# Questions About Your Organization

1. My organization most aligns with:
   1. Government
   2. Military / Defense
   3. Commercial / Industrial
   4. Academia
   5. Other
2. What is your impact on digital twins (select all that apply)
   1. As a vendor of supporting technology
   2. As a developer / product manager of twins or twinned products
   3. As a consumer of twins / user of twinned products
3. How large is your organization?
   1. N/A: Independent contractor / government / academic
   2. Small business (<100 people)
   3. Medium-sized business (100 – 1500 people)
   4. Large business (>1500 people)
4. How would you describe the career ages of your workforce?

**[Select All That Apply]**

* 1. 0 to 4 years
  2. 5 to 9 years
  3. 10 to 19 years
  4. 20 to 29 years
  5. 30 years or more

1. How much progress into digital twin and digital thread development has your organization achieved?
   1. Conceptual stage (designed, but no implementation at all)
   2. Minimum viable product (basic implementation, meeting design requirements)
   3. Operational on a team-wide scale (fully implemented in a limited setting)
   4. Operational on an enterprise scale (fully implemented and “fielded” to relevant teams/efforts)

# Questions About Your Experience

1. How long have you been in the science & engineering workforce?
   1. 0 to 4 years
   2. 5 to 9 years
   3. 10 to 19 years
   4. 20 to 29 years
   5. 30 years or more
2. Your age is \_\_\_\_ years old. (reasoning in parentheses – would not include those in survey 😊)
   1. less than 25 (entering workforce)
   2. 25 to 34 (becoming established)
   3. 35 to 44 (core career)
   4. 45 to 59 (established and mentoring)
   5. 60 to 65 (thinking about retirement)
   6. more than 65 (retired/no plan in retiring)
3. Do you agree with the DEIC’s definitions of a digital twin and digital thread?
   1. Yes
   2. No
   3. Other [Request Short Answers]
4. How would you classify your experience and expertise in these subject areas?

**[List of Subject Areas with Options to Choose Levels of Expertise Next To Them]**

e.g., Subject Area \_\_\_\_\_\_ {Dropdown Box With List of Levels of Expertise}

1. Regarding which subject areas would you feel comfortable answering survey questions?

**[Select All That Apply]**

1. Computational Design and Analysis Framework Development
2. Impacts of Computational Design and Analysis on Enterprise Data and Software Architecture
3. Hardware and Software Infrastructure Co-Design
4. Impacts of Socio-Technical Interactions on Computational Design and Analysis Strategy
5. If you would like to see the survey results, please provide your email. Note: this will not be shared to anyone without your permission.

**[Request Short Answer}**

# Computational Design and Analysis Framework Development

1. Select appropriate level of *personal* professional experience and expertise in:  
   **[None / Dabbled / Learning / Occasional / Commonplace]**
   1. Co-simulated (uncoupled) Multiphysics (e.g., aeroacoustics, CHT, FSI, etc.)
   2. Coupled Multiphysics Mod/Sim
   3. Multiscale Mod/Sim (single or multi-physics/discipline)
   4. Multifidelity Mod/Sim (single or multi-physics/discipline)
   5. Multidisciplinary Trade-off Analyses (integrated design/manufacturing, performance/lifing, etc.)
   6. Automation for labor-intensive tasks (meshing, post-processing, etc.)
   7. AI/ML applied to sophisticated automation, data analysis, etc.
   8. Hybrid AI/ML + traditional modeling/simulation integrated methods
   9. Other: [Request Short Answers]
2. Select your best estimate of your *enterprise*/collaborators’ best experience and expertise in:  
   **[None / Dabbled / Learning / Occasional / Commonplace]**
   1. Co-simulated (uncoupled) Multiphysics (e.g., aeroacoustics, CHT, FSI, etc.)
   2. Coupled Multiphysics Mod/Sim
   3. Multiscale Mod/Sim (single or multi-physics/discipline)
   4. Multifidelity Mod/Sim (single or multi-physics/discipline)
   5. Multidisciplinary Trade-off Analyses (integrated design/manufacturing, performance/lifing, etc.)
   6. Automation for labor-intensive tasks (meshing, post-processing, etc.)
   7. AI/ML applied to sophisticated automation, data analysis, etc.
   8. Hybrid AI/ML + traditional modeling/simulation integrated methods
   9. Other: [Request Short Answers]
3. In which research areas do you believe digital engineering would find the most interoperability?

