ARTES project 0005-20

Rolls-Royce

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Direct dial	246929
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Date	8th June 2000
Our ref	001MB-LeJEM
Your ref	

Dear Sir,

Re: Research into Flexible Reliable Timing Constraints

Rolls-Royce Control Systems procures digital controllers for a range of gas turbine engines. The engines are used in a variety of small, medium and large aircraft applications as well as for power generation and marine propulsion. The systems must satisfy a large number of critical timing constraints to ensure that the closed loop control of the engine is both stable and responsive. There are also many timing constraints imposed by the interface to external systems such as cockpit displays and air data computers.

Unlike modern desktop computing platforms which have witnessed spectacular increases in computing capability, engine controllers are constrained to use somewhat less powerful electronics for reasons of maturity, availability and environmental performance. This leads to a significant trade-off between achieving temporal performance whilst maintaining acceptable spare timing capacity within the processor.

As suggested in the research proposal timing requirements are often specified in terms of the target implementation, for example iteration rates and end-to-end deadlines. Indeed these become constraints rather than design goals. Furthermore these constraints tend to drive an artificial structure on the design of the software itself which makes it less visible and more difficult to maintain when changes to the requirements are encountered.

Engine control systems have traditionally been based around a fixed cyclic scheduler. Whilst this technique is well understood and visible it is accepted that there is scope for applying more modern flexible scheduling mechanisms such as fixed priority pre-emptive to these systems. Current process improvement activity is looking to insert this technology into future systems, supported by research work carried out at the University of York. The use of a more flexible

scheduling structure leads to a desire to move away from the 'constraint' based approach to specifying timing requirements and towards methods which are based more on the fundamental requirements which the system must satisfy. In this respect the research work proposed would be of considerable interest, for example algorithms for transforming requirements into fixed priority schedules.

Rolls-Royce has extensive experience of the problems which are caused by the artificial specification of timing constraints and we would be willing to help in seeing how this could be used within the activities. We would also wish to ensure that the research work results in something which can actually be applied to real world projects. Our experience shows that technology transfer can often be more difficult to achieve than the technology itself.

Yours sincerely

M Bardill

Mike Bardill
Software Engineer