

# ILAIA

Estación polar científica conjunta glaciar Unión

Marcelo Bernal, Pol Taylor,  
Francisco Valdivia

Antártica, Chile, 2013 - 2014



In 1998 the Chilean Air Force FACH commissioned ARQE to design, fabricate and build the Estación Polar Teniente Arturo Parodi (EPTAP) in order to support the operation of the landing runway in blue ice at Patriot Hills, Antarctica. Due to geopolitical issues the station was later abandoned after eight years. In 2013, together with the Chilean Antarctic Institute (INACH), the activities were resumed and a new station dedicated to the research and development of polar technologies was consolidated, near a second ice-landing strip at Unión Glacier. Given the success of EPTAP's insertion, it was then decided to completely recycle the structure, testing the reversibility of its assembly process within a zero-impact logic. The components were transported on sledges and the station was relocated 9 km south, in a process of 14 days and a mission of 20 people. In 2014 we developed a new housing unit for researchers (polar-helmet) and a prototype of its enclosing skin (torsionoid) to receive the cold-dry sanitary system which freezes human residues and eliminates the use of water. The 'polar-helmet' internally differentiates an area to sleep in half-light -counteracting the permanent daylight if the polar circle- and another area for work, naturally illuminated by two skylights. The 'torsionoid' is a geodesic ellipsoidal structure composed of linear elements made of plywood and compressed by a PVC membrane with no insulation which resists low temperatures. Each panel in the membrane is a paraboloid of double curvature that coincides with the subdivision of the structural pattern, consolidating the geometry when it's tensed against the anchoring system. These points correspond to excavations in the snow which are filled with water that, once frozen, produces an efficient tension point with no impact on the environment. The structure has a ski on its base that distributes the loads to avoid sinking. ARQ



Estación Polar Teniente Arturo Parodi EPTAP – Minga polar  
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Estación Polar Científica Conjunta Glaciar Unión EPCCGU / EPCCGU Joint Scientific Polar Station Unión  
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### Arquitectos / Architects

Marcelo Bernal, Pol Taylor, Francisco Valdivia

### Colaboradores / Contributors

Pablo Barría, Paola Vezzani, Ricardo Jaña —Glaciólogo INACH—,  
Comandante FACH Miguel Figueroa

### Ubicación / Location

Glaciar Unión, Antártica

### Encargo / Commission

Departamento Antártico, Fuerza Aérea de Chile, FACH

### Cálculo estructural / Structural design

Francisco Valdivia

### Construcción e instalación sanitaria / Construction and plumbing

ARQZE

### Fecha proyecto / Date of project

2013

### Fecha construcción / Date of construction

2014

### Materiales / Materials

Estructura en terciado marino de 12 mm, terminaciones en terciado marino de 12 mm y membrana exterior de PVC / Structure in 12 mm marine plywood, finishing in 12 mm marine plywood and PVC outer membrane

### Superficie construida / Built area

16 m<sup>2</sup> (Cascopolar), 42 m<sup>2</sup> (Torsionoid)

### Presupuesto / Cost

US\$ 50/ m<sup>2</sup> (Cascopolar), US\$ 12/ m<sup>2</sup> (Torsionoid)

### / BIBLIOGRAPHY

- TAYLOR, P.; BERNAL, M.; SERRANO, P. «Estación Polar Teniente Arturo Parodi, tácticas antárticas, infraestructura desplegable.» *Ciudad y Arquitectura*, 103 (2000):58-63.
- TAYLOR, P.; BERNAL, M.; SERRANO, P. «Estación Polar Teniente Arturo Parodi (EPTAP)». ARQ 45 (Agosto, 2000):62-65.
- GALLANTI, F. «Architecture in extreme environment I, Antarctica, EPTAP 1999-2004». *Domus* 870 (2004):28-35.

### MARCELO BERNAL

Architect, Pontificia Universidad Católica de Valparaíso, Chile. PhD candidate in Design Computing, Georgia Institute of Technology, United States. Co-founder and partner of ARQZE studio. Professor at the Universidad Técnica Federico Santa María.

### POL TAYLOR

RIBA architect graduated in Glasgow. He attended the masters program at the Institute of Membranes and Shells (IMS), Dessau, Germany. Co-founder and partner of ARQZE studio. He is currently researching on membrane technologies at the SUR.FACE workshop in Valparaíso.