**[Select All That Apply]**

* 1. Co-simulated (uncoupled) Multiphysics (e.g., aeroacoustics, CHT, FSI, etc.)
  2. Coupled Multiphysics Mod/Sim
  3. Multiscale Mod/Sim (single or multi-physics/discipline)
  4. Multifidelity Mod/Sim (single or multi-physics/discipline)
  5. Multidisciplinary Trade-off Analyses (integrated design/manufacturing, performance/lifing, etc.)
  6. Automation for labor-intensive tasks (meshing, post-processing, etc.)
  7. AI/ML applied to sophisticated automation, data analysis, etc.
  8. Hybrid AI/ML + traditional modeling/simulation integrated methods
  9. Other: [Request Short Answers]

1. In which research areas do you believe digital engineering would find the least interoperability?

**[Select All That Apply]**

* 1. Co-simulated (uncoupled) Multiphysics (e.g., aeroacoustics, CHT, FSI, etc.)
  2. Coupled Multiphysics Mod/Sim
  3. Multiscale Mod/Sim (single or multi-physics/discipline)
  4. Multifidelity Mod/Sim (single or multi-physics/discipline)
  5. Multidisciplinary Trade-off Analyses (integrated design/manufacturing, performance/lifing, etc.)
  6. Automation for labor-intensive tasks (meshing, post-processing, etc.)
  7. AI/ML applied to sophisticated automation, data analysis, etc.
  8. Hybrid AI/ML + traditional modeling/simulation integrated methods
  9. Other: [Request Short Answers]

1. Which research areas do you think DEIC-CoDADE should invest the most time in investigating interoperability?

**[Select All That Apply]**

* 1. Co-simulated (uncoupled) Multiphysics (e.g., aeroacoustics, CHT, FSI, etc.)
  2. Coupled Multiphysics Mod/Sim
  3. Multiscale Mod/Sim (single or multi-physics/discipline)
  4. Multifidelity Mod/Sim (single or multi-physics/discipline)
  5. Multidisciplinary Trade-off Analyses (integrated design/manufacturing, performance/lifing, etc.)
  6. Automation for labor-intensive tasks (meshing, post-processing, etc.)
  7. AI/ML applied to sophisticated automation, data analysis, etc.
  8. Hybrid AI/ML + traditional modeling/simulation integrated methods
  9. Other: [Request Short Answers]

1. In which research areas do you think DEIC-CoDADE should suggest guidelines for maximizing interoperability?

**[Select All That Apply]**

* 1. Co-simulated (uncoupled) Multiphysics (e.g., aeroacoustics, CHT, FSI, etc.)
  2. Coupled Multiphysics Mod/Sim
  3. Multiscale Mod/Sim (single or multi-physics/discipline)
  4. Multifidelity Mod/Sim (single or multi-physics/discipline)
  5. Multidisciplinary Trade-off Analyses (integrated design/manufacturing, performance/lifing, etc.)
  6. Automation for labor-intensive tasks (meshing, post-processing, etc.)
  7. AI/ML applied to sophisticated automation, data analysis, etc.
  8. Hybrid AI/ML + traditional modeling/simulation integrated methods
  9. Other: [Request Short Answers]

1. Do you believe that the AIAA’s DEIC position on digital twins would promote responsible use of models in these research areas?

**[Select All That Apply]**

* 1. Co-simulated (uncoupled) Multiphysics (e.g., aeroacoustics, CHT, FSI, etc.)
  2. Coupled Multiphysics Mod/Sim
  3. Multiscale Mod/Sim (single or multi-physics/discipline)
  4. Multifidelity Mod/Sim (single or multi-physics/discipline)
  5. Multidisciplinary Trade-off Analyses (integrated design/manufacturing, performance/lifing, etc.)
  6. Automation for labor-intensive tasks (meshing, post-processing, etc.)
  7. AI/ML applied to sophisticated automation, data analysis, etc.
  8. Hybrid AI/ML + traditional modeling/simulation integrated methods
  9. Other: [Request Short Answers]

1. In which research areas do you think DEIC-CoDADE should suggest guidelines for maximizing responsible use?

**[Select All That Apply]**

* 1. Co-simulated (uncoupled) Multiphysics (e.g., aeroacoustics, CHT, FSI, etc.)
  2. Coupled Multiphysics Mod/Sim
  3. Multiscale Mod/Sim (single or multi-physics/discipline)
  4. Multifidelity Mod/Sim (single or multi-physics/discipline)
  5. Multidisciplinary Trade-off Analyses (integrated design/manufacturing, performance/lifing, etc.)
  6. Automation for labor-intensive tasks (meshing, post-processing, etc.)
  7. AI/ML applied to sophisticated automation, data analysis, etc.
  8. Hybrid AI/ML + traditional modeling/simulation integrated methods
  9. Other: [Request Short Answers]

