

The Universities vs the Nuclear Industry: a Prisoner's Dilemma

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December 1999

prepared for presentation to the AECL R&D Advisory Council

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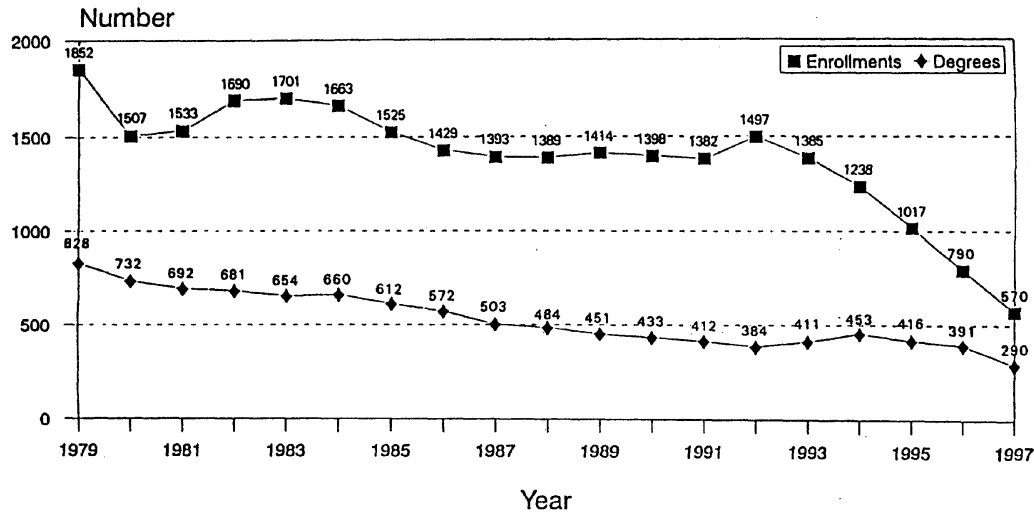
Overview

- Mandate and activities of the Universities Committee
- Our view of the Canadian nuclear enterprise
- CANDU book
- AECL code centre
- The status of Nuclear Engineering programs
- Steps forward
- Final message

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- **Mandate and activities of the CNS Universities Committee**

- terms of reference (see handout)
- Recent Officers' Seminar report (see handout)



Nuclear engineering undergraduate (junior- and senior-level) enrollments and degrees, 1979–1997
(Source: U.S. Department of Energy)

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- **Our view of the Canadian nuclear enterprise**

- Credo: We are in the business of education so we can provide the baseline of training of fundamentals for the nuclear industry. The universities, really, are part of the infrastructure for industrial technology.
- More and more we fail to attract quality students in sufficiently large numbers as nuclear engineering is perceived as a moribund field.
 - We absolutely need to initiate a turnaround for this situation, and we don't see how this can be done without an obvious and well publicized support from the nuclear industry.
 - AECL has to make some commitments to long-term education by providing student scholarships and supporting university research. Why should a professor do research in the nuclear area? Why should students enter the field?
- The vast majority of recent hires at AECL (and I very much suspect, at OPG too) have had little or no exposure to nuclear training or even occasional nuclear courses. For the sake of the quality of work in the future, we need to have a workforce which understands the technology in which it is working!
- It is very important to expand our education of people in other countries in CANDU technology.

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Payoff Matrix

		Column Player	
		Cooperate	Defect
Row Player	Cooperate	$R=3, R=3$ Reward for mutual cooperation	$S=0, T=5$ Sucker's payoff, and temptation to defect
	Defect	$T=5, S=0$ Temptation to defect and sucker's payoff	$P=1, P=1$ Punishment for mutual defection

NOTE: The payoffs to the row chooser are listed first.

$$T > R > P > S$$

$$R > (T + S) / 2$$

- > Open or closed game?
- > How big a shadow does the future cast?
- > Discount factor, w , between 1 and infinity. The promises of tomorrow are not worth as much as the spoils of today.
- > Future worth = Current worth / w .
- > So what is the best strategy?