### FRANCISCO VALDIVIA

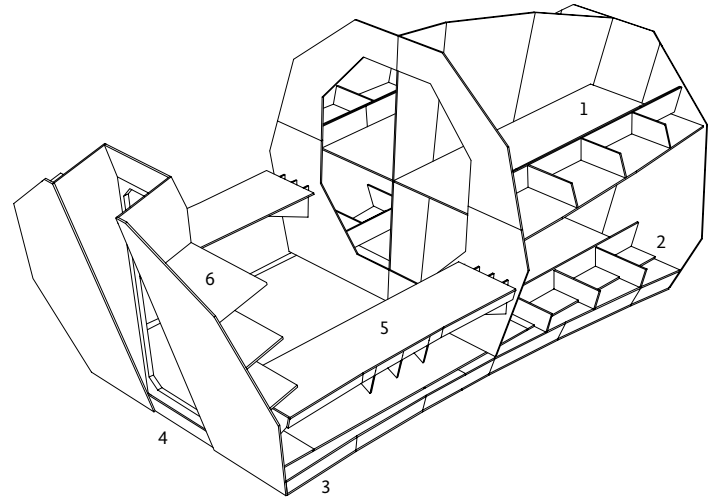
Architect, Universidad Técnica Federico Santa María, Chile. Archineer master's candidate in the Institute of Membranes and Shells (IMS), Dessau, Germany. He currently works at the SUR.FACE workshop.

### Cascopolar interior isometric view

S. e. / N. s.

### / LEGEND

1. Camarotes 900 × 2000 mm / Bunk beds 900 × 2000 mm
2. Compartimentos artículos personales / Compartments for personal items
3. Pack piso aislado / Insulated floor pack
4. Acceso: puerta 700 × 1900 mm / Access: 700 × 1900 door
5. Escritorios de trabajo / Working desks
6. Repisas / Shelves

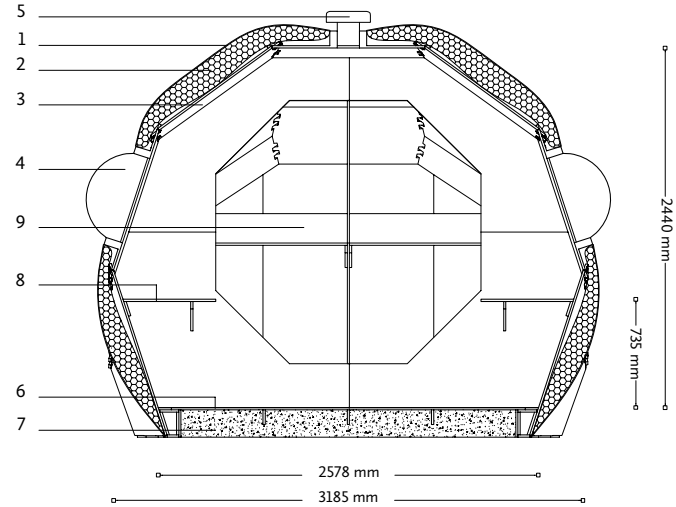


### / Cascopolar section

E. / S. 1: 50

### / LEGEND

1. Membrana exterior PVC-PE / Outer membrane PVC-PE
2. Cobertor de poliéster con aislación térmica y acústica 2x85 mm / Polyester cover with thermal and acoustic insulation 2x85 mm
3. Casco en terciado marino e= 12 mm / Marine plywood hull t= 12 mm
4. Ventana circular acrílica Ø 800 mm / Circular acrylic window Ø 800 mm
5. Ventilación cenital Ø 150 mm / Roof ventilation Ø 150 mm
6. Piso en terciado marino e= 18 mm / Marine plywood t= 18 mm
7. Aislación en poliestireno expandido / Expanded polystyrene isolation
8. Escritorio / Desk
9. Camarotes / Bunk beds

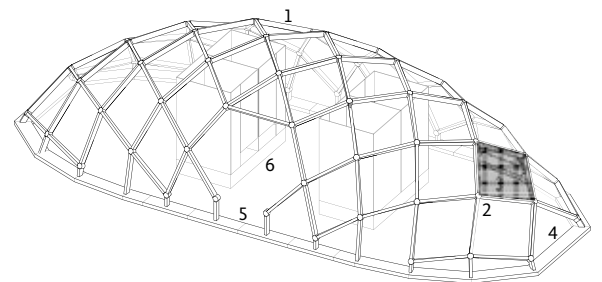


### / Torsionoid isometric view

S. e. / N. s.

### / LEGEND

1. Vigas laminadas en terciado marino / plywood beams
2. Conector metálico Ø 5" / Metal connector Ø 5"
3. Ventanas desmontables / Removable window
4. Base SKY / SKY base
5. Acceso / Access
6. Cabinas sanitarias / Sanitary cubicles

