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Development of a Computer Program to Generate Typical Measurement Values for Various Systems on a Space Station

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Abstract

The elements of a simulation program written in Ada have been developed. The program will eventually serve as a data generator of typical readings from various Space Station equipment involved with Communications and Tracking, and will simulate various scenarios that may arise due to equipment malfunction or failure, power failures, etc.

In addition, an evaluation of the Ada language has been made from the viewpoint of a FORTRAN programmer learning Ada for the first time. Various strengths and difficulties associated with the learning and use of Ada are considered.

Introduction

The planning and testing of the various data collecting and management systems on the proposed U. S. Space Station requires that various configurations be tested to determine whether performance criteria can be realistically met. This requires that the various systems and their interaction with the data collection/monitoring and data management systems be simulated. (Eventually, as actual equipment becomes available, it can replace its software simulation in the monitoring system.) In particular, readings from anticipated equipment involved with Tracking and Communication are to be simulated by computer programs which will mimic the typical performance of such equipment, and, eventually, simulate the effects of anomalis behavior or equipment failure.

It is anticipated that Ada will be used as the programming language for the simulation. Since there has been limited experience thus far with Ada, an evaluation of the language and its capabilities in this area is also of interest. The two goals of this project thus were:

a) To begin the programming of a data generator which will simulate various equipment involved with Tracking and Communications on the Space Station, and

b) To evaluate the Ada language as the language of choice for such a simulation.

Results and Conclusions

In order to meet the two major goals of this project, the principal investigator undertook to learn Ada, and then to apply it in programs that could serve as a basis for (or at least a start on) the required simulation. Headway was made in defining the parameters to be included in the simulation, and preliminary programs have been written that can serve as a basis for further programming.

In terms of an evaluation of Ada, the following comments about Ada are reported:

a) Ada is a language well suited for large scale simulation programs. In fact, it appears designed specifically for such applications (It would be cumbersome for small programs or numerical analysis).

b) Ada is complex and relatively difficult to learn (a background in PASCAL appears to be helpful). It contains much jargon, and many of the current references are poorly indexed.

c) The diagnostics on the VAX (typical?) are poor and not very helpful.

d) All of the bugs are apparently not worked out of the DEC implementation on the VAX-- we discovered one involving the TEXT_IO package and port I/O and were apparently the third facility to bring this to DEC's attention.

e) One of Ada's most powerful facilities is the ability to program concurrent (or parallel) tasks that execute "simultaneously." (Outside of Ada, such concurrent processing is only possible at the system level by "detaching" from jobs that then continue to run in the background. Such processes, however, are machine/system dependent and therefore not readily transportable.) This feature should be especially useful in programming simulations.

The general conclusions of this project are that Ada is a powerful language that is well suited to programming simulations, but that its complexity means that it is not for the casual programmer.

References

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