MathWorks SAE Aero Design Simulation Challenge 2027

Introduction

The MathWorks SAE Aero Design Simulation Challenge provides a platform for Aero Design teams to virtually test and demonstrate flight-readiness through flight simulation in a virtual environment. Teams download Virtual Environment for SAE Aero Design from File Exchange

The project contains the

- simulation model and supporting files required to configure the aircraft,
- connect an RC controller,
- virtual environment to fly missions,
- record flight data and
- prepare the submission.

Teams customize the model parameters to represent their competition aircraft and may also modify the Aircraft Dynamics subsystem to represent the dynamics of their aircraft. This challenge recognizes teams that demonstrate innovative and effective use of MATLAB or Simulink to design their aircraft, develop a digital twin, and perform simulated flight missions in Simulink.

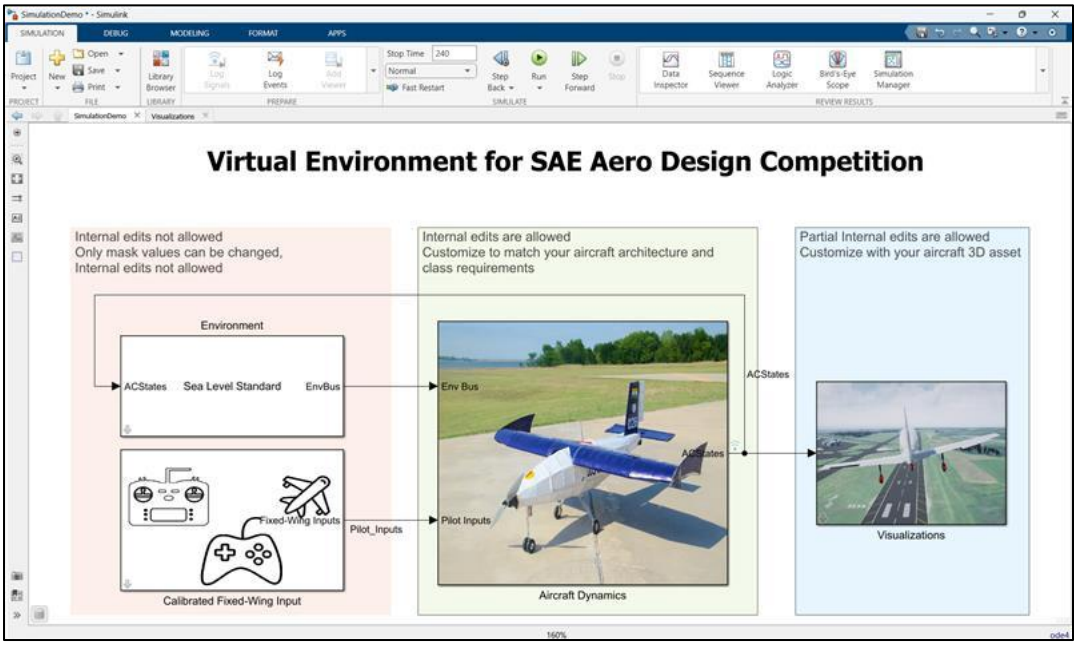

Figure 1: Virtual Environment for SAE Aero Design Competition

Last update date: Oct 16, 2027

Award Prizes and Recognition

The top three teams in the MathWorks SAE Aero Design Simulation Challenge will receive the following awards

- First place: $500
- Second place: $300
- Third place: $200

Winners will be announced at the SAE Aero Design awards ceremony and will receive certificates of achievement. They will also be invited to write a blog for the Student Lounge Blog and collaborate on a social media post with the @matlab_students Instagram channel.

Winners will be ranked in a single pool across the Regular, Micro, and Advanced classes; there will be no separate awards for each class. Judge's decision is final and binding.

Challenge Criteria and Eligibility

The challenge is open to teams participating in the SAE Aero Design 2027 competition in the Regular, Micro, and Advanced classes. Each team can make only one submission.

