

**Author:** Marjan Colletti of marcosandmarjan  
**Research Output 1:** NURBSTERS I–VIII

**Co-Author:** Marcos Cruz

**Output Type:** Design

**Design and Production of Artefacts for Solo and Group Exhibitions:**  
NURBSTERS I–VIII

**Exhibitions/ Locations/ Dates:** NURBSTER I wall (Bartfest, 2003; Prague, 2004); NURBSTER II desk (Venice, Lisbon, Aveiro, São Paulo, 2004–2005); NURBSTER III exhibition islets (Prague, Bratislava, Kosice, 2004–2005); NURBSTER IV seat (Taiwan, 2005); NURBSTER V seat (2005); NURBSTER VI structure (2005); NURBSTER VII house (Lisbon, Badajoz, Mérida, Cáceres, 2005); NURBSTER VIII wintergarden (Badajoz, Madrid, 2006). All NURBSTERS have featured in solo exhibitions (Hamburg, Braunschweig, 2005).

## 300 Word Summary

NURBSTERs I–VIII is a series of models and 1:1 prototypes, conceived for exhibitions/installations. The design and manufacturing are completely computerized.

### Questions

How to develop a poetic digital avant-garde through 2D/3D software, computer numerically controlled (CNC) and rapid prototyping (RP) technologies that go beyond software-related aesthetics and parametric constraints?

### Aims/Objectives

To develop:

- (1) A file-to-factory design methodology bridging the gap between digital architectural theory and the built environment.
- (2) Various typologies of interior and urban furniture designs.
- (3) Efficient and sustainable designs that maximize CAD/CAM cutting processes to attain positive and negative cut-outs for use as 3D objects and 2D screens.

### Contexts

CAD/CAM technologies are long established in the shipbuilding industry and expanding owing to their availability and affordability. However, these technologies have not so far changed the way architecture is theorized, designed or produced. If at all, such expertise has been used for the mass-manufacturing of product design, but rarely for main steel structures, facades, skins, internal secondary structures and division walls.

### Methods

Individual components cut out of standard-sized MDF, plywood or metal boards by CAD-operated machines. A series of notched sections creates a complex object, fitting programmatic, structural and ergonomic requisites, and reinterpreting the traditional Chinese wooden cut-joint fitting technique ideal for quick assembly and disassembly.

### Dissemination

NURBSTER I wall (Bartfest, 2003; Prague, 2004); NURBSTER II desk (Venice, Lisbon, Aveiro, São Paulo, 2004–05); NURBSTER III exhibition islets (Prague, Bratislava, Kosice, 2004–05); NURBSTER IV seat (Taiwan, 2005); NURBSTER V seat (2005); NURBSTER VI structure (2005); NURBSTER VII house (Lisbon, Badajoz, Mérida, Cáceres, 2005); NURBSTER VIII wintergarden (Badajoz, Madrid, 2006). All NURBSTERs have featured in solo exhibitions (Hamburg, Braunschweig, 2005). Reviewed, featured, broadcast internationally.

### Esteem

International grants/sponsoring for design/manufacturing: approx. £38,000.

### Authorship

As part of the joint architectural practice marcosandmarjan, Colletti and Cruz both contribute equally to the research.

