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Brief 69-10590

NASA TECH BRIEF

Monte Carlo Simulation by Computer for Life-Cycle Costing

The problem:

Development of a method of simulation of a system, for prediction of its behavior and support requirements during its entire life cycle so that estimates of its life cycle cost will be facilitated. Such a system could reduce the ultimate cost of a system to the procuring agency because it would take into consideration the costs of initial procurement, operation, and maintenance as true indications of the total cost of owning an engineering system. Earlier techniques have considered only the costs of initial procurement or resupply. Experience indicates that the initial cost of a system may be less than 10% of its life-cycle cost.

The solution:

Application of Monte Carlo methods to modeling of a proposed system.

How it's done:

A competing contractor is asked to develop a Monte Carlo model of his proposed system that incorporates the following parameters: predicted reliability and maintainability; operation and maintenance processes; and requirements for facilities, spares, personnel, and transportation. The maintenance activities are inserted in the operational activities on the basis of probability of occurrence as determined by the predicted reliability characteristics of the system. Dollar costs are associated with all the support and operating elements, and successive runs of the model are made for establishment of life-cycle cost and levels of confidence in that cost.

The simulated life of the system may amount to months or years, depending on the intended use of the system. Information on availability of the system, or other figure of merit of the system, can be predicted by the model; these data, combined with information on cost, enable comparison of one contractor's proposal with another's.

Any degree of detail can be modeled with this system: at the level of the gross functional system, a subsystem, or a first-level-maintenance component. The degree of detail is determined by the size of the program involved, the state of its development, and the degree of accuracy desired by the procuring agency.

After letting of a contract the model will be retained in an active status as a valuable tool for studies of parametric trades in the system; and, when data become available from actual tests or operation, for comparison of "attained" values of maintainability, reliability, and availability with predictions made during competition for the contract. Also the model will facilitate formulation of quantitative requirements for operating and logistics elements.

Notes:

1. For details of comparable systems see NASA, Rept. NT-36, "Saturn V prelaunch system simulation model" (available from NASA New Technology System); NASA, Rept. D5-15398-2, "Saturn V operations analysis optimization methodology" (available from Document Repository, Marshall Space Flight Center); The Boeing Company, Rept. D2-16187-2, "Minuteman simulation model for availability, maintenance, and logistics studies: Modernized wings I through V and wing VI" (available from The Boeing Co., Seattle, Wash.).
2. The technique may be useful for process-control systems in industry, and for systems dealing with relation of facilities to population in an urban environment; the armed forces and designers and analysts of systems may be interested.

(continued overleaf)

3. No further documentation is available. Inquiries may be directed to:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama 35812
Reference: B69-10590

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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