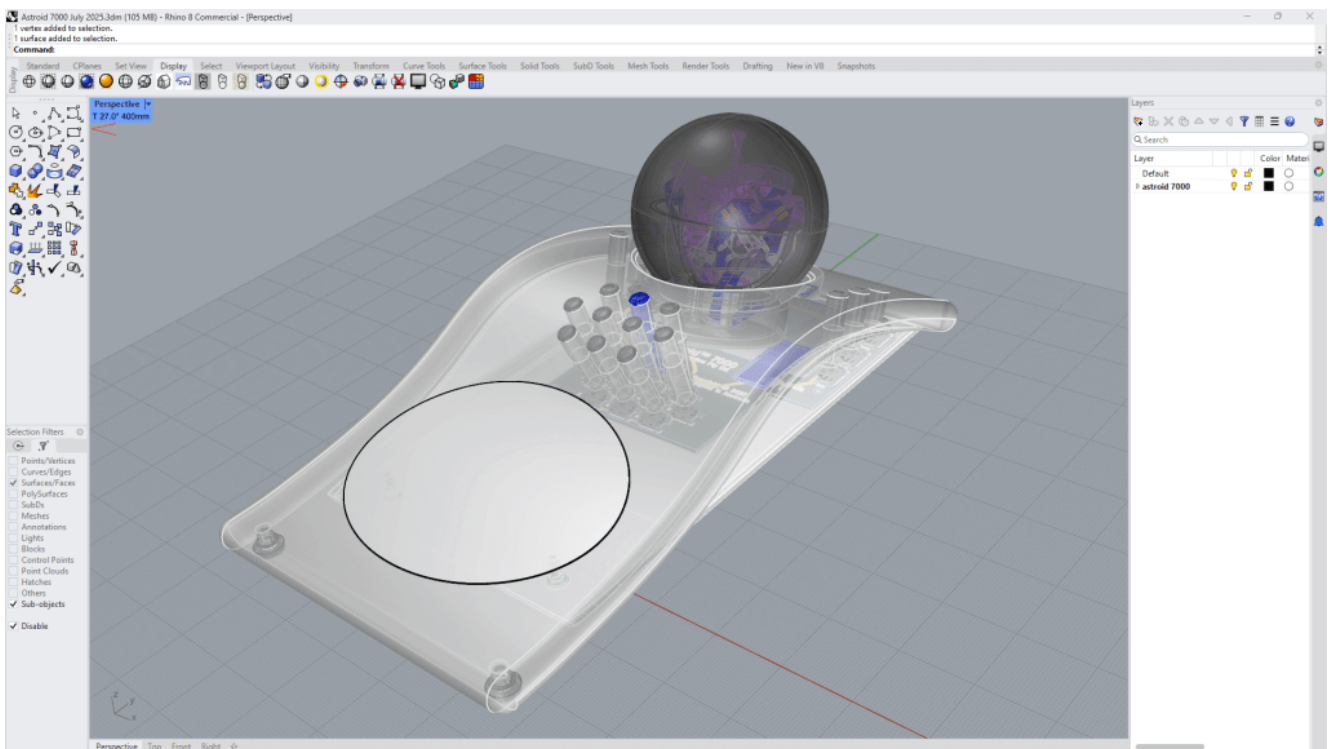


# Astroid: A Parametric Ergonomic Mouse Built with Rhino

The [Astroid 7000](#) is a 3D mouse, a device for intuitive spatial navigation and control, refined over decades of innovation in 3D input hardware. Its design and development exemplify how modern digital tools like [Rhino](#) can power a full product workflow, from the earliest geometric studies through to final assembly.



*The Astroid 7000 3D model in Rhino*

## CONTEXT & LEGACY

In the early 1980s, the first Spaceball was invented at the [University of Sydney](#), a breakthrough that eventually led to a range of devices celebrated by CAD professionals and gamers alike. John Hilton, the inventor of the original Spaceball, went on to develop multiple iterations over thirteen years.

Although corporate consolidation pushed these products out of the

market, their legacy lives on. [Spatial Freedom](#) was founded in 2002 with the intent of breaking monopolistic pricing and reintroducing innovation to 3D input devices. Today, with the Astroid 7000, that legacy is revisited and refined to deliver to a new generation of designers a two handed engagement with Rhino that simply accelerates design.

