**Milestone Round Submission Requirements for Digital Twin Solutions**

**General Instructions:**

* The submission must address each required section and topic described below.
* In addition to this template, teams are also required to submit the following items, as described in the Milestone Round Submissions section of the challenge rules:
  + A link to a publicly accessible video recording of the presentation (no longer than 30 minutes) that includes a demonstration of at least a portion of the preliminary digital twin visualization for 1) the nominal scenario and 2) one (1) of the off-nominal scenarios; and
  + A Preliminary Demonstration Proposal for your digital twin
* Teams should maintain all numbered section headings in their submission. PLEASE NOTE: Any submission that does not address all of the requirements will receive a “Fail” score for completeness and will not be eligible for a prize.

**Presentation Instructions:**

* All submissions must be in English; submissions in any other language will not be judged and will not be eligible for a prize.
* The presentation must be a PDF file and may include no more than 20 slides. Judges will not review any materials beyond 20 slides.
* The text on slides must be no smaller than 16-point font (Arial or Times New Roman recommended). Teams should use a standard size slide with 4:3 aspect ratio.
* Each section includes a “Recommended length” for the answer. These recommendations are intended to provide guidance on the expectations for the length and quality of the answer, but teams are not required to adhere to these recommendations. Teams may allocate space to different sections as they see fit.
* The recorded presentation may be no longer than 30 minutes. Judges will not review the presentation beyond 30 minutes.
* The recorded presentation must include a demonstration of 1) a preliminary digital twin visualization for the nominal scenario and 2) a preliminary digital twin visualization for one (1) of the off-nominal scenarios.
* The recorded presentation should be given by the team leader and/or team members, not by an AI.

1. Vision and Innovation (*Recommended length: 1-2 slides*)

1.1. Name/Title for your solution

1.2. How does your solution use innovation in the Digital Twin?

1.3. How does the solution build or improve upon current state of the art digital twins?

1.4. How does your solution leverage advanced technologies?

1.5. Describe the commercial potential of your digital twin.

1. Preliminary Digital Twin Architecture (*Recommended length: 5-6 slides*)

2.1. Describe the architecture of your preliminary digital twin.

2.2. What is your design approach? Describe the physics-based models, simulation, and visualization you will use to create a virtual representation of your team’s Prototype Solution.

2.3. Describe the level of fidelity and resolution that demonstrates how closely the digital representation matches your team’s Prototype Solution.

2.4. Describe the sensors and observing systems and the data acquisition and data integration approaches.

2.5. Describe any automated control and decision-making capabilities.

2.6. Describe any artificial intelligence, machine learning, and empirical modeling capabilities.

2.7. Describe your expected approach to virtual prototyping and to testing performance and functionality in a simulated environment.

2.8. Describe your validation approach for computer models (e.g., how accurately the model's predictions or outputs align with your team’s Prototype Solution).

2.9. Describe how the digital twin would communicate with physical assets that are part of your team’s Prototype Solution.

1. How your preliminary Digital Twin addresses the Nominal Scenario (*Recommended length: 2-3 slides*)

3.1. Describe how your digital twin will model the nominal scenario, including the engineering data, predictive capabilities, and bi-directional communication that will be incorporated into the model.

3.2. Describe any features or capabilities (such as thermal management, prediction of stress conditions, or any other capabilities) that your digital twin will demonstrate in the Nominal Scenario that would not otherwise be addressed by your team’s Prototype Solution.

1. How your preliminary Digital Twin addresses one Off-Nominal Scenario (*Recommended length: 2-5 slides*)

4.1. Describe how your digital twin will model one (1) of the off-nominal scenarios, including the engineering data, predictive capabilities, and bi-directional communication that will be incorporated into the model of these scenarios.

4.1.1. If you are designing your own off-nominal scenario, explain how your off-nominal scenario leverages the capabilities of your digital twin to deliver additional valuable insights into the design or operation of your team’s Prototype Solution

4.2. Describe the data or insights that your digital twin will provide that may help to improve the form, fit, and function of your team’s Prototype Solution or a modification of your team’s Prototype Solution that enables increased capability, reliability, or efficiency.

1. Digital Twin Characteristics (*Recommended length: 1-2 slides*)

5.1. Describe how your preliminary digital twin addresses Accuracy, defined as the degree to which the digital representation reflects your team’s Prototype Solution in data fidelity, model fidelity, and predictive capability.

5.2. Describe how your preliminary digital twin addresses Cohesion, defined as how closely coupled the different parts of the digital representation (e.g., model/simulation) are and how the model/simulation adheres to the laws of physics the same way your team’s Prototype Solution does.

5.3. Describe how your preliminary digital twin addresses Predictive Capabilities, defined as the ability of the digital model to anticipate the future behavior and performance of your team’s Prototype Solution.

5.4. Describe how your preliminary digital twin addresses Verification and Validation, defined as how you will determine the degree to which the digital twin is a true representation of your team’s Prototype Solution.

1. Development/Project Plan *(Recommended length: 1-2 slides)*6.1. Describe your plan for developing your final and complete Digital Twin Solution for the Final Round Demonstration. Teams should address the technical steps necessary for development and testing; success criteria for testing; personnel and other resources; and expected timeline/schedule in relation to the Final Round deadlines.