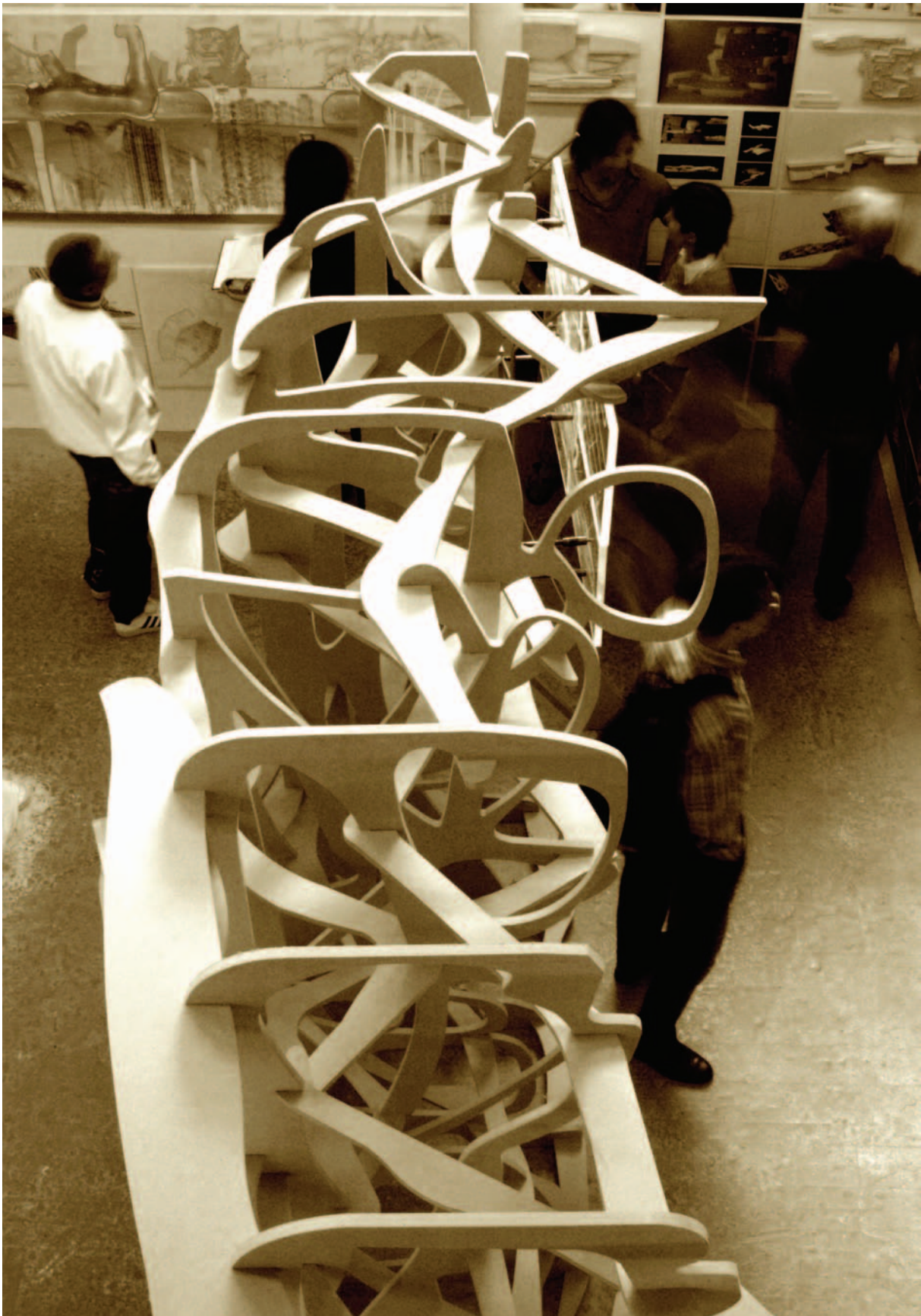


Image 1  
1:1 prototype assembled,  
marcosandmarjan, NURBSTER  
I, Slade School of Art London  
(2004).  
Photograph: Marjan Colletti.

## General Description

NURBSTERs I-IX is a series of models and 1:1 prototypes, conceived for exhibitions and installations. The design and manufacturing processes are completely computerized.

