

Highlighting spinoffs in the field of construction is a NASA-developed computer program for analyzing energy considerations in building design

An Energy Saver Called NECAP

Energy requirement has long been a matter of significance in building design, but in recent years planning for utmost energy efficiency has become a matter of paramount importance. Energy prices have risen sharply and the expectation is that they will continue to climb. Thus, architects and engineers must explore every avenue of design innovation to offset soaring fuel costs by reducing energy usage. In so doing, they are getting valuable assistance from a relatively new design tool: the energy analysis computer program, which considers the many factors related to energy consumption of buildings and identifies energy-saving design features for new buildings or modifications to existing facilities.

One of the most comprehensive and most effective programs is NECAP, an acronym for NASA Energy Cost Analysis Program. Developed by Langley Research Center, NECAP operates according to heating/cooling calculation procedures formulated by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE). The program enables examination of a multitude of influences on heat flow into and out of buildings. For example, NECAP considers traditional weather patterns for a given locale and predicts the effects on a particular building design of sun, rain, wind, even shadows from other buildings. It takes into account the mass of structural materials, insulating values, the type of equipment the building will house, equipment operating schedules, heat thrown off

by people and machinery, heat loss or gain through windows and other openings and a variety of additional details. NECAP ascertains how much energy the building should require ideally, aids selection of the most economical and most efficient energy systems and suggests design and operational measures for reducing the building's energy needs. Most importantly, NECAP determines cost effectiveness—whether an energy-saving measure will pay back its installation cost through monetary savings in energy bills.

Originally developed to promote energy conservation in NASA buildings and those of other government agencies, NECAP is available to commercial building designers—through NASA's Computer Software Management and Information Center (COSMIC)® at the University of Georgia—and the program has found wide acceptance in the construction industry.

A major NECAP user is McGaughy, Marshall & McMillan of Norfolk, Virginia, one of the world's leading architectural engineering firms and a pioneer in computer-aided construction planning. Five years ago, McGaughy, Marshall & McMillan started development of an energy conservation/management computer program. The firm compared a number of commercially available programs and ultimately selected NECAP as the one which considered more variables than the others investigated. McGaughy, Marshall & McMil-

lan purchased NECAP from COSMIC, adapted it to the firm's own computer, refined it and, beginning in 1977, put it into service. In that year, NECAP demonstrated its effectiveness on three major company projects, including the design of two new buildings for the U.S. Navy and modification of an older government building in Washington, D.C.

Since then, McGaughy, Marshall & McMillan has continued to make extensive use of NECAP as a primary planning and evaluation tool in the firm's widespread operations, which include design and supervision of construction projects costing more than \$100 million annually. A current example involves development and construction of the Georgia Public Safety Training Center. The Center, a project of the Georgia State Office of Planning and Budget, is intended to serve as a large "university" which will provide academic and operational training for state and local peace officers, firefighters, correction officials and other state safety personnel. This project represents a special challenge with regard to designing for energy efficiency because of the many different building environments—academic, training, administrative, dormitory, medical, security and food service facilities, together with a number of special laboratories. To prevent potentially enormous energy losses resulting from the extremely diverse nature of the Center's activities, McGaughy, Marshall & McMillan is using NECAP to incorporate maximum energy efficiency into the



plans. NECAP's contribution to anticipated energy cost savings has not yet been computed, but the Norfolk firm expects it to be "impressive."