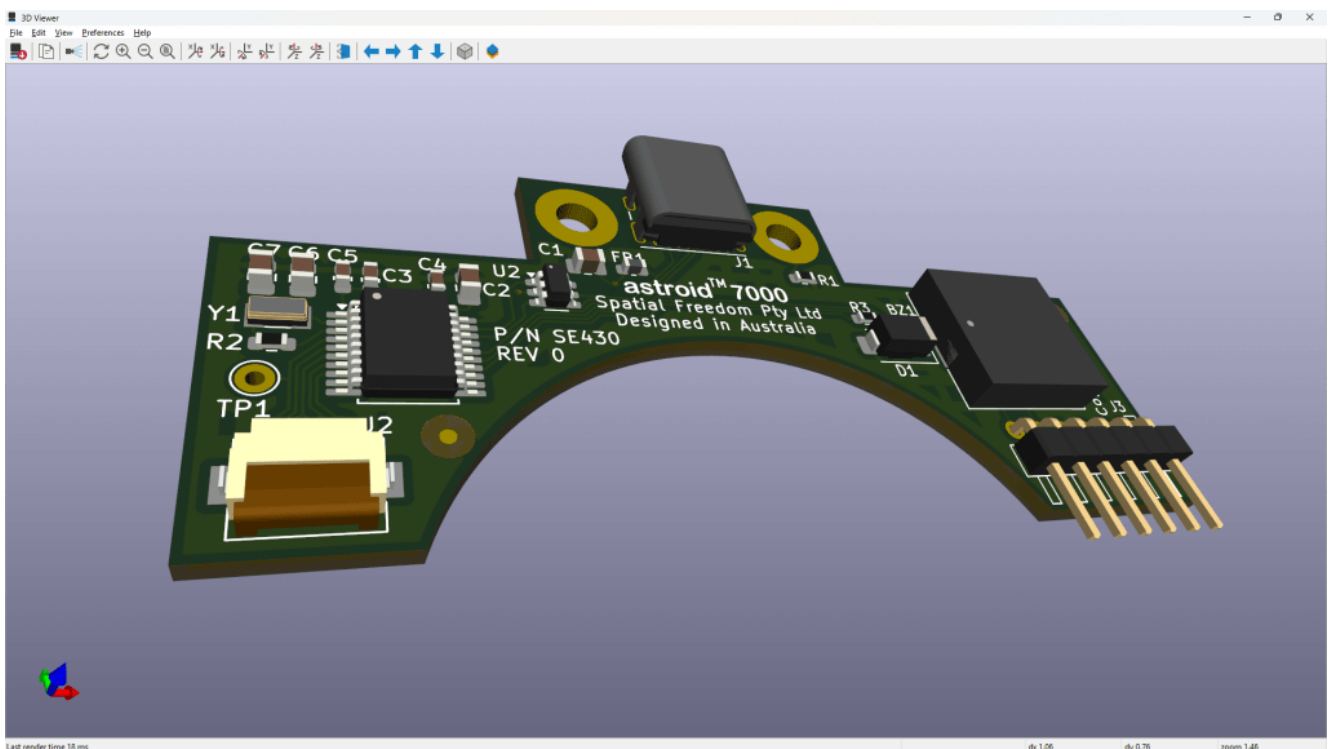


*John Hilton, inventor of the original Spaceball, pictured with ten of his earlier Spaceball models.*

## **DESIGN PHILOSOPHY & RHINO'S ROLE**

At the heart of the development of the Astroid 7000 is a design philosophy centered on user-centered control combined with cost-effective, agile fabrication processes. Rhino was chosen for its liberating geometric toolkit and its ability to handle both freeform sculpting and precise engineering. The workflow embraced Rhino's versatility in several key ways:

- **Legacy Integration:** Earlier Spaceball and Astroid 6000 components, originally modeled in [Solid Edge](#) and other platforms, were imported into Rhino using STEP files. This allowed the team to evaluate the compatibility of legacy sensor geometries with new design constraints while preserving functional heritage.
- **Digital Iteration:** Rhino enabled rapid design evolution. Using its powerful [NURBS](#) tools, designers could adjust the ergonomic contours and internal geometries of the mouse in real-time. [Grasshopper](#) further allowed the team to explore parametric variations based on the astroid curve, a geometric figure that inspired the mouse's silhouette and internal structure. Each iteration was assessed for both visual appeal and mechanical functionality.
- **Interoperability with Electronics:** The design process extended to the electronic domain via [KiCad](#). PCB models were exported as STEP files and imported into Rhino to ensure that the layout of buttons, batteries, and other components harmonized perfectly with the physical enclosure. This simultaneous consideration of mechanical and electronic constraints was critical in achieving a compact and ergonomic design.

