. From 1990 to 1992, Battelle paid out approximately \$200,000 to key contributors, and in the first six months of 1993, payouts exceeded the payouts for all of 1992.

At another government contractor run organization, SRI International at Menlo Park, California, a royalty based compensation plan has been in effect since 1978. There, scientists share a pool of funds worth 25% of license and royalty fees. One of their scientists who developed software to enhance ultrasound imaging has earned over one million dollars in royalties. The director of technology marketing at SRI stated, "The royalty program plays a significant role in encouraging productivity". An additional feature of the SRI royalty program is that 35% of funds from royalties and license fees go to the department where the technology originated. This money is used to buy additional equipment, etc.

Despite the apparent success of royalty based compensation, a 1992 survey of industry by William M. Mercer, Inc. showed that only 7% of U.S. firms offer such compensation packages. According to a survey by the Hay Group, 76% of high-technology companies have some kind of special pay policy, including bonuses, for key technical people,. At Texas Instruments, in Dallas, Texas, an inventor can receive up to \$175,000 in bonuses for a single patent. John McMillan, managing director of William Mercer, Inc., who supports royalty compensation programs, notes that the lack of wide spread use of such programs is due in part to organizations having to answer some important questions in applying them. The questions include: What are we trying to encourage?, What percentage of profits should be returned to the employees?, How do we determine who is eligible?, and What kind of message will this send to employees who don't receive royalties? McMillan believes that by "basing an incentive not on an invention's technical elegance, but on its commercial acceptance, you get the developer to focus on what the customer really wants". He believes that this focus will speed up the technology transfer process.

In a recent review of commercialization of technology from U.S. federal laboratories, Elie Geisler and Christine Clements (1995) found that financial incentives were not as important as non-financial incentives in facilitating technology transfer. Generally, non-financial rewards, such as recognition awards to outstanding employees, were viewed by the laboratory managers as more effective. The employees themselves were not surveyed. Other factors that facilitated technology

transfer were senior management support for technology transfer through policies and resources, and personal contacts between the government laboratories' scientists and those in industry.

In summary, the literature on reward and recognition for creative scientists and engineers tends to emphasize intrinsic rewards over direct financial incentives. Scientists, with a more cosmopolitan orientation, want the opportunity to work on challenging projects that are adequately funded and that will result in some meaningful output that will be recognized by their scientific peers. Whether this output is a scientific paper and/or a new product depends on the culture in the organization and the reward structure. The reward and recognition system must encourage creative employees to take the extra steps needed to ensure new product or process development takes place. That system must be valued by the employees, not just by management. Recent evidence suggests that royalty based compensation programs, although not widely used in industry, can have an effect on the technology transfer performance of scientists or engineers.

It is clear, however, that half-measures in either financial or non-financial rewards will be ineffective, and may backfire. Small financial rewards may be viewed as grossly inadequate where an organization has major earnings as a result of an invention, while limited non-financial recognition efforts may be viewed as insincere.

#### DISCUSSION

## SCOPE OF FEDERAL POLICY ON AWARDS

## Legality of Payments to Innovators and Software Developers

In the opinion of one NRC manager, a serious question arises whether the Treasury Board policy on granting awards to innovators as well as inventors is legal. It draws its authority to pay awards from the Public Servants Inventions Act which specifies that the awards go only to inventors. It is also questionable whether award payments for software development that is normally protected under copyright, and for commercialization activities are covered.

The spokesperson went on to say that it was intended that the Public Servants Inventions Act and/or the Financial Administration Act would be modified to incorporate awards to innovators and others involved in developing new technology-based intellectual property; this was never done.

Environment Canada, along with the other science-based departments should, through the Federal Partners in Technology Transfer committee, approach Treasury Board about modifying the Public Servants Inventions Act and/or the Financial Administration Act so that there is no question about the legality of award payments to public servants other than the inventor.

#### Eligibility

Notwithstanding the above concerns, Environment Canada's Award Plan should allow for revenue sharing among the inventors and those who play a key role in the development and commercialization of government developed and owned intellectual property.

The definitions of who these people are should be clearly spelled out in the policy. For example, the "inventor" should not be limited to just the persons named on a patent. Where appropriate it may include the technician(s) who worked closely with the principal scientist or engineer.

