https://collieraerospace.com/where-is-hyperx-software-used-8/

COLLIER AEROSPACE

Software Capabilities Support Company

Where is HyperX Software used?

Scroll down to see where HyperX has been used in the past.

190,000,000

Altitude: Miles



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Mars - 190 million miles from earth.

Nasa worked a mission to return soil samples back to earth. On top of this rocket you can see the Mars sample return capsule.

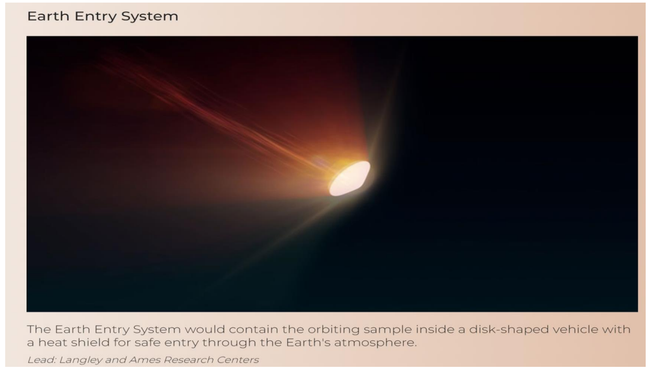
Our company worked on this project for 8 years, 1st at NASA Langley and then with JPL.

No

Mars Sample Return Capsule

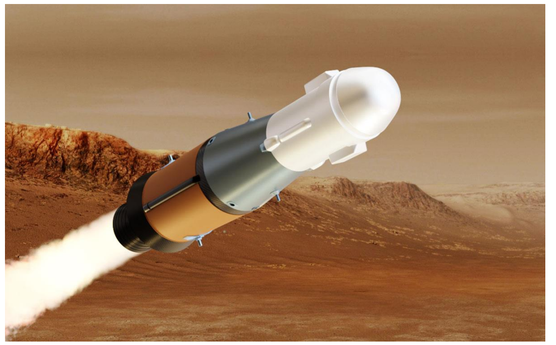
NASA and the European Space Agency (ESA) are planning ways to bring the first samples of Mars material back to Earth for detailed study.

Collier Research Engineers using HyperSizer have been designing and analyzing the secure containment capsule for safe delivery to Earth.



The Earth Entry System would contain the orbiting sample inside a disk-shaped vehicle with a heat shield for safe entry through the Earth's atmosphere.

Lead: Langley and Ames Research Centers



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2

The Moon – 239,000 miles from earth

in addition to the NASA Orion, which I presented this morning
we worked on several **commercial** crew modules

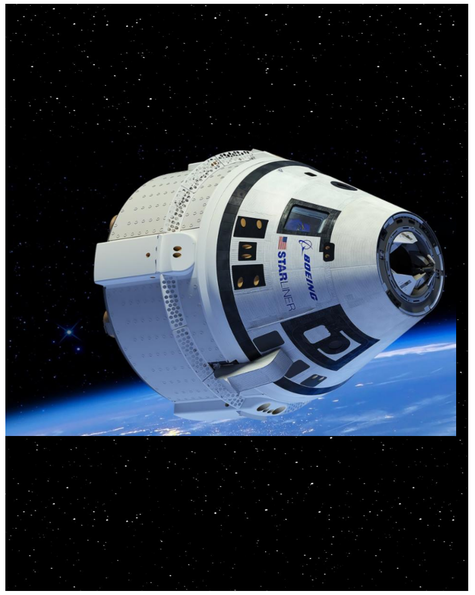
No

Boeing CST 100 Commercial Crew Module

HyperSizer was used extensively by Boeing for design and analysis of their CST 100 astronaut crew module to support NASA manned missions to the moon.
Boeing flew the Orbital Flight Test 2 on May 19, 2022

Blue Origin Moon lander (Not Shown)
Blue Origin will design, develop, test, and verify its Blue Moon lander to meet NASA's human landing system requirements for recurring astronaut expeditions to the lunar surface, including docking to a space station where crew transfer in lunar orbit.

The total award value of the Artemis V mission firm-fixed price contract is $3.4 billion. HyperX is currently being used on this project.