Teams will be assessed on two components:

- Flight missions in the virtual environment
    - Teams must download the Virtual Environment for SAE Aero Design from MATLAB File Exchange.
        - Teams must not modify the ***Environment*** subsystem, ***Calibrated Fixed-Wing input*** subsystem, and related any supportive functions (Refer figure-1).
        - Teams must change aircraft parameters with their aircraft data, may modify the internal architecture of the ***Aircraft Dynamics*** subsystem and ***Visualization***, while retaining the interface (Refer figure-1).
    - Teams will fly one mission in each of the following environments:
        - Sea Level Standard
        - Either competition site as appropriate:
            - Aero Design East - Lakeland, FL
            - Aero Design West - Van Nuys, CA
    - Teams must submit the best recorded flight from each environment along with the complete MATLAB Project and an engineering report.
    - Both scored missions must be flown manually by a team pilot using an RC transmitter or joystick connected to the template. Autopilots and scripted control inputs are not allowed for the scored missions.

- The calibrated RC commands recorded before the actuator dynamics during each selected mission must be included in the submission. Judges will replay these commands through the submitted aircraft model to verify the results.
- The MATLAB project must run in latest MATLAB release (R2026b).
- The model generates a flight data file after every simulation. Only the best scored simulation needs to be submitted.

- Mission Definition
  - Each selected simulation runs for 240 seconds (4 minutes). The aircraft flies one lap in six steps, numbered as in the figure below. The origin is the aircraft's start point on the runway.

Table 1: Class wise limits for each segment

Class	**Take-off limit**	**First-turn distance**	**Landing limit**
Regular	Under 100 ft (30.48 m)	400 ft (121.92 m)	Under 400 ft (121.92 m)
Micro	Under 50 ft (15.24 m)	350 ft (106.68 m)	Under 200 ft (60.96 m)
Advanced	No upper limit	400 ft (121.92 m)	No upper limit