## TYPE OF AWARD

A review of the literature and conversations with private sector officials indicate that the Award Plan should incorporate not only financial rewards, but also recognition. The use of plaques, trophies for cumulative patents and patent earnings, etc. and presentation lunches have a place in reinforcing that technology transfer is a valid and respected part of a public servant's role.

Formal presentation of awards by the minister or deputy minister is suggested for the Environment Canada proposed Award Plan. The importance of these ceremonial occasions cannot be underestimated. Simply getting a cheque in the mail once a year gives the impression that something is happening that is not quite respectable.

#### AWARD ADMINISTRATION

#### Automatic Award

If Environment Canada has a policy of encouraging its scientists and engineers to engage in technology development and transfer activities, then the award of some fixed percentage to the pertinent groups of players should be automatic, and not subject to individual interpretation.

There should be no uncertainty in the minds of the innovation team that they will share in the revenues generated by their innovation if it is successfully marketed.

The actual amounts awarded to each group should be decided in consultation with Environment Canada staff (not just managers) but, in line with other departments, the "inventors" should receive 15%.

#### Transparency of Process

Although legally an ex gratia payment, the government is entering into a business deal with its staff to share income from licensing revenues, or from internal savings.

So that the positive impact of receiving a financial reward is not undermined, the government should provide recipients with a statement of how it arrived at the amount paid each year.

A financial statement will avoid any suspicions that the government is not dealing fairly with the award recipients. As several respondents noted, they are in contact with the firms who are licensing their technology and have a rough idea on how well it is selling. If there are discrepancies between anecdotal data from the firm on sales and the financial statement provided by the department to the recipient, it would signal the need for a further review.

#### Returns to the Laboratory of Origin

The potential for a negative impact on the morale of colleagues in the laboratory by an individual receiving a patent award will be greatly reduced if the laboratory shares in the license revenue stream. Scientific personnel who have no opportunity to develop commercial patents will see that they can still benefit from their colleague's success in developing a profitable technology through provision of research resources to buy new equipment, or to fund research.

Morale will also be maintained if all the people in the laboratory clearly understand how the revenues from licensed technology are applied.

#### Portability of Awards

Where the key inventors are moved along with their program to a new laboratory site, the "non-award" revenue from the license should be transferred to the new site.

Where only the key inventors move to a new laboratory facility, they should bring with them a small percentage of the "non-award" revenue to their new laboratory. This will prevent jealousy and resentment building up in their new colleagues.

#### Uniformity of Awards

There should be uniformity of awards across Environment Canada. If questions of equity and fairness are allowed to arise, they will undermine the positive benefits of the policy and objectives set down by Treasury Board, the employer.

#### MISSION DRIFT

Given the present government's philosophy of revenue generation and retention, it is hard to imagine instances where the mandate of a department would not allow for some activities that would enhance the probability of technology transfer to the private sector.

At the moment, because of the size of most of the awards, there is little likelihood of the bench scientists warping their research programs to a degree that would put their mission-oriented work in jeopardy.

Mission drift is more likely to occur when senior management decides that making money in the short term is more important than carrying on R&D that does not lead to immediate revenue generation. This has been noted in at least one government department. In this particular department, the bench scientists were raising the red flag on mission drift.

#### AUTHORIZATION LEVEL

Although the amounts awarded to the various groups involved in the development and commercialization of government developed and owned intellectual property, the division of the awards among the various players should have local input.

The authorization level should remain as it is so that local management is kept up-to-date on the status of license revenue and the awards received by their staff.

#### CONCLUSIONS

The final result of a successful inventors and innovators award program should be to encourage Environment Canada's scientific staff to take the extra steps needed to commercialize intellectual property when the opportunity arises.

This program should ultimately be self-financing and therefore immune from any outside criticism that unwarranted awards are being given to public servants who are already being paid for their work.

While not a major source of motivation for creative scientific staff, the financial rewards associated with successfully commercializing a technology are a solid form of recognition that the work of the scientist is relevant and being utilized.

Because of the present salary and promotion freeze in the federal government, financial compensation for exceptional performance can no longer be given within the present salary system. In addition, government departments do not have the capability that the private sector does to recognize exceptional performance through award dinners, paid holidays, etc. Thus using a royalty based compensation program is an effective substitute. A financial award based on license revenue is therefore viewed, by the recipients we contacted, as a welcome form of recognition for their work.

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