Notes Page

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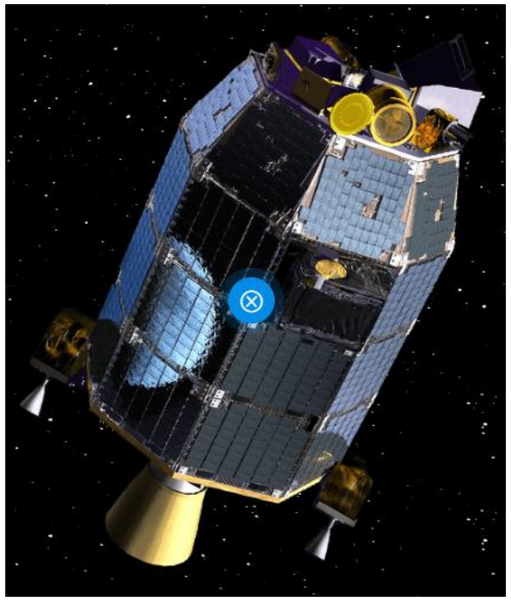
The Moon – 239,000 miles from earth



The NASA Ames LADEE

circled the moon for 100 days in 2014

HyperX was used to resolve negative margins and get weight out for new load cycles.

No

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Blue Origin's --- Orbital Reef --- Space Station -- 310 miles from earth

Show popup #1 of green plants

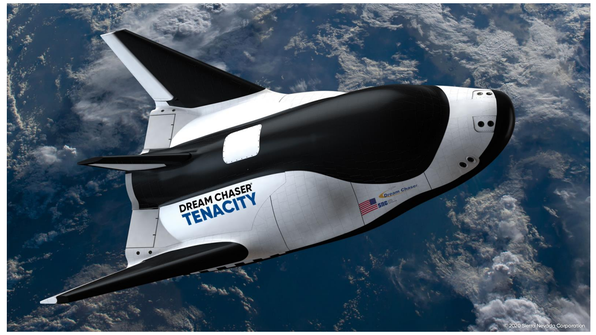
HyperX was used by both Blue Origin and Collier Engineers for its design and analysis.



Show popup #2 Dream Chaser

Sierra Space - Dream Chaser Vehicle

- Its purpose is to return crew from space.
- Designed with wings so it can land like conventional aircraft.
- HyperX was used to perform architectural trade studies
- We provided insights & sensitivity of the structural weight to various design features



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Space Tourism – 62 miles from earth

- Seen here is Blue Origin's **New Shepard rocket and space capsule,** is designed to carry customers past the Kármán line, which is 62 miles.
- The crew capsule **carries six passengers with large windows** for viewing space.
- **HyperX** was used by Blue Origin and by Collier Engineers for its design and analysis.
- **No**



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Space Tourism – 54 miles from earth

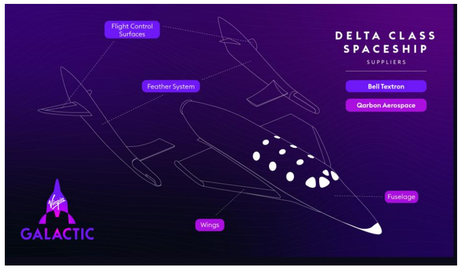
- **Virgin Galatic's** Reuseable suborbital rocket has a wing design. The empennage has a unique feather system to slow the descent.
- It is carried to it's launch altitude with **Scaled Composites White Knight 2 plane.**
- **Show popup**
- The VG vehicle flies into the upper atmosphere powered by its own engine and then **glides back to earth for a conventional runway landing.**
- **HyperX** was used on both the VG and the Scaled Composites vehicles for analysis and design.
- **Bell Textron** is designing and manufacturing the **feather system**. And using HyperX for design and analysis, and you will hear their presentation **tomorrow**.

Scaled Composites SpaceShipTwo

is an air-launched suborbital spaceplane designed for space tourism. It is carried to its launch altitude by a Scaled Composites White Knight Two, before being released to fly on into the upper atmosphere powered by its rocket engine. It then glides back to Earth and performs a conventional runway landing.