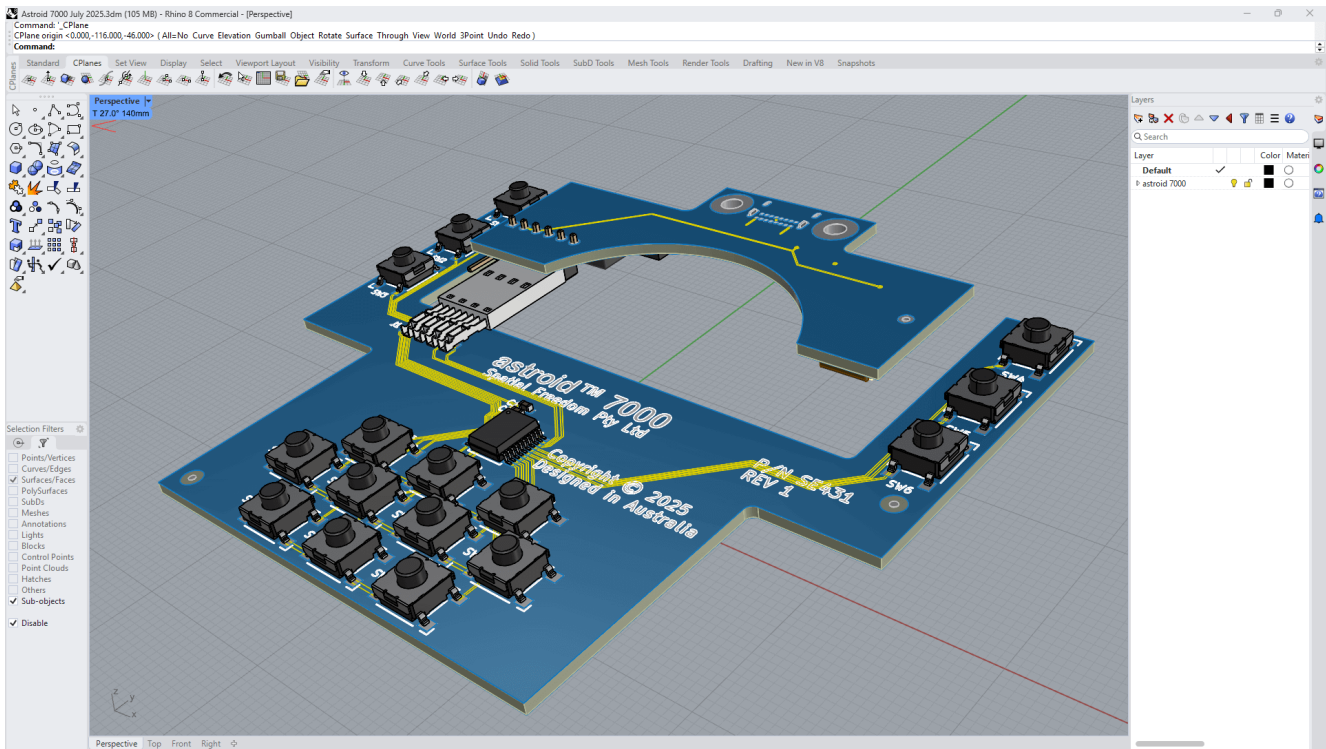


*KiCad 3D Viewer image*

# FABRICATION: FROM THERMOFORMING TO CNC ROUTING

To avoid the high costs of conventional injection molding, the team embraced an alternative fabrication approach:

- **Material Selection:** The mouse's enclosure is fabricated from 10mm semi-translucent opal acrylic. Its light-diffusing properties not only contribute to the visual softness of the device but also provide a distinctive matte finish when lightly sanded.
- **Digital Fabrication Techniques:** The process begins with laser cutting the flat acrylic sheets according to digitally prepared 2D profiles. Next, the pieces undergo thermoforming, a controlled heating and bending process, to achieve the desired three-dimensional shape. Finally, a 4-axis CNC router is used to refine edges and drill precise features, ensuring that the enclosure is functional, ergonomic, and aesthetically pleasing.
- **Rapid Prototyping and Testing:** Early prototypes validated the chosen material and fabrication method. Hands-on testing allowed designers to verify that the tactile feel, balance, and durability met the exacting standards required for a high-performance 3D mouse.



