CANADIAN NUCLEAR ASSOCIATION

ANNUAL MEETING - JUNE, 1971

71-CNA-403

DO THE UNIVERSITIES PREPARE THE TYPE OF ENGINEERS THAT OUR NUCLEAR INDUSTRY NEEDS

Outline of Panel Presentation by

G.L. Brooks, P. Eng.,

Manager, Systems Design Division
Bruce, Pickering, RAPP
Atomic Energy of Canada Limited

May, 1971

"DO THE UNIVERSITIES PREPARE THE TYPE OF ENGINEERS THAT OUR NUCLEAR INDUSTRY NEEDS"

To lead off, let me say that in my opinion, the broad answer to the question posed for discussion by this panel is undoubtedly yes. However, as in the case of any human endeavour, improvement is always possible. Therefore I would like to offer one or two suggestions as to possible improvements in the preparation of fledgling engineers by our universities.

Before doing so, I should explain that my suggestions are based on, and unquestionably biased by, my experience as a designer. Had my experience been in other fields such as research and development, construction, or operations for example, I am certain that my viewpoint would be rather different. None the less, I hope my suggestions may be of some value.

My first suggestion is that, in the university training of engineers, more emphasis be placed on systems engineering as distinct from component engineering. Let me try to explain the distinction involved by example. I have found that most new graduate engineers can do an adequate job of, for example, calculating the heat transfer coefficient for a normal tubular heat exchanger but have difficulty in recognizing the importance of <u>firstly</u> establishing the complete performance requirements for that heat exchanger. In other words, the significance of the heat exchanger as part of an integrated process system is not fully recognized; hence, the new engineer may well design a perfectly fine heat exchanger only to later discover that it wasn't in fact the right heat exchanger for the job.

Why do I make this suggestion with regard to our nuclear industry? I make it in the context of the design of a nuclear power station which by its very nature is an overall system comprising many subsystems. The individual components of these systems and subsystems are important certainly, but only insofar as they serve as "building blocks" for the systems in which they are installed. It is the system which necessarily dictates the performance requirements of the component parts.

Now I certainly recognize that our undergraduate engineering courses do, to a greater or less degree, bring the student into contact with the concept of systems engineering. My suggestion is related to the apparent degree of this contact.

In reflecting on this suggestion, a question has come to mind which I have not really been able to resolve. I hope perhaps, in the subsequent discussion, that others may be able to shed some light on it. The question is, does the apparent (to me at least) lack of adequate systems engineering awareness in the typical new graduate result simply from an educational time problem? That is, is there simply not enough time available in the undergraduate program to properly cover systems engineering concepts as well as all the other topics which must be covered?

Assuming that the answer to the question posed is, at least, partially yes, I would like to offer a second suggested improvement. This is to offer, as an option, graduate school courses which are specifically directed to equipping students for a design career as distinct from the traditional research-oriented graduate course.

You will note that this suggestion is specifically related to the training of design engineers. It may well have some value if applied to other fields of engineering endeavour - perhaps others will wish to comment on this.

In any case, I am firmly convinced that a design-oriented graduate course would be valuable, particularly if appropriate systems engineering concepts were included.

I would not advocate specialization as to particular design engineering fields such as, say, power reactors. The principles of engineering design are general and universally applicable. Hence, I feel the student should concentrate on these general principles together with the further strengthening of his basic technological store of knowledge.

I fully recognize that there is nothing really novel about this suggestion. It has been advocated by at least some engineers for many years. Perhaps now, however, is the time to treat the suggestion seriously for at least two reasons. Firstly, there appears little question but that the need for well qualified design engineers in the nuclear power field will increase substantially over the next few years. Secondly, if current press reports are to be believed, our graduate schools are perhaps training a surplus of research-oriented students at the present time.

Lest my preceding remarks be taken as indicating that I do not properly respect the importance of basic research and development, let me say in conclusion that I fully recognize its importance. This is proven by the observation that there would be no nuclear power programs today had it not been for basic research and development.