HyperSizer was used by Scaled for its design and analysis.

Bell Textron is designing and manufacturing the feather system of the next Delta Class spaceships~~. Bell is using HyperX for design and analysis.~~



https://www.virgingalactic.com/news/virgin-galactic-announces-primary-suppliers-for-delta-class-spaceships/



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Crew Capsule Re-entry Vehicle – 36 miles from earth

- Shown here is the **Orion Crew Module's Heat Shield** …that I showed this morning.

- This was a unique combined **structural / thermal-protection design challenge**.

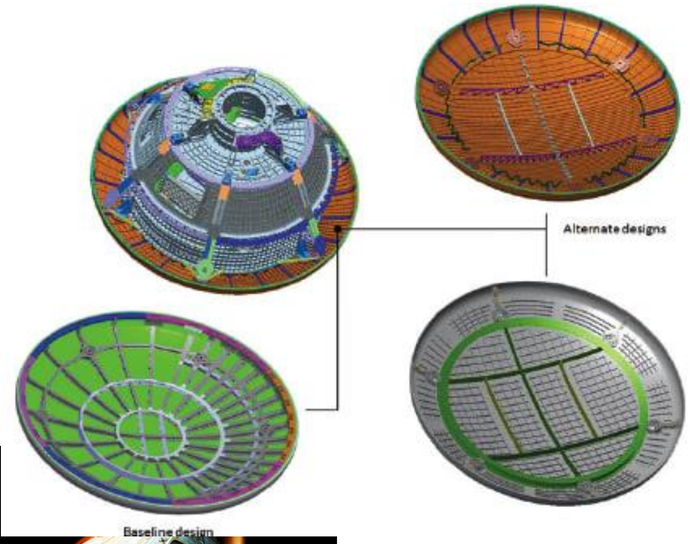
Orion Crew Module Heat Shield

Orion Crew Module Heat Shield illustrated at peak heating altitude.

Lightweighting is especially important for these structure, and the structural design is a combined structural thermal protection design challenge.

"We needed to come up with a lighter structure that could withstand the aerodynamic pressure of the Earth's atmosphere re-entry, and support the thermal protection heat shield," said Mike Kirsch of NASA Langley

HyperSizer evaluated different structural concepts for the heat shield carrier structure. The baseline composite skin with Titanium I stringers (left, bottom) was evaluated against alternate metallic grid stiffened designs (right, top and bottom).





https://www.techbriefs.com/component/content/article/ntb/features/application-briefs/20499#

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Aerion supersonic business jet – altitude of 60,000 feet

- In 2020, Aerion Corporation unveiled an updated design for the 12-passenger jet, reaching Mach 1.4 in **super cruise** with **non**-afterburning engines

- in 2021 Aerion **shutdown** for business **after 17 years of development**, and the AS2 was never built.

- However, its **composite stiffened panel wing was highly optimized** with HyperSizer by both Aerion and Collier employees.



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Business Jets -- 41,000 feet

A **lot** of our applications **are** composite.

However, we also work with a lot of traditional metal aircraft customers

Business Jets and Commercial Jets are designed and manufactured with Aluminum…

This requires: traditional analysis methods to account for
-their thin sheet skins
-that are mechanically fastened to stringers.

We do these traditional analyses often for **many** customers

Example Business Jet OEM Customer

Brenden A. Autry
Verification and Refinement of an Aircraft Structural Design and Optimization Tool, ATLASS

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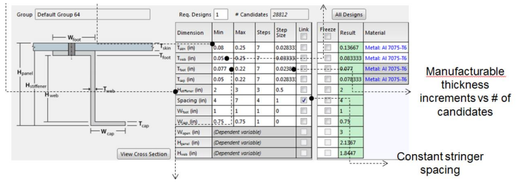
Figure 11. Global Structural Finite Element Model



Metal Zee Fastened Panels



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Space Launch - Mothership – at 34,000 feet

Designed and built by Scaled Composites, Stratolaunch was the largest composite-structure aircraft ever made at the time.

HyperSizer was used in the design of the carbon-fiber structure of it's 385-ft. WINGS.

