Commentary on: Planning and Scheduling Challenges for Orbital Express

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Introduction

This paper, by Russell Knight, Caroline Chouinard, Grailing Jones, and Daniel Tran, reports on the application of the ASPEN planner to short-term planning for DARPA's Orbital Express mission. The paper discusses two separate contributions. First, the ASPEN planner was extended to support "schema-level uncertainty," and second, the authors implemented a system to read human-generated procedures and produce planning models in AML, ASPEN's domain modeling language.

The application domain and the technical approach taken are both very interesting, and so I would have liked more detail on one or the other, or, ideally, both. For example, there are no examples of the domain model in the paper, which would help considerably in the reader's understanding of both the extensions for schema-level uncertainty and automated procedure parsing. For the latter, it would have been nice to see the whole process: a procedure, followed by the resulting AML output by the implemented software. Unfortunately, it was apparently impossible to gain permission to present any part of the model in a publication, according to one of the authors.

Schema-Level Uncertainty

In an effort to reduce the computational overhead of reasoning with uncertainty, the authors used ASPEN's ability to model complex, multi-activity operations using *schemas*, adding uncertainty only in terms of schema parameters, rather than individual actions. This is one of the places I very much wanted (and the authors apparently were prohibited from providing) more detail. This approach will have effects on the computational effort required for planning, on the form of models constructed, and on the results of the planning process. It would be good to understand what those effects are and what tradeoffs are possible. These being essentially pragmatic questions, lacking details on the domain model there is not much way to gain that understanding. One point that did become clear in corresponding with one of the authors in generating this commentary is one of the means of reducing computational cost. When in the paper it says that plans were generated for the cross-product of the possible instantiations of uncertain schema parameters, for continuous values only the bounds were checked, rather than discretizing the space.

Why ASPEN?

There is another question raised by this paper and answered incompletely and only implicitly: why was ASPEN chosen as the SRP planner? From the discussion in the paper, one can infer that ASPEN's schemas were important, and that replanning was accomplished by a process of plan repair, at least some of the time, which is another ASPEN strength. But one of the most telling arguments for using ASPEN isn't in the paper at all: according to one of the authors, ASPEN had already been in use before their involvement in Orbital Express, because it was the only planner that the prime contractor could use by themselves, out of all the ones they tried.

Nagging Questions

The authors report a very substantial impact for the use of this system: 26% reduction in mission execution time, 50% reduction in staff required for planning, and 35% reduction in planning errors. It would be nice to have a better understanding of how that was accomplished. For example, what was the interaction between short-range and long-range planning? What was the interaction between Rendezvous Planning and Scenario Resource Planning (which apparently do not, as I initially thought, corrrespond to long-term and short-term planning, respectively)? How much hand tweaking was required on the output of the procedure translator, to produce usable AML?

Conclusion

This is an interesting and well-written paper reporting significant impact on a real-world application, but it lacks the detail required to really evaluate (or apply) the results. I wish the authors had the space and permission required to provide much more detail.