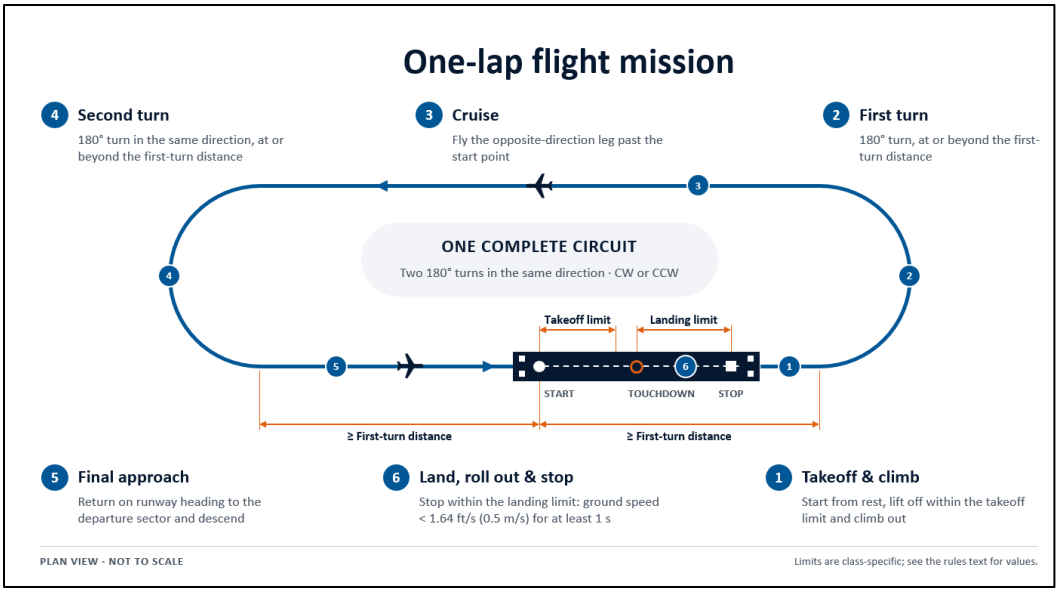

Figure 2: Mission profile

- **Takeoff and climb (5 points)**
  - Start from rest, leave the ground, and stay at or above 1.64 ft (0.5 m) above ground level (AGL) for at least 0.5 s.
  - Complete the takeoff within your class takeoff limit.
  - Climb to the cruise altitude of 98.4 ft (30 m) and continue in the takeoff direction.
  - A takeoff within the class limit earns 5 points. A takeoff beyond the limit, or a flight with no detected takeoff, earns 0 takeoff points.
- **First turn (5 points)**
  - Do not start the first turn before reaching your class first-turn distance from the origin.
  - Turn 180 degrees. Clockwise and counterclockwise circuits are both accepted.
  - Completing the first 180-degree turn earns 5 points.
- **Cruise**
  - Fly the opposite-direction leg back past the origin.
  - Continue until you are at least the first-turn distance from the origin on the other side.
- **Second turn (5 points)**
  - Turn 180 degrees in the same direction as the first turn.
  - Start this turn at least the first-turn distance from the origin, on the opposite side from the first turn.
  - Completing the second 180-degree turn earns 5 points, but only if the first turn was valid.

- **Final approach (5 points)**
  - Return on the runway heading to the departure sector. This closes a true 360-degree circuit.
  - Descend for landing.
  - Returning to the departure sector earns 5 points, but only if both turns were valid.
- **Land, roll out and stop (5 points)**
  - After touchdown, stay below 1.64 ft (0.5 m) AGL and stop on the runway.
  - A stop is detected when horizontal ground speed stays below 1.64 ft/s (0.5 m/s) for at least 1 s.
  - Complete the landing within your class landing limit.
  - A completed landing within the class limit earns 5 points. An incomplete landing, or a stop beyond the limit, earns 0 landing points.
- **Circuit rules (steps 2 to 5)**
  - From the end of the initial climb until the final descent, stay between 82.0 ft and 114.8 ft (30 ± 5 m) AGL. If the aircraft leaves this band, the circuit is not counted.
  - Only the first 360-degree circuit attempted within the 240 s mission time is scored. Additional circuits earn no points.
  - Circuit points are awarded in order. A step scores only when the earlier circuit steps are valid.
  - An early first turn, a straight out-and-back path, skipped sectors or an incomplete step earn no points for that step.

- **Mission score**
  - Each mission is worth 25 points:
    - 5 for takeoff (step 1)
    - up to 15 for the circuit (steps 2, 4 and 5, at 5 points each)
    - 5 for landing (step 6)
  - The Sea Level Standard mission and the applicable East or West competition-site mission have equal weight.
  - The flying mission score is the sum of both mission scores, with a maximum of 50 points. No environment multiplier is applied.

$$Mission\ Score\ (MS)\ (25) = (Take\ off\ (5) + Circuit\ (15) + Landing\ (5))$$

$$Total\ Mission\ Score\ (TMS) = MS_{Sea\ Level} + MS_{Competition\ site}$$

- Engineering report:
  - Teams will also be assessed through their Engineering Report and submitted simulation model, including how effectively the model represents the aircraft and

how well the Aircraft Dynamics subsystem is supported by data, assumptions, and verification.

- Each team must submit an Engineering Report that explains how the MathWorks SAE Aero Design Virtual Environment, MATLAB, and Simulink were used to address specific project challenges. The report must meet the following specifications:
  - Font size: 12 pt proportional font
  - Line spacing: double
  - Layout: Two columns
  - Page size: ANSI A (8.5 × 11 in)
  - Margins: Left: 1.0 in (25.4 mm); Right: 0.5 in (12.7 mm); Top: 0.5 in (12.7 mm); Bottom: 0.5 in (12.7 mm)
  - Page limit: 4 pages, including figures, and tables. Content beyond page 4 will not be judged.
- Header at the top of page 1 must show: Team name, School/University, Class (Regular/Micro/Advanced) and Competition (East/West).
- File format: PDF, named Competition_Class_TeamNumber_TeamName.pdf (for example, East_Micro_101_TeamAlpha.pdf).
- Suggested report structure: Teams may address the following points:
  - Problem and approach: the design problem and why the virtual environment/MATLAB/Simulink was used.
  - Aircraft model and simulation setup: what was modeled and what was added to the template.
  - Analysis and design insights: plots, trade studies or optimization results, and the design decisions they led to.
  - Test and verification: how the model was checked, including comparison with ground or flight test data where available.
  - Reflection: what worked well, what was difficult, and which MATLAB/Simulink features were useful or missing.
- A panel of MathWorks judges will evaluate the Engineering Report and submitted model using the scoring rubric below.