NURBSTER I resembles a 3D dividing wall designed especially for the Unit 20 Bartfest (2004). (image 1)

NURBSTER II is an installation/exhibition desk designed especially for the Venice Biennale (2004). (image 2)

NURBSTERs III are a series of exhibition islands designed especially for the Bartlett/British Council exhibitions in Prague, Bratislava and Kosice in (2004) and (2005). (image 3)

NURBSTER IV is a dividing media wall/seat designed during a workshop at the Feng Chia University in Taiwan in 2005. (image 4)

NURBSTER V is an urban furniture proposal designed especially for the 75th Lisbon Book Fair (2005). (image 5)

NURBSTER VI is a hanging structure designed especially for the Orientierung solo exhibition in Hamburg (2005). (image 6)

NURBSTER VII is a model for an experimental house in Portugal designed especially for the ExperimentaDesign exhibition in Lisbon (2005). (image 7)

NURBSTER VIII is a proposal for a public wintergarden designed especially for the Meta.morfosis exhibition at Meiac in Spain (2006). (image 8)

NURBSTER IX is an installation/exhibition desk and modular seats designed especially for the Unit 20 Bartfest (2007). (image 9)

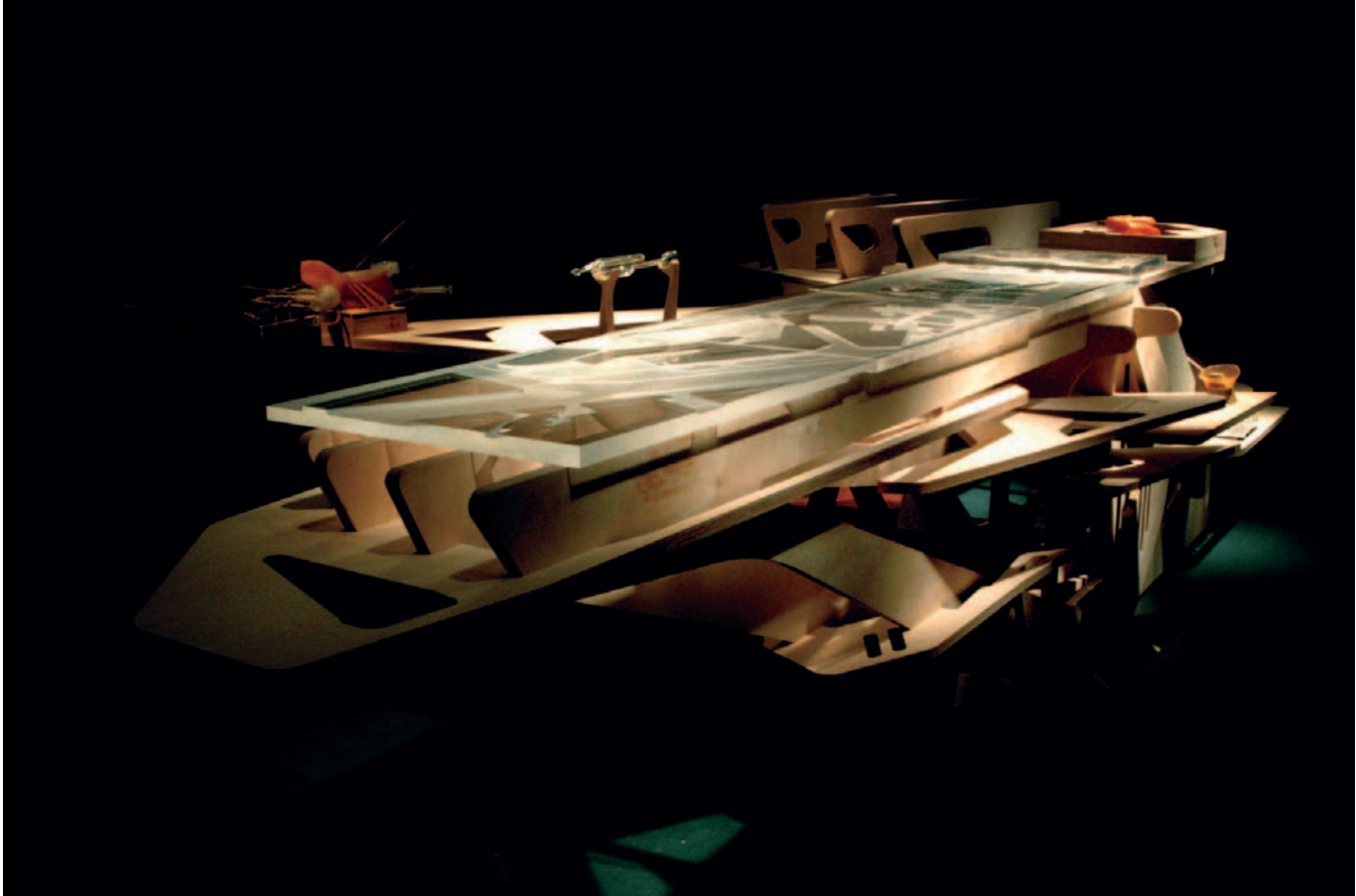


Image 2  
1:1 prototype assembled,  
marcosandmarjan, NURBSTER II,  
The Venice Biennale, Venice, Italy  
(2004).  
Photograph: Sirichai Bunchua.



Image 3  
1:1 prototype assembled, Marjan Colletti, NURBSTER III, Fragner Gallery, Prague, Czech Republic (2004–5).  
Photograph: Marjan Colletti.



Image 4  
1:1 prototype assembled,  
marcosandmarjan, NURBSTER  
IV, The Ren Yen Building, Feng  
Chia University, Taichung, Taiwan  
(2005).  
Photograph: Marjan Colletti.