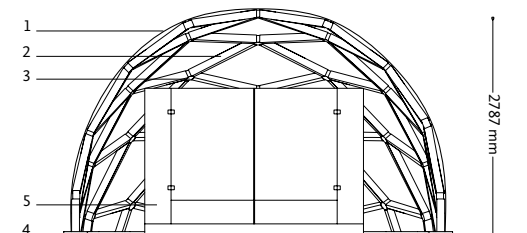


### / Torsionoid section

E. / S. 1: 100

### / LEGEND

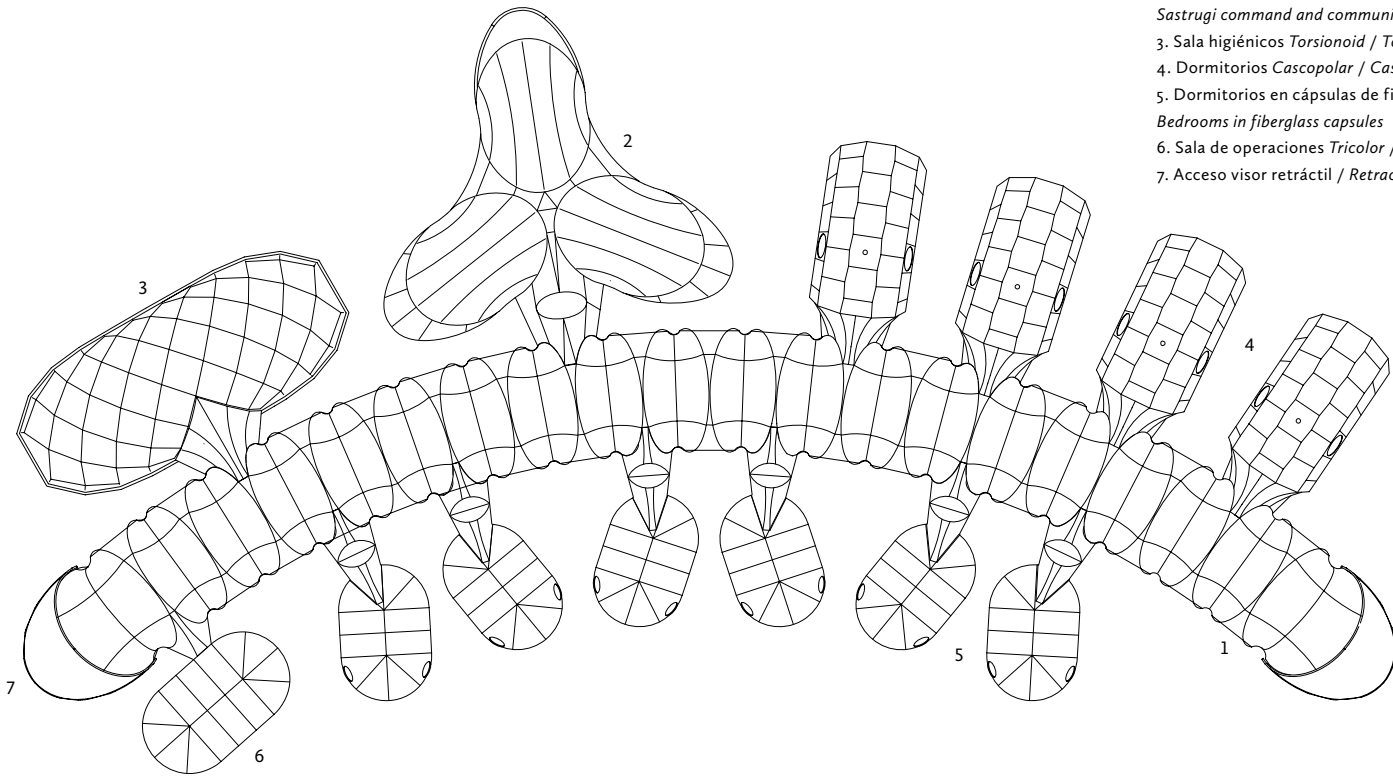
1. Membrana exterior PVC-PE / Outer membrane PVC-PE
2. Vigas laminadas en terciado marino / plywood beams
3. Conector metálico Ø 5" / Metal connector Ø 5"
4. Base SKY e= 36 mm / SKY base t= 36 mm
5. Cabina sanitaria / Sanitary cubicle





/ LEGEND

- 1. Túnel técnico / Technical tunnel
- 2. Cuarto de comando y comunicaciones Sastrugi / Sastrugi command and communications room
- 3. Sala higiénicos Torsionoid / Torsionoid Hygienic room
- 4. Dormitorios Cascopolar / Cascopolar bedrooms
- 5. Dormitorios en cápsulas de fibra de vidrio / Bedrooms in fiberglass capsules
- 6. Sala de operaciones Tricolor / Tricolor operating room
- 7. Acceso visor retráctil / Retractable viewfinder access



Estación Polar Teniente Arturo Parodi ЕРТАР – desmantelamiento / dismantling  
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Fuselaje del *Cascopolar* / *Cascopolar fuselage*  
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Parka de aislamiento del *Cascopolar* / *Cascopolar insulation cover*  
 © Pol Taylor, Marcelo Bernal & Francisco Valdivia



Estructura *Torsionoid* / *Torsionoid structure*  
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Membrana *Torsionoid* / *Torsionoid membrane*  
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*Ilaia*. Palabra Yagán que designa lo «más austral que el sur». / *Ilaia*. *Yagan word that designates "the south southernmost"* © Pol Taylor, Marcelo Bernal & Francisco Valdivia