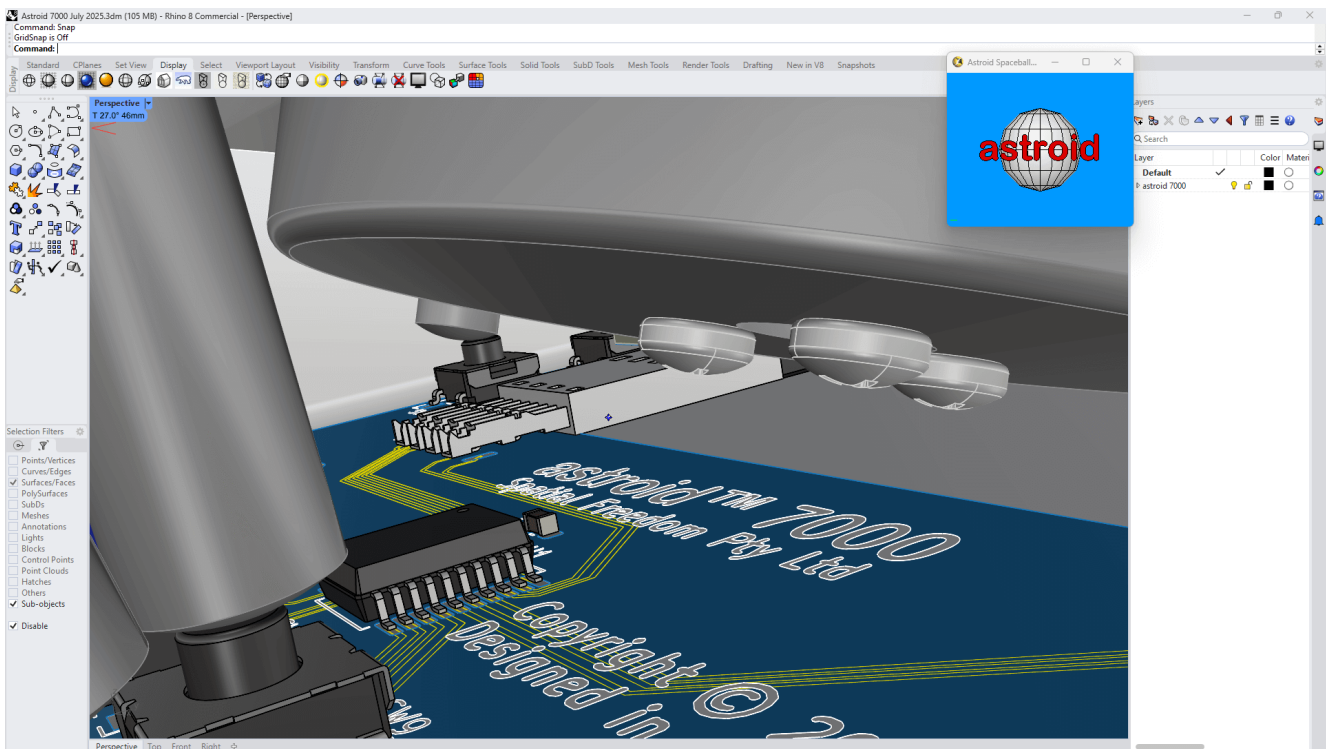
*PCB models of the electronic domain were exported as STEP files and imported into Rhino*

## SOFTWARE INTEGRATION & USER EXPERIENCE

Beyond its physical design, a critical component of the Astroid 7000 is its software, the custom Rhino plug-in that underpins its operation:

- **Adaptive Navigation:** The plug-in taps into Rhino's camera-target view system, automatically adjusting pan and zoom responses based on the the model's distance from the camera. This dynamic scaling leads to an intuitive user experience, reducing the need for manual sensitivity settings. As a result, users can navigate complex 3D models more naturally.
- **Interactive Modes:** The device supports advanced flythrough and walkthrough modes. These functions enhance spatial awareness during design reviews and presentations and allow for the rapid creation of walkthrough videos when combined with screen capture tools.
- **Programmable Control:** With 16 programmable buttons, the Astroid 7000 can execute common or repetitive commands swiftly. This

feature not only improves workflow efficiency but also demonstrates how physical controls can be tailored to user-specific needs within a digital environment.



