



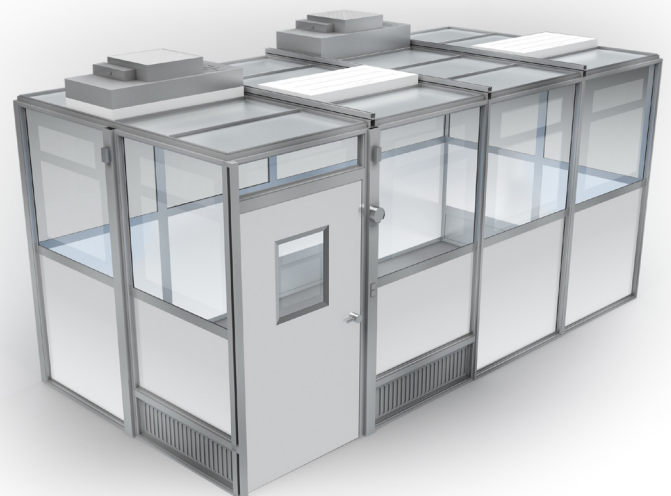
## AEROSPACE & DEFENSE



Subzero Engineering designs, builds, and installs custom cleanrooms for both commercial and government clients in the aerospace and defense industries.

In general, aerospace/defense companies require a cleanroom for the following reasons:

- 1 *Manufacturing airship or spaceship components in a dust and contaminant-free environment.*
- 2 *Performing any process – such as cleaning a rocket or lowering a satellite into a nose cone – that must be done in the absence of airborne contaminants.*
- 3 *Performing research in a clean, sterilized location.*



Here are some examples of cleanroom projects that Subzero Engineering has performed for aerospace and defense clients:

## The James Webb Space Telescope

On December 25, 2021, the James Webb Space Telescope – a.k.a. “the Webb” – was launched from Kourou, French Guiana. The Webb is designed to conduct infrared astronomy using high-resolution instruments. It can detect celestial objects in the farthest regions of space, and can observe the first stars and the formation of the first galaxies. The telescope was developed by the National Aeronautics and Space Administration (NASA), in partnership with the European Space Agency (ESA) and the Canadian Space Agency (CSA).

The Webb was launched from the Guiana Space Centre. APCO Technologies, a Swiss firm, was in charge of installing the folded telescope inside the nose cone of an Ariane 5 rocket. For this task, the APCO crew of technicians required an ultra-clean environment.

An Airblock Softwall cleanroom was installed at the top of the launch building, surrounding the rocket's nose cone. The octagonal cleanroom was made up of eight clear 16' x 48', flexible PolySim 509 softwalls, which were non-outgassing, Electrostatic Discharge (ESD) protective, and had an E84 Class A fire rating. The cleanroom was occupied by up to 12 technicians plus equipment. APCO Technologies designed and installed the cleanroom, while Simplex provided expertise, guidance, and market-leading materials for its construction.



Simplex Solution in use Webb Space Telescope





Pictured: Cleanroom on a bridge

## Ascent Aerospace: A Cleanroom on a Bridge

In 2016, Ascent Aerospace was contracted to provide cleaning and support services for a 60-foot rocket being assembled at NASA's Michoud facility in New Orleans, Louisiana. Manufactured by Boeing, the rocket featured a spherical nose cone, with a circular opening in the top to allow technicians to enter the nose cone in order to clean it.

For this project, Ascent built a 27' x 12' aluminum bridge that could be lifted by crane and placed above the rocket. Simplex built a rectangular cleanroom on the bridge itself. The cleanroom included hoist attachments used to lower technicians down through a hatch in the bridge floor, and through the nose cone's circular opening, to clean the rocket interior.

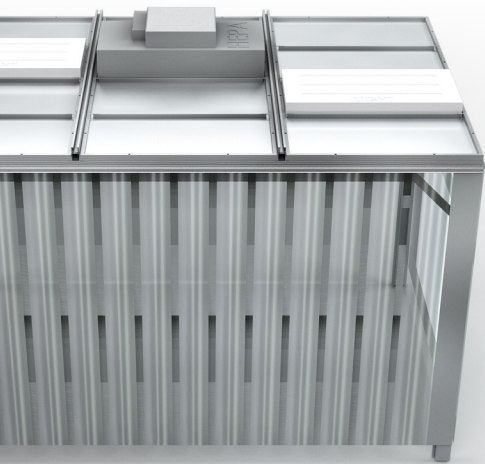
The bridge cleanroom was constructed of transparent Polysim walls, and included air fans and HEPA filters to purge the room of air particles. Also, the cleanroom included a separate anteroom where the technicians would put on their protective suits, gloves, and hair bouffants. Air fans in the anteroom would remove particulates before the technicians entered the controlled work area through a strip curtain.

## A Cleanroom for Manufacturing Defense Lasers

In 2019, a major aerospace company was hired to produce laser components for an Iron Dome defense system for the U.S. military. Similar to the system employed by Israel, the Iron Dome will protect America from incoming missile attacks. Although its primary defense weapons are short-range missiles, the Iron Dome also uses solid-state lasers as a supplementary weapon to target, intercept, and destroy incoming rockets and other airborne threats.

The lasers had to be assembled in a contaminant-free environment, so the aerospace company hired Simplex to design and build a cleanroom in their manufacturing facility. The ISO 6 cleanroom included three 28' x 40' x 12' Airlock enclosures, each featuring its own gown room. The cleanroom was accessed via high-speed roll-up doors, and was seismically-rated, using white Polypro inserts in the ceiling and wall frames.

Each enclosure included laser curtains, mounted on screws around the perimeter of the room. The pass-through curtains that divided the enclosures served as barriers for stray laser beams, to prevent damage or harm to people or products outside the cleanroom.



## A Portable, Scalable Cleanroom for Manufacturing Space Components

In 2022, a spacecraft infrastructure company received a contract to manufacture and assemble parts for the International Space Station (ISS) Earth Observatory. The company hired Simplex to design cleanrooms for the project.

Simplex provided fifteen separate ISO 5 cleanrooms at the company's manufacturing facility. Each individual cleanroom was 12' x 12' x 11'. The SIS212 cleanrooms were constructed of softwall panels mounted on casters (wheels) for easy portability, with Polysim strip door entrances. The panel frames could be disassembled and latched together to make a larger 36' x 60' x 11' room.

### FEATURES & BENEFITS



#### Customized Design

SubZero's engineers work with your agency or company to design a customized cleanroom. Your cleanroom will meet your required ISO cleanliness rating (e.g. ISO 5), and will be designed to fit the needs of your project and/or work environment.



#### Specialized Materials

Upon request, Subzero's engineers can manufacture your custom cleanroom using Class A fire-rated, electro-static dissipation (ESD) compliant, and/or non-outgassing materials.



#### Installation Options

Your agency or company has the option to install the cleanroom yourself, have a general contractor install it, or have Subzero's site services team install it at your facility. If you choose to install it yourself, Subzero ships the clearly-labeled cleanroom components to you, with an installation kit that includes easy-to-follow instructions.



#### Flexible Configuration

Your custom cleanroom can include multiple rooms, including anterooms and/or gowning rooms, and can be designed with multiple special features, such as sliding doors, wall switches, glove ports, a pass-through, etc.



#### Portable Solution

Subzero's cleanrooms are portable. You can easily disassemble the cleanroom, move it, and reassemble it at a new facility.



**Partner with Subzero Engineering for a tailor-made cleanroom solution that meets your exact specifications.**