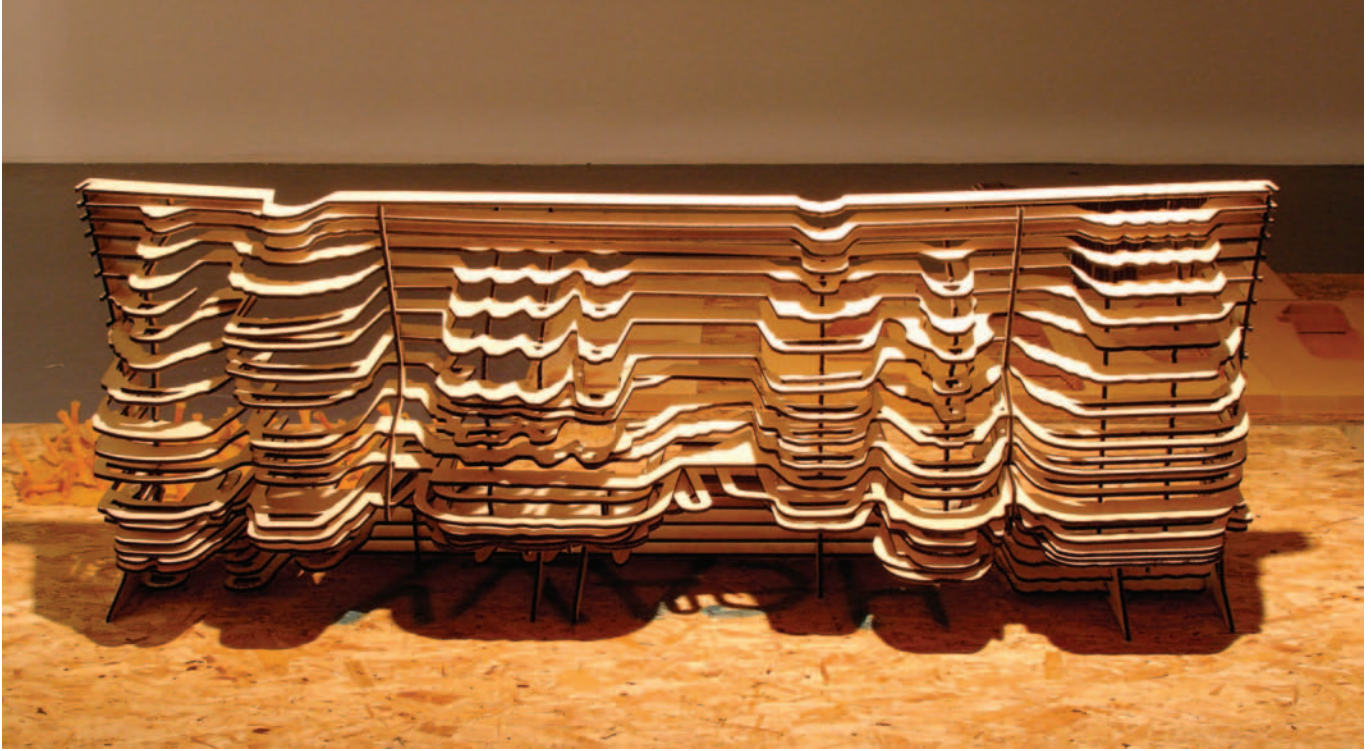


Image 5  
1:3 model assembled,  
marcosandmarjan, NURBSTER  
V, Architekturvavilion TU,  
Braunschweig, Germany (2005).  
Photograph: Marjan Colletti.





Image 6  
1:1 prototype assembled,  
marcosandmarjan, NURBSTER  
VI, Institute for Cultural Policy,  
Hamburg, Germany (2005).  
Photograph: Marjan Colletti.

