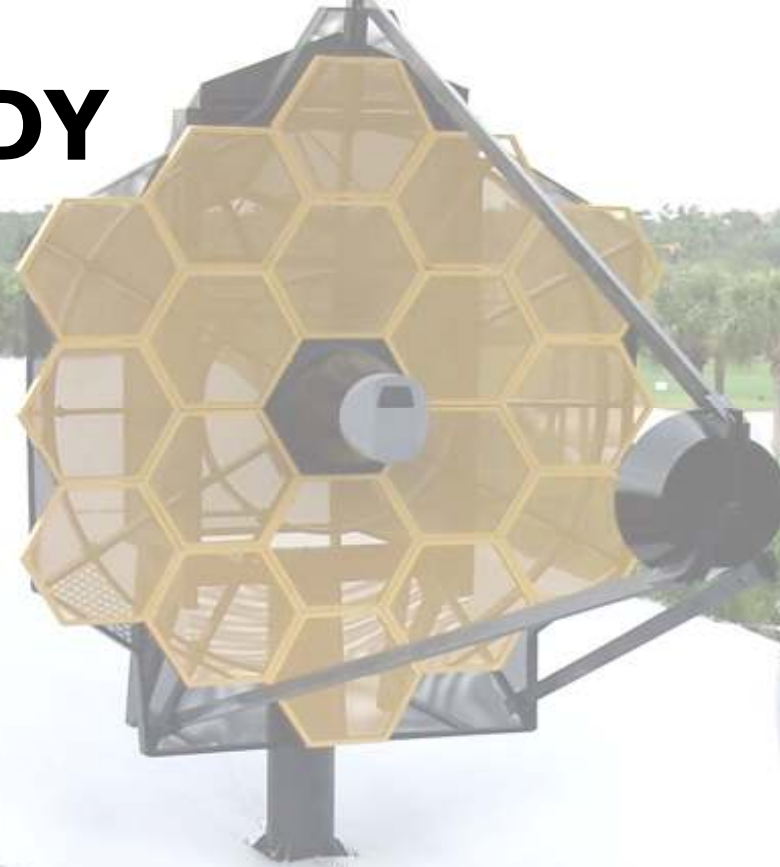


# CASE STUDY



Design and Fabrication  
of the  
**Full Scale Display Replica** and  
**High Tolerance Prototype**  
**Testing Components**

for NASA's

**James Webb Space Telescope**  
**(JWST)**



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# JWST CASE STUDY SUMMARY

## Problem

- A. NASA and Northrop Grumman need a proper tool to educate and excite the industry and public about the development and future launch of the James Webb Space Telescope.
- B. Northrop needs a prototype element to test the design of the JWST's Optical Telescope Element, prior to fabrication. The OTE was designed for zero gravity, but must be tested on Earth.
- C. Northrop needs a prototype element to test the design of the JWST's Sunshield ("IVA") Element, prior to fabrication. The IVA was designed for zero gravity, but must be tested on Earth.

## Deliverable

- A. Penwal designs and produces a full scale (tennis-court sized) display replica of the JWST, true in every detail to NASA's rendering.
- B. Penwal engineers and fabricates a testworthy prototype of the Optical Telescope Element, built to full scale and high tolerance, and structured for testing on Earth.
- C. Penwal engineers and fabricates a testworthy prototype of the Sunshield ("IVA") Element, built to full scale and high tolerance, and structured for testing on Earth.

## Refer to Pages...

- A. 3 of the Case Study.
- B. 4 of the Case Study.
- C. 5 of the Case Study.

Learn more about the JWST on the web:

<http://jwst.nasa.gov>

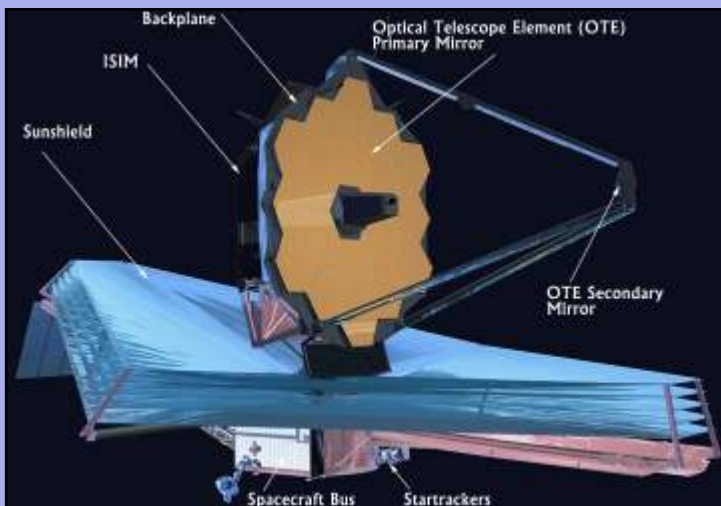
<http://www.as.northropgrumman.com/products/jwst/index.html>

<http://www.PenwalPrototypes.com>

# CASE STUDY 1: FULL-SCALE DISPLAY MODEL

NASA develops the James Webb Space Telescope (JWST) to replace the Hubble Space Telescope in 2014, and awards the project to Northrop Grumman as the Prime Contractor.

**The Mission:** Create a Full-Scale Display Replica of the JWST, based on NASA's rendering, for Promotional and Educational Purposes.



With over **61,000sf of space**, Penwal can handle the largest elements with ease.