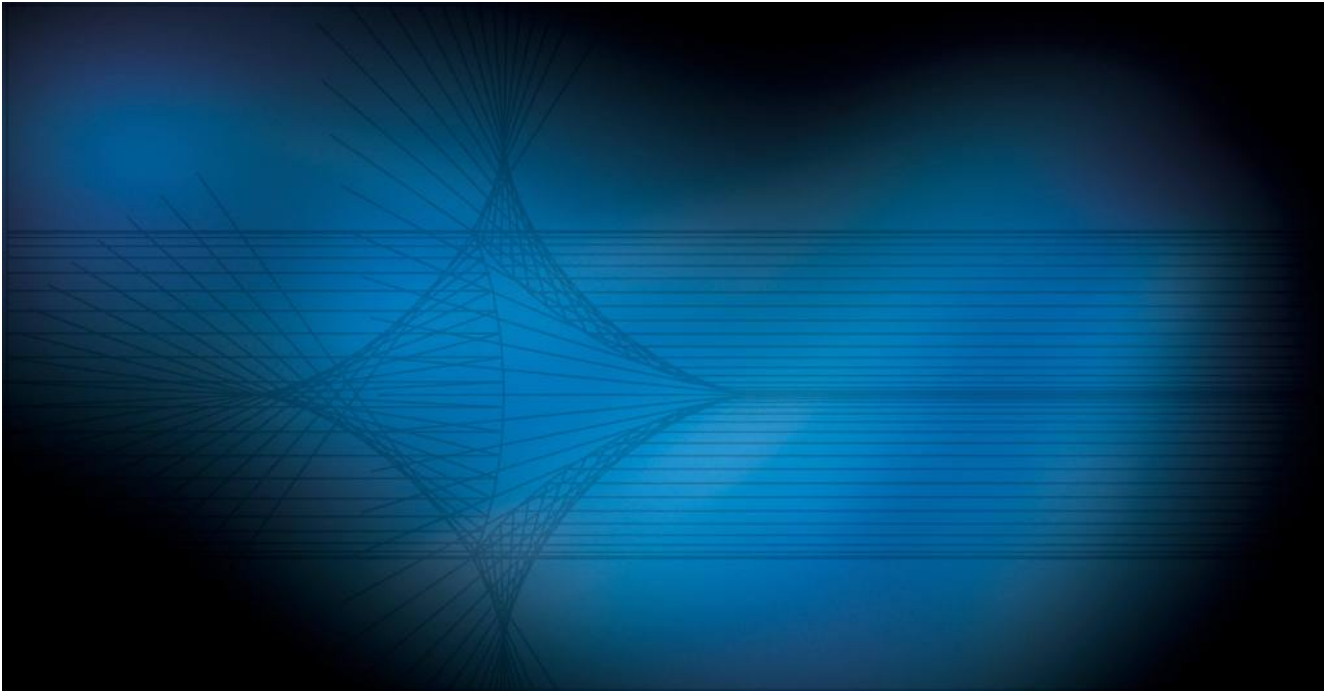
*The Astroid 7000 3D model*

## FINAL CONSIDERATIONS & FUTURE DIRECTIONS

The Astroid 7000 is the culmination of decades of expertise in 3D input devices, refined through modern digital design practices. By leveraging Rhino's robust capabilities in modeling, parametric design, and interoperability with other software platforms like KiCad, the development team has created a device that is both technically advanced and economically accessible.

Additional design considerations included a custom low-power RF protocol for wireless operation, allowing the device to run up to 12 months on just four AA batteries, and careful material selection to meet international standards (RoHS, REACH) and wireless certifications (FCC, CE).





## **CREDITS**

John Hilton – Spatial Freedom Managing Director