1. Are you most interested in developing one-off digital twins or repeated-use digital twins?
   1. One-off digital twins
   2. Few-repeated-use digital twins (used a finite number of times and shelved)
   3. Continuously used and operated digital twins
   4. Other: [Request Short Answers]

# Impacts of Computational Design and Analysis on Enterprise Data and Software Architecture

1. Which kinds of data do you mostly utilize in your work?

**[Select All That Apply]**

* 1. Unstructured text data
  2. Structured data
  3. Boundary conditions
  4. Geometric data
  5. Tolerances
  6. Photographs
  7. Other: [Request Short Answers]

1. Is the data you work with:
   1. Measured
   2. Simulated
   3. Fusion (mixed simulated and measured data)
   4. Other: [Request Short Answers]
2. Which types of data would you expect to be the least challenging to manage with respect to digital twin development?

**[Select All That Apply]**

1. Unstructured text data
2. Structured data
3. Boundary conditions
4. Geometric data
5. Tolerances
6. Photographs
7. Other: [Request Short Answers]
8. Which types of data would you expect to be the most challenging to manage with respect to digital twin development?

**[Select All That Apply]**

1. Unstructured text data
2. Structured data
3. Boundary conditions
4. Geometric data
5. Tolerances
6. Photographs
7. Other: [Request Short Answers]
8. What data management do you think DEIC-CoDADE should investigate how to maximize interoperability with digital twin development?
   1. Unstructured text data
   2. Structured data
   3. Boundary conditions
   4. Geometric data
   5. Tolerances
   6. Photographs
   7. Other: [Request Short Answers]
9. What types of data do you think DEIC-CoDADE should investigate how to utilize responsibly in digital twin development?
   1. Unstructured text data
   2. Structured data
   3. Boundary conditions
   4. Geometric data
   5. Tolerances
   6. Photographs
   7. Other: [Request Short Answers]
10. With what types of data do you think DEIC-CoDADE should suggest guidelines for maximizing responsible use?

**[Select All That Apply]**

* 1. Unstructured text data
  2. Structured data
  3. Boundary conditions
  4. Geometric data
  5. Tolerances
  6. Photographs
  7. Other: [Request Short Answers]

# Hardware and Software Infrastructure Co-Design

1. What research areas do you use high performance computing for? **[Select All That Apply]**
   1. Co-simulated (uncoupled) Multiphysics (e.g., aeroacoustics, CHT, FSI, etc.)
   2. Coupled Multiphysics Mod/Sim
   3. Multiscale Mod/Sim (single or multi-physics/discipline)
   4. Multifidelity Mod/Sim (single or multi-physics/discipline)
   5. Multidisciplinary Trade-off Analyses (integrated design/manufacturing, performance/lifing, etc.)
   6. Automation for labor-intensive tasks (meshing, post-processing, etc.)
   7. AI/ML applied to sophisticated automation, data analysis, etc.
   8. Hybrid AI/ML + traditional modeling/simulation integrated methods
   9. Other: [Request Short Answers]
2. What types of data do you utilize in your research areas that use high performance computing? **[Select All That Apply]**
   1. Unstructured text data
   2. Structured data
   3. Boundary conditions
   4. Geometric data
   5. Tolerances
   6. Photographs
   7. Other: [Request Short Answers]
3. Approximately what percentage of your cyber-physical infrastructure is dedicated to computational design and analysis?

**[Choose One Option]**

* 1. <10%
  2. 10-20%
  3. 20-30%
  4. 30-40%
  5. 50-60%
  6. >60%

1. What types of scaling do you anticipate your enterprise having to undergo in the future?

**[Select All That Apply]**

1. Strong scaling – Incorporate more hardware to reduce the time-to-solution for a given problem.
2. Weak scaling – Incorporate more hardware to solve larger problems than before.
3. User scaling – Add ability to support growth in concurrent users with minimal efforts.
4. Functional scaling – Add new functionality/interoperability with minimal effort.
5. Horizontal scaling – Add more nodes/racks/data centers.
6. Vertical scaling – Upgrading nodes (e.g., processor, memory, interconnect)
7. Which research areas would benefit the most from which kind of scaling?