Important Dates

- Aero Design East submission deadline: January 24, 2027, at 11:59 p.m. Pacific Time
- Aero Design West submission deadline: February 21, 2027, at 11:59 p.m. Pacific Time

Submission Process:

1. Prepare the submission as a ZIP package by following the instructions in the Prepare your submission section. The package must contain:

   - The Engineering Report in PDF format, prepared according to the specifications above.
   - The complete Virtual Environment project, including the required setup files and both selected flight-data files.
2. Upload the ZIP package to a team-managed cloud platform such as OneDrive, Google Drive, or Dropbox.
   - Set sharing to "Anyone with the link can view and download."
   - The link must not require a sign-in, password, or access request and must remain active until the results are announced.
   - Submissions that judges cannot download, open, or replay will not be scored. All submission files will be downloaded within one hour after the deadline.
3. Submit the final ZIP-package link through the form for the applicable competition:
   - Aero Design East Submission Form: submit by 11:59 p.m. Pacific Time on January 24, 2027.
   - Aero Design West Submission Form: submit by 11:59 p.m. Pacific Time on February 21, 2027.
4. Each team may make only one submission. Teams must submit the final cloud link through the applicable form above. The ZIP package and cloud link must not be changed after the submission deadline.

Available resources:

- Access the template repository: Virtual Environment for SAE Aero Design
- How to use the repository and submit your solutions: Launch webinar
- Get your MATLAB license here
- Learning resources:
   - Pilot-in-the-loop Flight Simulation for Aerospace Design Competitions
   - Aerospace Design Learning Resources for Students
   - UAV Learning Resources for Students
   - Aero Design-specific resources

Scoring Rubric

School Name	MathWorks SAE Aero Design Simulation Challenge			
Section	**Description**	**Max Points**	**Score**	**Comments**
Flying mission in virtual environment (50 points)				
Flying mission in the virtual environment	Did the team: • Fly one complete 240-second (4-minute) mission in each required environment: Sea Level Standard and the applicable East or West competition-site environment? • For each mission, did the team complete a valid takeoff, the scored 360-degree circuit stages and a valid runway landing? • Did both recordings include the required calibrated pre-actuator RC commands and support evaluator replay?	50		
Engineering report and simulation model assessment (50 points)				
Problem Framing & Tool Justification	Did the team: • Clearly state the technical design problem they are trying to solve? • Explain why the virtual environment/MATLAB/Simulink was the right tool for this problem?	5		
Aircraft model and simulation depth	Did the team: • Customize the supplied model with aircraft-specific geometry, mass properties, aerodynamics, propulsion and actuator data? • Where the Aircraft Dynamics architecture was changed, were the changes relevant and technically justified? • Does architecture align with the competition class? • A well-parameterized use of the supplied architecture may score	15		

	well; added blocks alone do not earn points.			
Analysis and design insights	Did the team: • use MATLAB/Simulink to extract design or performance insights through plots, metrics, trade studies or optimization? • use insights to support aircraft-design or flight-readiness decisions?	10		
Test and verification	Did the team: • check the model and flight dynamics against appropriate evidence such as hand calculations, supplier data, bench tests, wind tunnel, ground tests or flight-test data? Were assumptions, acceptance criteria and differences explained?	10		
Data traceability and model limitations	Did the team: • identify important data sources, units, coordinate conventions and assumptions? • explain the operating range, known limitations and areas where the model should not be extrapolated?	5		
Report quality and reproducibility	Is the report • clear, well organized and supported by readable labelled figures? • does it follow the required format and identify the important model files or block paths so judges can reproduce the work?	5		
Total		100		

Prepare your submission

1. Add the required files to the appropriate folders in the Virtual Environment project:
    a. Add both selected simulated flight-data files to ***Submission/Flight Data***.
    b. Add the Engineering Report PDF to ***Submission/Engineering Report***.
2. From the project shortcuts, select ***Prepare your submission***. The MATLAB app will open and guide you through packaging the simulation files, flight data, and Engineering Report required for submission.

