Review of Proposed Chapter entitled: Towards Deliberative Control in Marine Robotics

GENERAL
The authors have done a commendable job of explaining the use, advantages and limitations of constraint reasoning as it applies to their architecture. The work appears to be leading edge - they are an appropriate choice to do this chapter. It certainly is representative of the state-of-the-art in autonomy. The chapter covers the development of these capabilities from early days to near present day. Contains a fairly comprehensive literature review which should give new readers good perspective on what the authors have contributed and its significance. In one place the authors have tied together all the work they have done in this area.

The chapter is written in 10 pt font which is likely smaller than what will be published (?). Fonts for text in general should be 11 point, at a minimum, for readability. As well, some of the figures are too small to be readable. When the fonts and figure sizes are fixed this chapter will be much larger than then 55 pages that it now spans. While this may make this chapter larger I recommend that none of the sections be cut or reduced unduly (final recommendation lies with the Editor, of course). As it is, the chapter is comprehensive and self-contained.

Having said that, might consider relocating some of the sections to a chapter appendix. For e.g. some of Section 3: Foundational Concepts. Just a suggestion.

The Experimental Results section shows the architecture implemented in a wide variety of real world applications. This is important and not always emphasized enough by other workers who tend to concentrate on only the robotic aspects. If there is room, some of the examples deserve more coverage (e.g. the mixed-initiative frontal tracking).

The outline and layout of the sections build logically on previous sections.

I support publication of this Chapter within the book Autonomy for Marine Robots. It follows the intent and spirit of subject book as explained to me.

The T-REX is a fairly complex system that is implemented on-board for in-situ planning and execution. It might be instructive for the reader to get some idea of the processor that is used to implement it say on the Dorado AUV. What percentage of the AUV energy budget is dedicated to T-REX?

Definition of a 'situated' agent has not been covered - this would really highlight the significance of the authors' work.

Fair amount of discussion about representation but not much on ontology. . .

Never clearly stated it but is an "observation" a sensor measurement or a state or both?

Just a few clarification points - the writing is pretty polished.

p. 4
2nd new para: "under-articulated robotic platform"
not familiar with this phrase - do you mean non-holonomic?

p. 6
Fig. 2 is too small

p. 7
"... that temporal reasoning using *methods* came to the forefront of AI ..."
what methods?

p. 9
"However, it is unclear whether to date this system actually deliberates and whether it is actually instantiated on a real platform for control."
If you are uncertain, should it be included in this review?

p. 11
Fig. 5 is too small to be of much value

Unclear what is meant by a "conjunctive set of constraints"
a few words to describe this?

p. 13
Fig. 7 is too small - not really readable

Explain Yo-Yo's to readers who may not be familiar with glider trajectories.

Has "constraint network" been defined up to this point?

p. 14
".. variable evolution over a temporal horizon we call timelines and which represent a single thread in the execution of a concurrent system.."
is the "thread" a control loop or an instantiation of a token?

"... one can seek out the nouns in any domain description ..."
do not quite understand what is meant here

p. 17
concept of master / slave tokens, and how they fit into the overall structure is a bit unclear

p. 18
the inter-relationships between temporal network and CRE and Resources, CRE, PDB, and Solver is not really captured in Fig. 11

in Fig. 11 assume that 'Constraint Engine' is the same as 'Constraint Reasoning Engine' - left out 'reasoning' for brevity?

p. 24
Fig. 13: what is the constraint? unclear how the '38' comes about? what does '^' below the left DG mean?

the concept of 'polynomial time' has not been described to this point

p. 27
".. In such a situation, the agent may THRASH if the internal state of the plan..."
what does that mean exactly?

p. 28
how is a reactor & object related as objects has partial plans and timelines as well?

how is a reactor's latency determined? is it a constant value or does it vary?

"Requests further in the future are buffered by the agent until this time window advances for an overlap."
not sure what is meant here?

p. 29
"This internal state in turn may be used by other reactors."
thought that internal variables are accessed only by the reactor that owned them? if not, what does 'internal' and 'external' refer to in terms of access?

p. 32
"... has identified a complete solution for its current internal goals..."
what is an internal goal and how does it relate to, or is different from, an external goal

would be useful to distinguish between a planning cycle, tick, and deliberation step

p. 36
"... it slices the execution of Algorithm 1 into atomic steps."
assume this is the algorithm on page 26? I would put in the pseudo-code title "back tracking"

"... to backtrack until a DecisionPoint that is not exhausted..."
what does 'exhausted' mean?