The **tennis-court sized, high-fidelity** Display Model neatly matched the rendering

The Display Model has gone on a tour of US and World Cities to **promote the JWST Program.**



# CASE STUDY 2: OPTICAL TELESCOPE ELEMENT TESTING PROTOTYPE

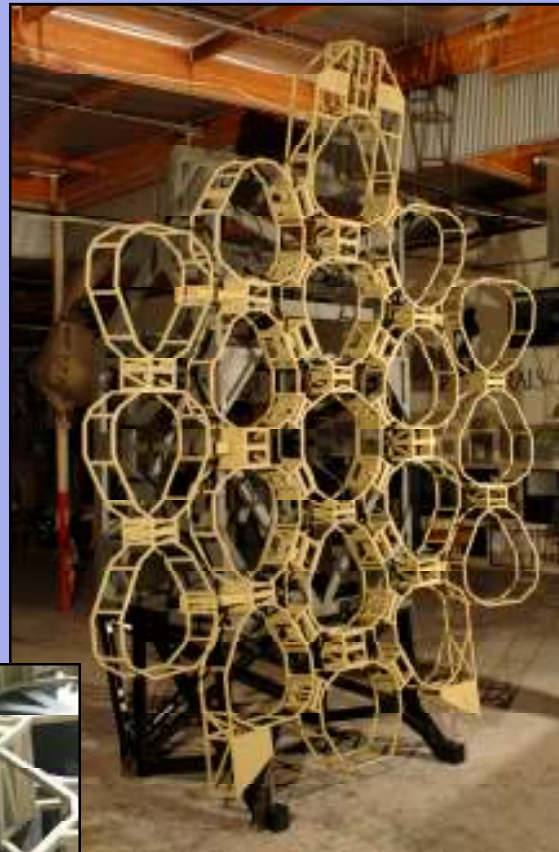
With the JWST in development, Northrop needs “proof of concept” prototypes of various components that **have never been built before.**

**The Mission:** Northrop turns to Penwal to design and produce the Optical Telescope Element or “OTE.”

The OTE is the honeycomb-shaped dish at the top of the satellite, which transmits data back to earth.

Northrop needed to perform tests to verify the size and angles of the dish — but the JWST was designed for the zero gravity of outer space, whereas they needed to test the unit on earth.

Penwal engineered the OTE testing prototype, and its in-house aluminum & steel forming, fabrication, welding, paint and assembly shop constructed the piece to ultra-high testworthy tolerances.



# CASE STUDY 3: SUNSHIELD (IVA) PROTOTYPE

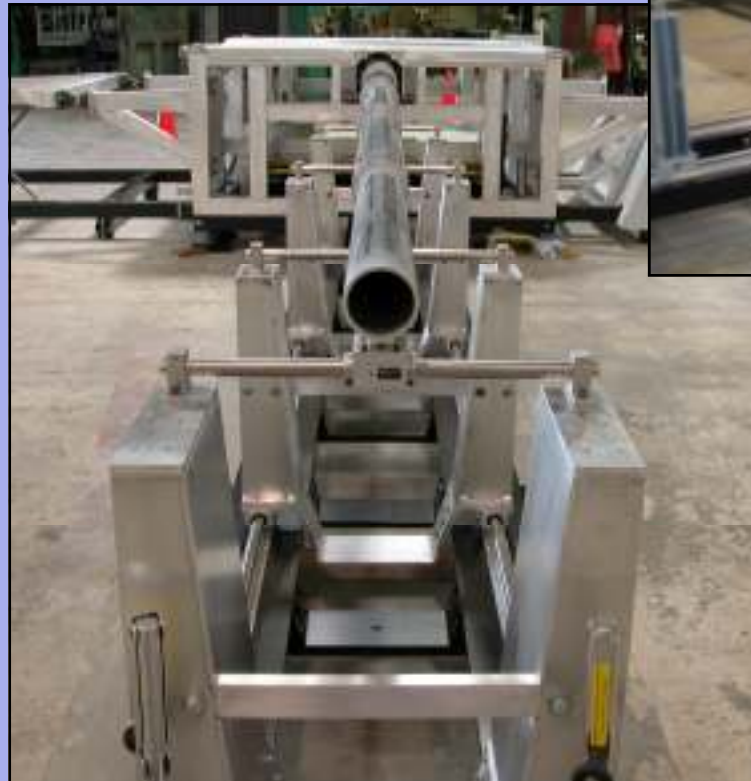
Northrop must also test the mechanism that deploys and retracts the JWST's Sunshields (IVA).

**The mission:** Penwal designs and builds a second testing prototype for the IVA.

Fabricated from steel, aluminum and fiberglass, and made to full scale (the size of a tennis court) with **testworthy tolerance**.

Penwal's IVA prototype featured fully kinetic retractable booms, raising center platform and articulating panels.

The IVA test component underwent a rigorous battery of tests, per Northrop's specifications, prior to delivery.



# PROJECT SUMMARY

Penwal's unique blend of expertise and experience was instrumental in bringing this project to the light of day:

- High detail design and artistic fabrication capabilities, using metal, polymer and natural materials.
- 61,000sf Southern California plant with abundant experience fabricating and handling large scale elements.
- Self-performing procurement and project management capabilities to keep complex jobs on track.
- Unrivalled engineering experience for the design of large, complex and fully kinetic structures.
- A 30-year history serving various industries, allowing us to engineer and fabricate elements in ways that haven't been thought of by your industry. We can cut right through seeming design obstacles!
- Unmatched quality of workmanship and performance of the finished element.

