Trusted AI Challenge for Armaments Systems Engineering

Summer 2024, Phase I

Taking a Systems Approach:

Systems Analysis consists of six major phases:

1. Determine goals of the system.
2. Establish criteria for ranking alternative candidates.
3. Develop alternative solutions.
4. Rank alternative candidates.
5. Iterate.
6. Action.

Part of the evaluation of the overall effort will be adherence to best practices. I would strongly suggest setting up your white paper to follow these steps and include novelty within those. In terms of our effort, we can think of these steps as follows:

1. **Executive Summary. (This will be completed last but show up first.)**
    a. While this is not one of the six major phases, having an executive summary, both as an introductory part of your white paper, as well as an introductory slide to the talk, is an important systems engineering method. This allows your client to have a very quick overview of the problem and solution before diving deeper. In addition to setting the stage for the rest of the discussion, this also provides administrative leads who may not read the entire document a proper understanding.
2. **Determine goals of the system.**
    a. Here we can indicate what we consider to be the overarching goals of the system, such as getting the soldiers across the field as quickly as possible. However, we may want to elaborate and discuss other goals such as preservation of human life given that we have been indicated that future iterations of the project may utilize UGVs which are less than 100% accurate.
    b. We will also want to discuss the objective and mission as stated in the "Trusted Artificial Intelligence Challenge for Armaments Systems Engineering" document and how those relate to the goals of the system.
3. **Establish criteria for ranking alternative candidates.**
    a. This is a very interesting part of the systems approach which can often be misplaced in the ordering of the steps. At times, teams will begin to evaluate and develop alternative solutions prior to this step. However, without methods for measuring success there can be no proper evaluation of alternative candidates and the team can suffer from a "tool-forward" approach to the problem.
    b. This can be a great place for novelty points.
4. **Develop alternative solutions.**
    a. This step is relatively self-explanatory. However, in the first phase of the project, this step may take up a multitude of the time and writing within the white paper. This step will be where you can layout the various methods and considerations for the eventual testing. Given the setup of the challenge, it isn't important to decide on a final solution in the summer phase but more to develop the alternative solutions.

   b. You should also consider providing some discussion on how these alternative solutions will be mapped back to the criteria.
   c. This can also be a great place for novelty points.
5. **Rank alternative candidates.**
   a. Using the criteria developed in step 3, evaluate the solutions from step 4 in order. Be sure to keep in mind concerns outside of the idealized system such as, but not limited to:
      i. Impact on existing system
      ii. Sensitivity of metrics to parameter variation
      iii. Emergent systems/evolution of current system (i.e., change from 100% to reduced effectiveness of UGV)
      iv. Unforeseen possibilities
   b. Consider developing groups of potential alternatives for iterative evaluation below.
   c. This can be a great place to begin discussing plans for the next phase if they may involve further refined ranking/evaluation of the potential alternatives.
6. **Iterate.**
   a. This phase of systems analysis involves choosing a subset of the previously created alternative solutions (with the assistance of the ranking step) to dive into and conduct a deeper analysis. In this step you may enhance your discussions and analysis of potential solutions and repeat the process with this information. In this way you consistently refine your solution. Be sure to keep track of this process for discussion in the white paper.
   b. Again, this can be a place for novelty.
   c. Consider also using this as an opportunity to discuss any ongoing iterations that may happen in the following phase (planning).
7. **Action.**
   a. In this phase we will not be conducting action since we will not be able to implement any solutions until the next phase. Therefore, use this space to finish out your planning for the next phase and how we will use our time and resources to further develop the system architecture.
   b. This can be another place for innovation as well.

Suggested Readings:

"How to Do Systems Analysis: Primer and Casebook" by Gibson, Scherer, Gibson, and Smith

Systems Engineering Body of Knowledge
[https://sebokwiki.org/wiki/Guide_to_the_Systems_Engineering_Body_of_Knowledge_(SEBoK)]