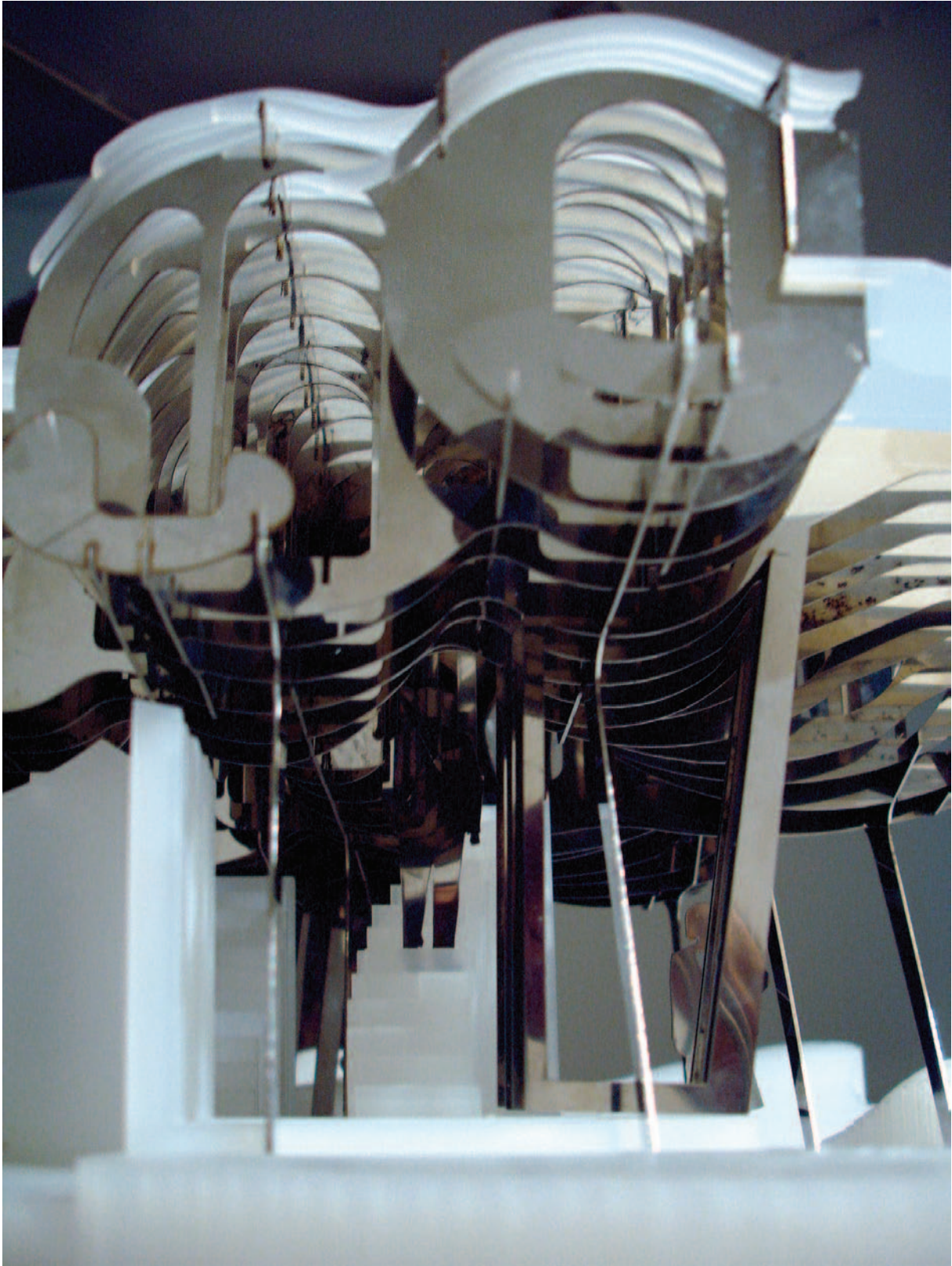


Image 7  
1:20 model assembled,  
marcosandmarjan, NURBSTER  
VII, ExperimentaDesign, Lisbon,  
Portugal (2005).  
Photograph: Marcos Cruz.