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- **CANDU book**

- Need to establish what the book is for and who the audience is
- Suggest it should document the 'why' more than the 'what'
- Matrix idea
- A number of AECL employees and university profs are interested in collaborating
- Why not build on the Thai courses?

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- **AECL Code Centre**

- AECL is interested in establishing an off-site code centre for training
- Risk of code misuse -> subsequent damage to AECL
- Risk of training non-AECL people on-site
- 2 camps at AECL - need to decide
- Would like to incorporate codes into courses
- Would like to use McMaster as a piper cub training centre

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- **The status of Nuclear Engineering programs in Canadian universities**

- Who's who (see handout)
- Collectively we'd make a great nuclear department
- AECL has prepared a brochure (see copy) on the nuclear programs in Canadian universities as a beginning in setting up a network of centres of excellence.
 - this was done a few years ago
 - there has been no followup

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- **Royal Military College:**

- Has an undergraduate program Chemical and Materials Engineering and a graduate program in Nuclear Engineering.
- Because of the military focus, their program is oriented towards the needs of the Department of National Defence.
- Research and education is conducted in the areas of fuel management, emergency response (equipment and dispersion analysis), regulations, radiation and health physics, fission product release, instrumentation, and neural nets.
- RMC obviously has a DND orientation.

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- **Ecole Polytechnique:**

- GAN exists mainly through the interests of Hydro Quebec.
- Daniel Rozon holds the HQ Chair and without that chair, the institute would not survive.
- The group has a definite bias towards research rather than teaching and are funded by HQ.
- Historically, the group has been an autonomous unit but they joined the Department of Mechanical Engineering about 5 years ago. That department has a definite teaching bias since Ecole rose out of a technical college. Daniel is now pressed to show a teaching component.
- Research is naturally oriented towards the power sector and the bulk of the research is in reactor physics (the DRAGON code) and thermalhydraulics (ASSERT and multi-channel analysis).
- In short, Ecole has established and maintained a strong link on the research side with HQ.

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- **University of New Brunswick:**

- The university has extensive ties to NB Power and the Centre for Nuclear Energy Research (CNER).
- The CNER Chair is held by Frank Stewart, the Nuclear Engineering Chair is held by Derick Lister and the Power Plant Chair is held by Robin Chaplin.
- The students can take a 16 month work term at Pt. Lepreau and can take a two week intensive Practical School at the plant.
- UNB has been working closely with NB Power, OH, and HQ to develop and present an extensive set of nuclear training material.
- The nuclear program at UNB have set up and maintained aggressive links to CNER and the utilities. The focus is operations and training.

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- **Toronto:**

- Their nuclear program is waning.
- Their SLOWPOKE is shut down.
- There has been a top level decision to get out of nuclear.

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- **McMaster University:**

- Each of the above four universities with a nuclear program have established a unique link to industry.
- The industrial / government partners are the key to the nuclear programs at all the other universities.
- McMaster has traditionally been aloof although individual professors have had specific contracts with industry.
- The obvious industrial partner is AECL design office at Sheridan Park in Mississauga.
- We have a 5MW swimming pool reactor (see brochure)
 - great trainer
 - switch to MAPLE fuel?
 - use of AECL codes for analysis / bench marking
- Programs (see description handout, web page handout and glossy university brochure)
 - Nuclear Engineering
 - Health Physics and Medical Physics

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- **Steps forward**

- Do things that latch
- Do things that have the best bang per buck
- Get AECL / OPG involved in
 - promotion
 - student hires
 - scholarships support
 - support of industrial chairs,
 - support of sabbatical leaves (both universities and industry)
 - teaching
 - support of the Teacher's Course
- Distance learning / courses for industry / on-line reference material / on-line refreshers / professional development....
- Capitalize on AECL / OPG in-house material

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- **Final Message**

- AECL needs to decide if the game is open or closed
- If AECL decides (even by defaulting to inaction) that the game is closed, then don't expect the universities to remain in the game or otherwise cooperate