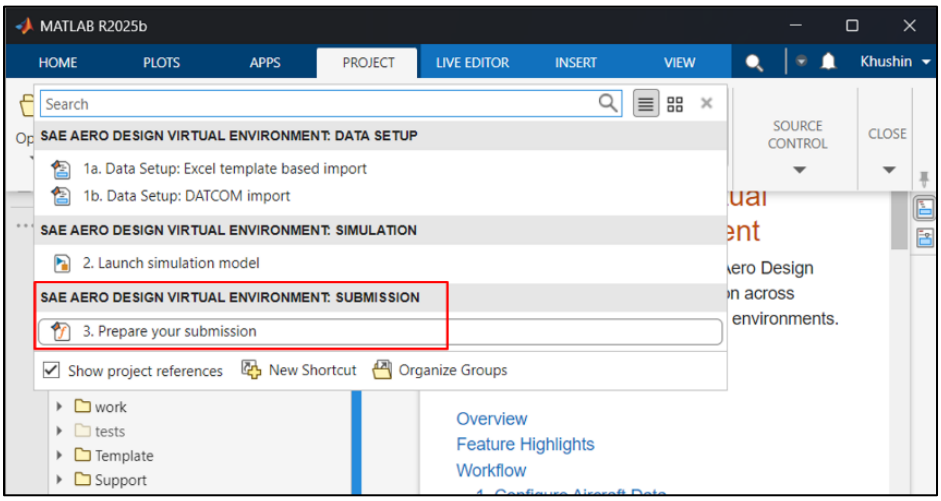

Figure 3: Access automated submission preparation process

    a. Enter the requested team information, review it for accuracy, and select **Next**.

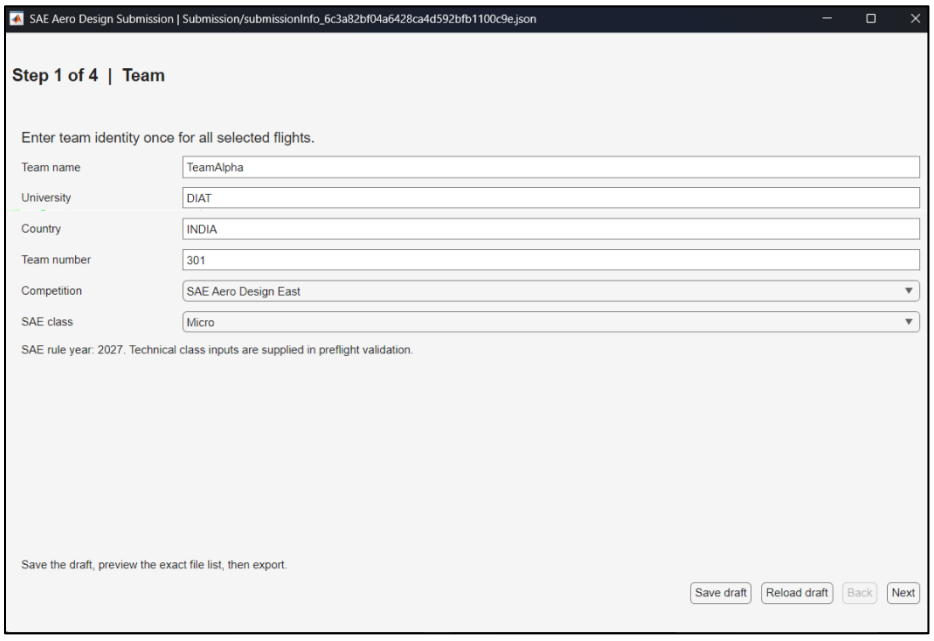

Figure 4: MATLAB App to prepare submission challenge

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b. Select the file used to define the aircraft data for the simulation, and then select **Next**.