Show popup

Aurora has been designing the Virgin Galactic Dawn airframe for the next generation airborne-launch mothership. HyperX is heavily being used on this project.



Scaled Composites Stratolaunch

Designed and built by Scaled Composites, Stratolaunch is the largest composite-structure aircraft ever made.

HyperSizer was used in design of the carbon-fiber structure of Stratolaunch's 385-ft.-span airborne-launch mothership.
https://collieraerospace.com/2017/11/10/aviation-week-nasa-project-faster-composites/

Aurora is currently designing the Virgin Galactic Dawn airframe for the next generation airborne-launch mothership. HyperX is heavily being used on this project.



https://www.space.com/stratolaunch-roc-aces-fourth-test-flight

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UAM eVTOLS – 1500 feet

Start-up aerospace companies in the UAM field are in need of all 4 HyperX categories to center their design

Show popup

Reduce Weight

-The weight of the electric battery make UAM designs very challenging.

Shorten Schedule

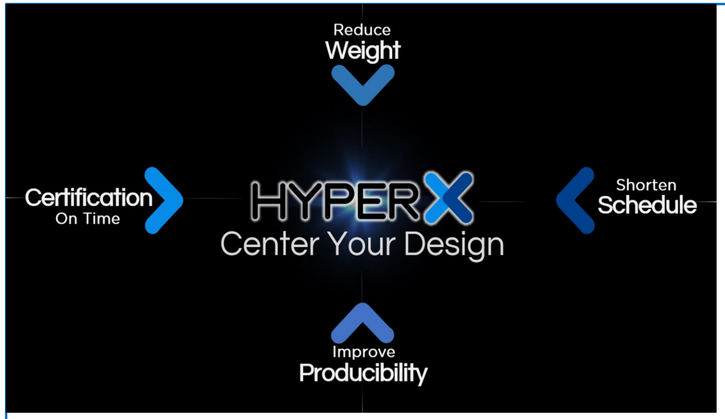
Goal is 4 years Entry-into-Service (average for General Aviation is 7 years)

Improve Producibility

Goal is 10,000 aircraft/year by 2030

Certification on Time

Design-Analysis Cycle (DAC) must be fast, accurate, and provide excellent traceability



UAM eVTOL Aircraft

Urban/Advanced Air Mobility (UAM/AAM) Electric Vertical Take-Off and Landing (eVTOL) are aircraft that can hover in-place for take-off and landing, but transition to wing-born flight for forward cruise.

Most designs are battery powered, and with the weight of the battery make their designs very challenging to meet Empty Weight Fraction requirements.

Engineering teams need to explore the design space completely and rapidly to achieve necessary lightweighting.

Additional challenges that companies in this competitive market are meeting with HyperX include:

Schedule
4 years to Entry-into-Service (average for General Aviation is 7 years)

Producibility
Rate & Cost: 10,000 aircraft per year by 2030 (highest General Aviation volume is 2200/yr)

Certification
Design-Analysis Cycle (DAC) must be fast, accurate, and provide excellent traceability



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Show popup

Here you see the Bell V-280 tilt-rotor aircraft

Spirit designed and fabricated the prototype fuselage **ahead** of schedule and **within** budget

To get there, Spirit used HyperSizer for detailed sizing

Structural requirements included strength, stability, stiffness and deflection limitations for severe flight, landing and ground load cases.





V280 Military Tilt Rotor Aircraft-- 1,000 feet

In 2023, the Army is contracting with Bell to provide V-280 tiltrotors to replace the Sikorsky H-60. V-280's cruise speed is more than 280 kt with a combat range of 500 nm

In 2015, for the V-280 prototype program, Spirit AeroSystems designed and fabricated the fuselage ahead of schedule and within budget. To get there, Spirit used HyperSizer for detailed sizing of the fuselage to structural requirements including strength, stability, stiffness and deflection/rotation limitations for severe flight, landing and ground load cases.
https://www.designworldonline.com/photos-of-the-day-designing-bell-helicopters-next-gen-tiltrotor-fuselage/

Collier Aerospace is looking forward to working with both Bell Aviation and Spirit AeroSystems as the V280 design continues through production.