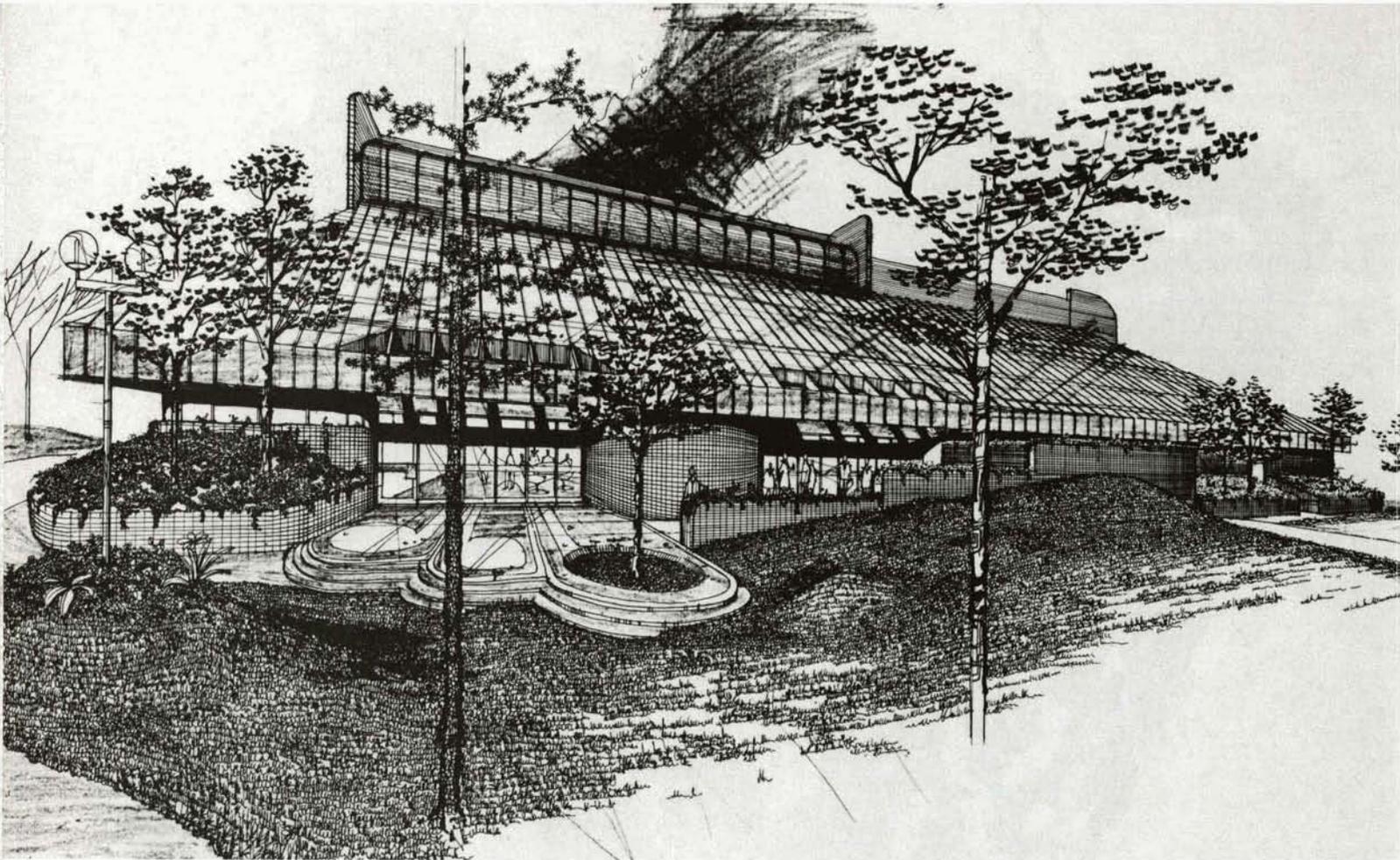
In another Georgia project, Georgia Institute of Technology is using NECAP for a comprehensive analysis of the factors involved in controlling the environments of campus buildings. The university is developing a computer-directed system for monitoring and controlling energy expenditure in 85 campus buildings, 14 of which are already being monitored. The goal is to reduce energy consumption by 20 percent and the potential savings run to millions of dollars.

In addition to McGaughy, Marshall & McMillan, a number of other large architectural-engineering firms are using in-house versions of NECAP, among them Stearns-Roger Incorporated of Denver, Colorado; Smith, Henschman and Grylls, Detroit, Michi-

gan; and TEC Incorporated, Kansas City, Missouri. NECAP has also served as the basis for a number of other widely used programs developed by such organizations as the Corps of Engineers, the State of California working jointly with the Department of Energy, and GARD, Incorporated, a Chicago-based architectural and engineering firm.

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This drawing shows the layout of the planned Georgia Public Safety Training Center, a multi-building complex for training state and local police, fire fighters and other safety personnel. The Center is being designed with careful attention to energy conservation, but it poses a challenge because of the many different building environments. For example, the academic building (Number 5 above), administration building (6), dormitory (10), weapons training center (11), vehicle maintenance building (13), sewage plant (21) and fire research laboratory (24) have substantially different energy requirements and involve different energy-saving design measures. The designers—McGaughy, Marshall & McMillan of Norfolk, Virginia—expect to achieve large scale energy cost savings through use of the NASA Energy Cost Analysis Program (NECAP), a comprehensive computer program which is helping architects and engineers design for maximum energy efficiency.



The firm of McGaughey, Marshall & McMillan used NECAP in planning construction of this striking structure, a club for enlisted personnel at the U.S. Naval Academy, Annapolis, Maryland.

NECAP is an energy analysis computer program which considers the many factors related to building energy consumption and identifies energy-saving design features.

The building shown is one of 85 facilities on the campus of Georgia Institute of Technology involved in a major energy conservation program. The university is installing a central computer-directed system for monitoring and controlling energy expenditure in the buildings, aiming to reduce energy consumption by 20 percent. NECAP is being used to analyze the many influences which must be taken into consideration in controlling building environments.