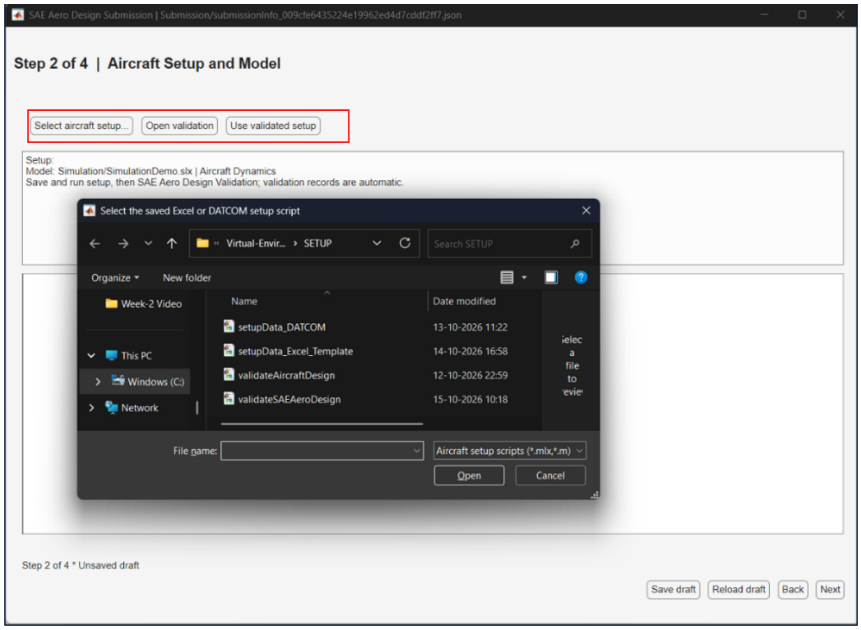

Figure 5: Select the file for aircraft data setup

c. Select both required flight data files and the Engineering Report PDF. Confirm that the files correspond to the team and competition entered in the previous steps.

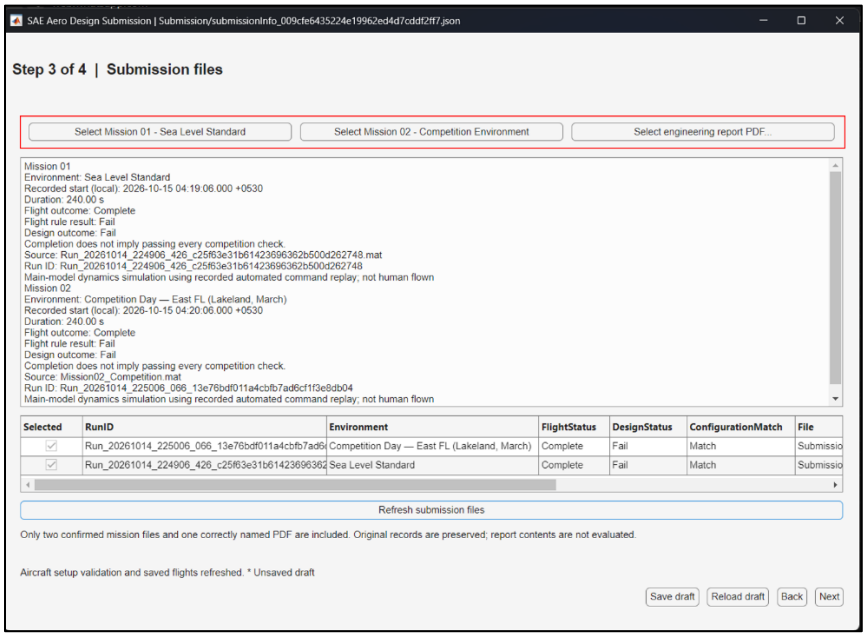

Figure 6: Select your flight data and engineering report

d. Select **Save Draft** to retain the entered information, then review the summary and selected files before exporting the submission package.