"... backtrack in the decision stack until a node of the tree is found with ..."
the use of the decision tree and how it fits in the overall picture has not really been discussed

concept of call stack has not really been defined or discussed

p. 37
".. T-REX maintin one plan structure shared between synchronization and PLANNING..."
do you mean deliberation instead of PLANNING? just checking

"Similarly we presented deliberation as an abstraction without discussing the disruptive nature of synchronization and how it impacts the planning process."
the disruptive nature becomes clear later on - from an instructive point of view it might be useful to clarify that at this point

"We first analyze the case when synchronization occurs after planning has completed."
Unclear on the purpose of talking about this special case, now, rather than after the more general case is discussed.

"... T-REX informs the reactor of this observation which is added to the partial plan as a fact..."
have not described what structure a 'fact' is (is this from an observation or sensor measurement) is and how it relates to the rest of the architecture

Fig. 20 caption - explain what the gray boxes are

Fig. 20 - explain what the double equal signs signify - is it a logical equal?

"In doing so, the EUROPA solver's focus on the execution frontier takes advantage of the existing plan to evaluate a solution that assumes the observation is consistent with what was decided by the reactor."
what happens in the event that it is inconsistent or is it always going to be consistent?

p. 40
do not know what clustering model is referring to based on the context

p. 42
"... within the DTA app.."
DTA has not been defined

Fig. 26 is too small

Fig 27 legend and axes not readable

p. 45
"...incorporate model outputs projecting these outputs into the space-time region of interest to GENERATE candidate hypotheses..."

p. 46
text in Fig. 30b is too small

MINOR TYPOS & GRAMMAR
p. 4

8th line from top: predicitve => predictive

"... in addition to being used for an AUV, is general enough TO be used for ..."

p. 5
"... is clear about the EXTENT of adaptation in stating ..."

p. 8
"...rate of updates from the science drivers is roughly ON the order of an earth ..."

"While this allows disparate code-bases to talk to each other THROUGH IPS (aN inter-process ..."

p. 9
"T-REX is an adaptive, artificial intelligence based control and provides A general framework ..."

"... an the execution of plans on an embedded robotic marine ~~ROBOTIC~~ platform..."

p. 15
".. to describe both state and behavior of objects is prevalent enough that EUROPA ... the token representation."
think a word is missing

"TokenS have built in variables to indicate the object to which the STATEMENT principally applies as well..."
what statement is being referred to?

p. 16
"... must first determine whether it can achieve those GOALS and how."

p. 25
Fig. 14 is too small for the legend and some of the axes to be apparent

need to clearly define what a 'partial plan' is as it is referred to in several spots

p. 27
"... by tightly integrating planning and execution in a single representational and computational framework with aN unified declarative model."

"The T-REX architecture contributes to agent architectures over and beyond IDEA ~~ARE~~ in the following ways.."

"... before being able to produce A plan to the agent..."

"... and world evolution to ensure that planning occuring curing continuous state update in the same PLAN database used for planning."

p. 28
"...For that reason, each reactor specifies the following two parameters that ARE applied toward the scope of the agent lifetime: ..."

p. 31
"It will only result IN these goals being ignored until newer goals are received."

p. 33
"This suggests a deliberate non-overlap between THE reactive planner and deliberative planners'..."

"... synchronization by controlling the scheduling of these two PROCESSES by the T-REX agent."

"If object.location.AT is external and Agent ..."

p. 35
"... always result on ending at the TARGET location."

"... would lead immediately to N plan consistency."

"... it does so by posting the times of aN EUROPA reactor."

p. 36
"(This case is developed further IN the next section)."

"As, time advances, these potential future flaws..."

p. 41
"While our model SUPPORT multiples patterns ..."

p. 48
"The second challenge has to IMPLEMENT a policy within the T-REX framework that explicitly deals ..."