

The Fire Science Centre at U.N.B.: Its Role and Development

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THE Fire Science Centre at the University of New Brunswick was established in 1967 by members of the Departments of Chemical Engineering, Chemistry, and the Faculty of Forestry to conduct and direct interdisciplinary research and study on fires and flames burning under artificial and natural conditions. Students with suitable backgrounds may work towards Master of Science (M.Sc.) or Doctorate (Ph.D.) degrees in Chemistry or Chemical Engineering, or Master of Forestry (M.F.) or Master of Science in Forestry (M.Sc.F.) degrees. In Chemistry, the emphasis is on research in the general field of combustion and oxidation, with course work as required. In Chemical Engineering, graduate courses are offered in radiative and conductive heat transfer, thermal properties of materials, combustion and other basic and applied studies, with research and preparation of a thesis being an integral requirement of the degrees. In Forestry, course work in fire ecology, fire control, fire use, and other related topics is offered. A major report is required for the M.F. degree, while greater emphasis is placed on research and a thesis for the M.Sc.F. degree.

The staff of the Centre is composed of members from various

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Departments and Faculties of the University, with Drs. F. R. Steward (Chemical Engineering), and A. J. Kayll (Forestry) as Co-Directors. A Board of Directors, composed of staff from the Departments or Faculties of Chemical Engineering, Chemistry, Civil Engineering, Physics, and Forestry with the Dean of Forestry, Dr. J. W. Ker, as Chairman, provides administrative direction. A Technical Advisory Committee, composed of representatives from the Federal and Provincial Governments, the Canadian National Research Council, and the New Brunswick Board of Underwriters, can be called upon periodically to advise on research programs of the Centre.

The role of the Fire Science Centre is one of acting as a focus and forum for the comprehensive accumulation of both basic and applied knowledge on the characteristics and behaviour of fire, with particular reference to forest fire, and to foster an exchange of information both within and between academic disciplines, research establishments, and management agencies. Within this comprehensive framework, members of participating agencies and disciplines can interrelate their respective studies and applications. By analogy, the Centre can be considered the hub of a wheel where the spokes are the lines of communication between participants and the Centre, and the rim the line of communication between participants. Participation is unrestricted. We hope at various times to involve members of the Federal and Provincial Governments, disciplines such as Forestry, Chemical Engineering, Chemistry and Physics, teaching agencies such as the University and the Maritime Forest Ranger School, and various chemically or forestry oriented industries.

Simply stated, the Fire Science Centre's role is to provide facilities for teaching and research at the undergraduate and graduate level and to provide a framework to facilitate the mutually beneficial exchange of information between teaching, research, or management oriented agencies. This meeting is an obvious instrument of this role.

FACILITIES

In addition to the usual office space for the Co-Directors and a secretary, four graduate students can be accommodated immediately adjacent to an 800-square-foot laboratory. The Centre's laboratory

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was originally the boiler room for the heating plant, and thus has a 17 foot clearance for part of its space, and a mezzanine floor for the remainder. Today, the smoke stack remains for exhausting smoke from the laboratory, and an air conditioning unit controls temperature and humidity.

Operational pieces of equipment include a low speed wind tunnel with a 4' x 4' cross-section, a propane fired radiant panel, and an experimental furnace for studying combustion phenomena is semi-permanently installed on the mezzanine.

Researchers in the laboratory also have immediate access to various pieces of equipment such as calorimeters, a moisture content determining balance, pyrometers, furnaces, potentiometric recorders, and a Hycon high-speed camera. Items currently on order include a T.V. videotape camera and recorder and a portable desk top computer for monitoring and computing in both laboratory and field experiments. Full scale computing problems can be handled on an I.B.M. systems/360 50H computer operating under HASP (Houston Automatic Spooling System) and MFT (Multiple Fixed Task) controls.

A fully equipped machine shop in the Department of Chemical Engineering provides excellent facilities for the fabrication of unique pieces of equipment and the more usual constructions required in an engineering laboratory.

PROGRAM

Current studies include the calculation and measurements of radiative heat flux in a furnace enclosure (Mr. S. Osuwan, Chemical Engineering), the calculation and measurement of heat transfer through the bark of trees (Mr. I. Chin, Chemical Engineering), and the measurement of the effect of wind on the amount of fire suppressant required to quench fires in artificial fuel beds (Mr. E. Stechishen, Forestry).

National Research Council Operating grants currently are supporting field studies of the efficacy of prescribed burning in cut-over hardwood stands and fire in ecosystems generally (Dr. A. J. Kayll) and laboratory studies of fire spread in various fuel structures, the

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spontaneous and pilot ignition of cellulosic fuels, and radiative interchange within free-burning fires (Dr. F. R. Steward).

Future studies will continue along the foregoing lines with elaboration and development occurring as circumstances develop and permit. Obviously, it is difficult to forecast exactly the ensuing development of the Centre and its research and teaching programs. But one thing is obvious—we cannot rely on being able to “burn to learn” each year, as evidenced by the summary of our fire weather index (Table 1) for this past summer. Therefore we feel we must utilize and develop modern techniques of audio-visual and computer simulation. Mr. P. G. Ormandy (Chemical Engineering) is associated with the Centre and is investigating and developing the audio-visual aspects of simulation. Using the computer, two simple fire control models have already been developed by two graduate students of the Centre (J. D. Walker, E. Stechishen), and incidentally, you will have an opportunity to play the “Fire Control Game” if you wish. We hope in the future to develop fire models which can be used for basic investigations of fire behaviour, for applied investigations of fire effects and uses, for training of both undergraduate and graduate students in fire behaviour and control problems, and by incorporating natural, wildfire “case histories,” for the training of ranger school candidates and field staff currently involved in fire control and fire prevention problems. This is essentially a “systems analysis” approach to the phenomena of flames and fire, in which fire behaviour may be better understood and predicted by simulating—both mathematically and visually.

TABLE 1. FOREST FIRE DANGER INDEX
(Recorded at the Fredericton District Ranger Station)
May 13, 1970—August 11, 1970

	May	June	July	August	Total	Per Cent
EXTREME						
VERY HIGH	1	1			2	2
HIGH	5	5	6	1	17	19
MODERATE	5	8	8	6	27	30
LOW	8	16	17	4	45	49
	19	30	31	11	91	100

No rain fell from July 22, 1970 to August 1, 1970. The Relative Humidity remained high during this period and the Danger Index did not rise above 10 (High).

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Testing the derived model in terms of real situations is the last in a number of steps which characterize and define the "system" and its inputs and outputs. Thus, we hope to impart some "biological realities" to Chemical Engineers, and some "mathematical truths" to practising foresters. As mentioned, it is likely that other disciplines, e.g. physics, chemistry, and other agencies, e.g. private industry, will become involved in the program of the Centre. We welcome your inquiries about and participation in its activities.

The science of fire seems ideally suited to interdisciplinary study. We are confident that the Fire Science Centre is equally suited as a sponsor.

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