

Determining atmospheric composition

Commemorating Kitty Hawk

A good precedent for debris mitigation

# AEROSPACE

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2023

# YEAR-IN-REVIEW



## First flights, launches and reentries mark an eventful year

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The **Atmospheric Flight Mechanics Technical Committee** addresses the aerodynamic performance, trajectories and attitude dynamics of aircraft, spacecraft, boosters and entry vehicles.

Engineers this year analyzed performance data from last year's **Artemis I** mission, in which an unoccupied NASA Orion capsule traveled around the moon and splashed down in the Pacific Ocean. The analysis was done to validate models and prepare for future Artemis missions, including the **Artemis II** crewed lunar flyby scheduled for November 2024.

In September, **NASA's OSIRIS-REx** spacecraft, built by Lockheed Martin, returned samples from the asteroid Benu to Earth, making the U.S. the second nation to retrieve asteroid samples. The sample return capsule, landed in Utah using a reentry sequence like that of previous missions, including the Japanese **Hayabusa** missions in 2010 and 2020. Built by Lockheed Martin, it was NASA's first Earth-return mission since the 2006 **Stardust** mission.

In November, **SpaceX** launched its second **Starship-Super Heavy** rocket from Boca Chica, Texas. The booster and upper stage separated as planned, but shortly after, Super Heavy exploded over the Gulf of Mexico and Starship was lost. During the first attempt, in April, a fully stacked Starship-Super Heavy lifted off and flew under control for 85 seconds before losing thrust vector control and exploding over the Gulf of Mexico. Before the November flight, SpaceX redesigned its launch platform by adding a **water deluge system**.

Several notable first flights occurred this year. The **Boeing-Saab T-7 Red Hawk** made its first flight in June. The T-7 is to replace the **U.S. Air Force's T-38 Talon trainers** and features an updated digital cockpit and software to simulate modern aircraft. In May, the **Comac C919** made its inaugural revenue flight in China, beginning Comac's bid to compete against Western aircraft giants Boeing and Airbus in the single-aisle jet market. The **U.S. Air Force's B-21 Raider** made its first flight in November. The B-21 will be the next-generation U.S. bomber platform, replacing the **B-1** and **B-2**.

As of November, preparations were underway for the first flight of **NASA's X-59** demonstrator in 2024. NASA seeks to demonstrate quiet supersonic flight over land with the X-59.

In January, **Boeing** delivered its final **747**. Between 1967 and 2023, Boeing produced 1,574 of the twin-aisle jetliners, democratizing global air travel for millions of people. In recent years, the **747 freighter** has been a mainstay of cargo airlines. A 747 variant has served as **Air Force One**, and the next-generation **VC-25B** is



scheduled for delivery in 2027.

Early in the year, the **SENS4ICE consortium** led by the **German Aerospace Center, DLR**, along with 16 partners across Europe, the U.S., Canada and Brazil, conducted two flight test campaigns in the U.S. and France to detect supercooled large droplet, or SLD, icing conditions. With a total of 30 flights and 75 flight hours, validation data in natural liquid water icing and in the rare SLD conditions were collected.

In January, the first phase of the eight-year European **CleanAviation initiative** started. This program focuses on developing technologies toward climate-neutral aviation using three pillars: hybrid-electric regional aircraft, ultra-efficient short/medium-range aircraft and hydrogen-powered aircraft. The initiative will also investigate capabilities to optimize, assess complete aircraft configurations and develop new means of compliance.

In February, the **X-62 Variable In-flight Simulation Test Aircraft** completed flight testing of its systems and was transitioned to operational use. Flight testing began in December 2022. VISTA provides a platform for **DARPA** and the **U.S. Air Force Research Laboratory** for experimentation of artificial intelligence and machine learning control of a fighter aircraft. The team accomplished constructive AI dogfighting and has demonstrated the use of multiple data links and the ability to quickly modify flight software while taxiing to take off or during flight. ★

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▲ A capsule containing rocks and dust from the asteroid Benu touched down under parachutes in September. The OSIRIS-REx mission — short for Origins, Spectral Interpretation, Resource Identification, Security, Regolith Explorer — was NASA's first attempt to sample an asteroid and the agency's first sample return mission since 2006.

NASA/Keegan Barber