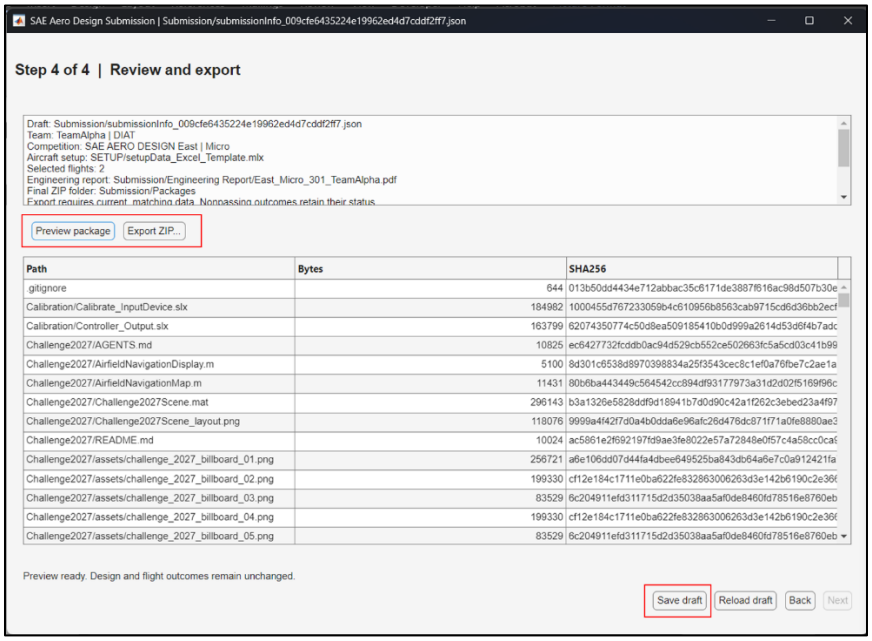

Figure 7: Save and export the zip package

e. Select **Export**. After a successful export, the ZIP package will be available in the ***Submission/Package*** folder. Upload this ZIP package to a team-managed cloud platform and submit a publicly downloadable link through the applicable competition form.

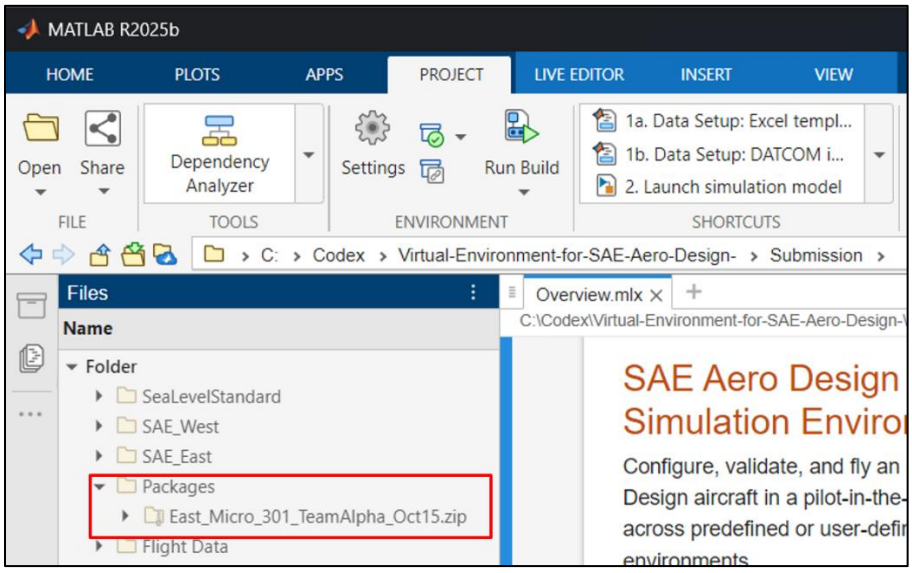

Figure 8: Final zip package ready for submission