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At Ground Level: Reusable Launch Vehicles

Show popup

HyperX has a long history of use by both government and industry for design and analysis of launch vehicle structure.

NASA used our software on all of their rocket designs going back to Ares 1, Ares 5, and SLS.

Industry such as Blue Origin (New Glenn rocket) used HyperX and our Collier engineering team on nearly every piece of structure:

- Fuel tanks
- Pressure domes
- Interstages
- Intertanks
- Fins
- Strakes
- Dry structure
- Thrust structure
- Fairings

And more

Reusable Launch Vehicles

There is a lot of structure inside of rockets (see image) that are highly loaded and require detailed sizing and analysis.

HyperX has a long history of use by both government and industry for design and analysis of launch vehicle structure.

NASA uses our software on all of their rocket designs going back to Ares 1, Ares 5, and SLS.

Industry such as Blue Origin (New Glenn rocket) uses HyperX and our Collier engineering team on nearly every piece of structure:

- Fuel tanks with and without internal frames and stiffeners
- Pressure domes
- Interstages and intertanks
- Fins and strakes
- Dry structure and thrust structure
- Fairings/shrouds, etc.

for composite sandwich and machined metal orthogrid stiffened panels.

HyperX is used for weight reduction sizing from early PDR to CDR, and analysis and margin stress reporting through drawing part release.

Rockets have large FEMs with element count in the millions, and reusable hardware that reenters earth atmosphere have hundreds of thermomechanical external loadings, all of which HyperX efficiently handles.





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Wind Blades– Ground Level

HyperX has been used for design and analysis of wind blades for over a decade for laminate stacking sequences, ply boundaries and layup stacking order.

Show popup

We were featured on the cover of NASA Tech Briefs in 2010



Wind Blades– Ground Level

HyperX has been used for design and analysis of wind blades for over a decade for laminate stacking sequences, ply boundaries and layup stacking order.

1st published by NASA Tech Briefs in 2010 and most recently in 2022, as according to Professor Yeonseung (Y.S.) of the Hongik University in South Korea , “HyperX software made an incredible difference in the design and development of the wind turbine blades …since the software optimizes all requirements at once rather than one at a time.”

HyperX is used by industry to design wind blades from 30m to offshore 100m length designs. Professor’s Lee’s application was a 7.4-meter natural fiber composite blade.



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Trek Bike – Ground Level

Trek uses HyperX for designing high performance composite bikes for both handlebar and frame

Show popup



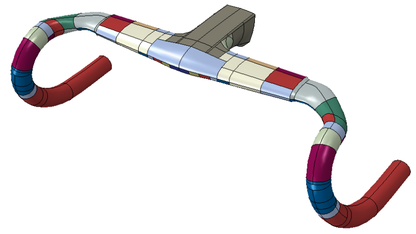
Trek Bike

Uses HyperX for designing high performance ~~road and mountain~~ composite bikes.

Adoption started with a straight handle bar and then moved to a challenging road bike (Madone) handlebar. Now Trek is applying HyperX to a frame.

There is much detail to ply shaping, sequencing, and stacking to achieve optimized material performance for the doubly curved surfaces at areas such as the bottom bracket.

Competitive sports require high performance but also speedy time to market and quick producibility. Trek is realizing all three enabled with HyperX's capability to light weight, reduce schedule, and improve producibility.





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SP80 – Ground Level

The team is attempting to break the world sailing speed record by developing a kite-powered boat capable of reaching 80 knots.

Last months runs they hit 58 knots. Its pretty amazing.

Show popup



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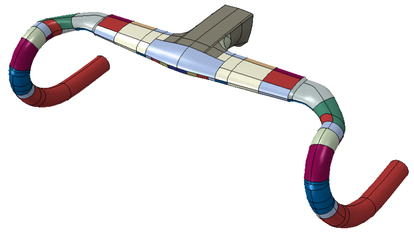



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CLOSING

This is just a sample of structures where HyperX has made significant impact.

There are many more – especially in design of wings such as Scaled Composite's **Global Flyer**

that flew nonstop around the world
enabled with very long and slender wings

I hope you enjoyed the show!



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