**[List of Research Areas with Options to Choose Types of Scaling Next To Them]**

e.g., Research Area \_\_\_\_\_\_ {Dropdown Box With List of Scaling Options}

1. The management of which types of data would benefit the most from which kind of scaling?

**[List of Research Areas with Options to Choose Types of Scaling Next To Them]**

e.g., Types of data \_\_\_\_\_\_ {Dropdown Box With List of Scaling Options}

1. Which types of scaling do you think the DEIC’s digital twin framework would be most interoperable with?

**[Select All That Apply]**

* 1. Strong scaling – Incorporate more hardware to reduce the time-to-solution for a given problem.
  2. Weak scaling – Incorporate more hardware to solve larger problems than before.
  3. User scaling – Add ability to support growth in concurrent users with minimal efforts.
  4. Functional scaling – Add new functionality/interoperability with minimal effort.
  5. Horizontal scaling – Add more nodes/racks/data centers.
  6. Vertical scaling – Upgrading nodes (e.g., processor, memory, interconnect)

1. Which types of scaling do you think the DEIC’s digital twin framework would be least interoperable with?

**[Select All That Apply]**

* 1. Strong scaling – Incorporate more hardware to reduce the time-to-solution for a given problem.
  2. Weak scaling – Incorporate more hardware to solve larger problems than before.
  3. User scaling – Add ability to support growth in concurrent users with minimal efforts.
  4. Functional scaling – Add new functionality/interoperability with minimal effort.
  5. Horizontal scaling – Add more nodes/racks/data centers.
  6. Vertical scaling – Upgrading nodes (e.g., processor, memory, interconnect)

1. In which types of scaling do you think DEIC-CoDADE should suggest guidelines for maximizing interoperability?

**[Select All That Apply]**

* 1. Strong scaling – Incorporate more hardware to reduce the time-to-solution for a given problem.
  2. Weak scaling – Incorporate more hardware to solve larger problems than before.
  3. User scaling – Add ability to support growth in concurrent users with minimal efforts.
  4. Functional scaling – Add new functionality/interoperability with minimal effort.
  5. Horizontal scaling – Add more nodes/racks/data centers.
  6. Vertical scaling – Upgrading nodes (e.g., processor, memory, interconnect)

# Impacts of Socio-Technical Interactions on Computational Design and Analysis Strategy

1. Who are currently considered to be stakeholders to your digital engineering efforts?

**[Select All That Apply]**

* 1. Other computational design and analysis teams
  2. Program management
  3. Direct customers
  4. End-product users
  5. Community around end-product users
  6. Tool vendors
  7. Other: [Request Short Answers]

1. Who do you believe should be considered as stakeholders to your digital engineering efforts?

**[Select All That Apply]**

* 1. Other computational design and analysis teams
  2. Program management
  3. Direct customers
  4. End-product customers
  5. Community around end-product users
  6. Tool vendors
  7. Other: [Request Short Answers]

1. Who currently has the most influence over your digital engineering efforts?

**[Select All That Apply]**

* 1. Other computational design and analysis teams
  2. Program management
  3. Direct customers
  4. End-product customers
  5. Community around end-product users
  6. Tool vendors
  7. Other: [Request Short Answers]

1. Have you experienced any recent cost-cutting in your digital engineering efforts? What has been the impact on your enterprise as a whole?

**[Choose One Option]**

* 1. Significant impact
  2. Minor impact
  3. No impact
  4. Other: [Request Short Answers]

1. Has the size of your organization impacted your ability to implement digital engineering? If so, what has been the impact?

**[Choose One Option]**

* 1. Significant impact
  2. Minor impact
  3. No impact
  4. Other: [Request Short Answers]

1. Has the career age of your workforce impacted your ability to implement digital engineering? If so, what has been the impact?

**[Choose One Option]**

* 1. Significant impact
  2. Minor impact
  3. No impact
  4. Other: [Request Short Answers]

1. Has your digital engineering implementation been impacted by having to integrate various tools? If so, what has been the impact?

**[Choose One Option]**

* 1. Significant impact
  2. Minor impact
  3. No impact
  4. Other: [Request Short Answers]

1. Has the alignment of your organization (e.g., government, defense, commercial, academia) had an impact on your implementation of digital engineering? If so, what has been the impact?

**[Choose One Option]**

* 1. Significant impact
  2. Minor impact
  3. No impact
  4. Other: [Request Short Answers]

# Short Answer Questions

1. What are the fundamental challenges / major barriers to utilizing digital engineering in this context?

**[Short Answer: No More Than 500 Words]**

1. What are the major tools/technologies/methods we would need to meet any previously identified gaps?

**[Short Answer: No More Than 500 Words]**

1. Would you like to identify yourself to the surveyors? Note: this is independent of the previous question asking for emails.

**[Short Answer: No More Than 500 Words]**