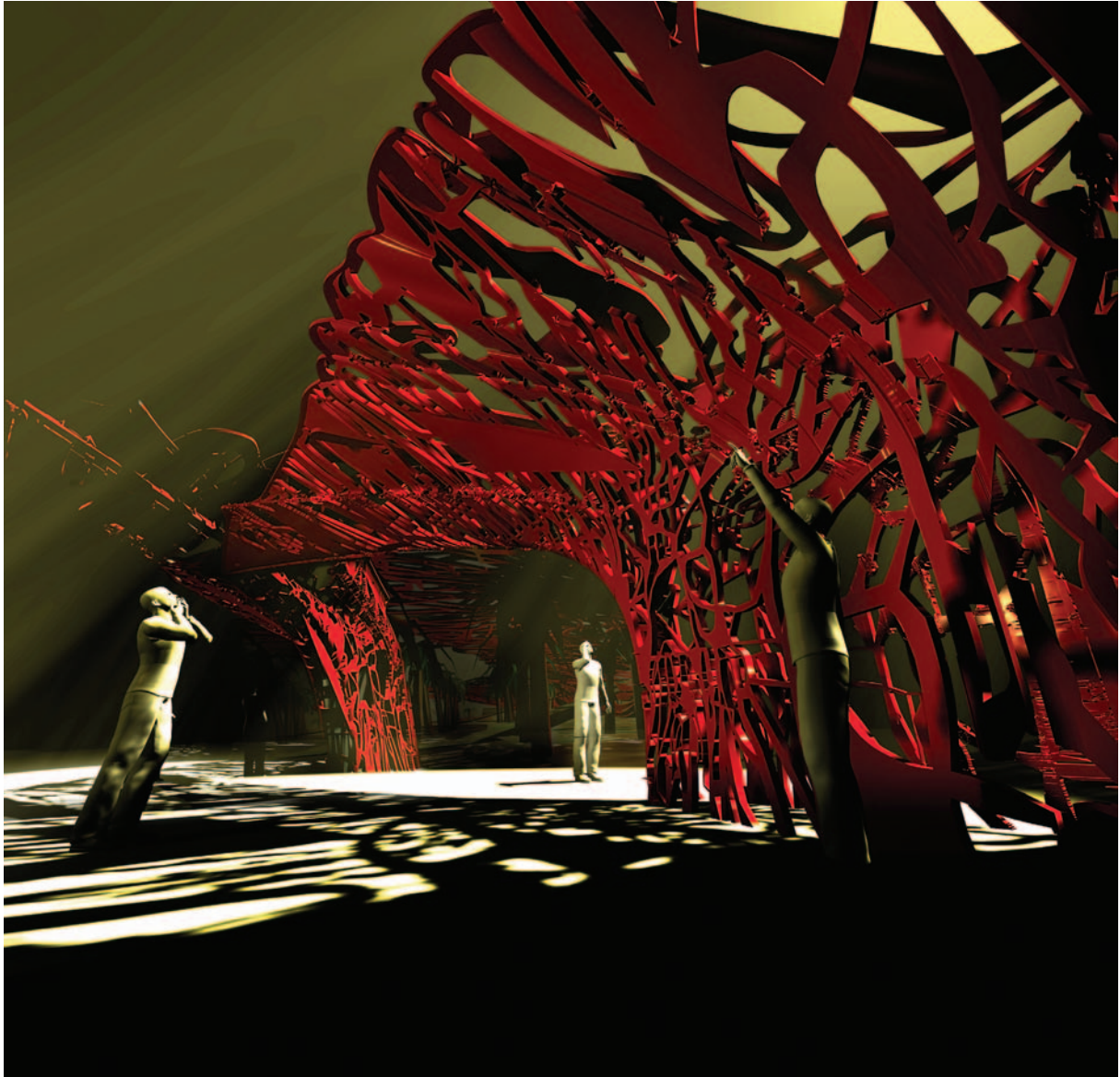


Image 8  
Rendering, marcosandmarjan,  
NURBSTER VIII, (2006).



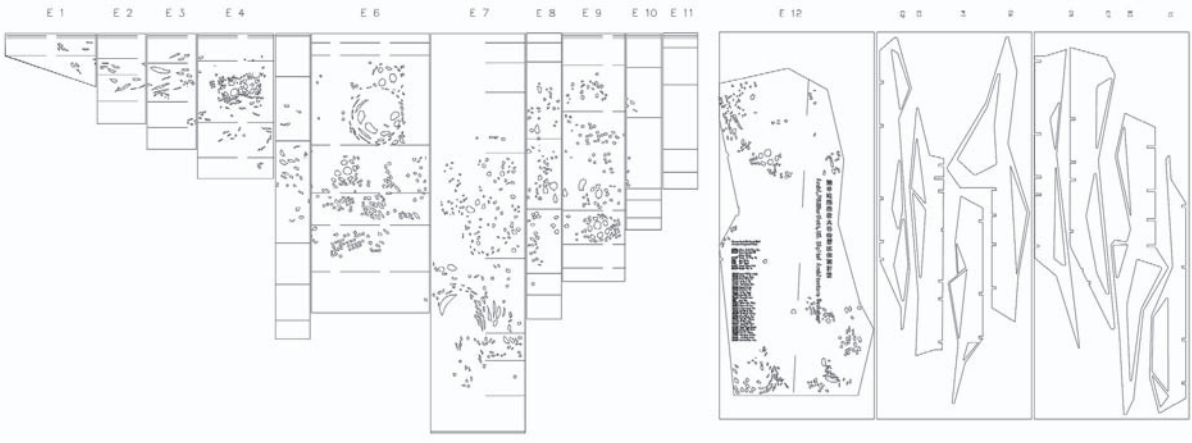
Image 9  
1:1 prototype assembled,  
marcosandmarjan, NURBSTER  
IX, Slade School of Art, London  
(2007).  
Photograph: Anders Christiansen.



Image 10  
Details showing internal spaces created by the synthesis of structural  
and stylistic components, NURBSTER I, Medium Gallery, Prague, Czech  
Republic (2004).  
Photograph: Marjan Colletti.

## Questions

The key questions this research addresses is how to develop a poetic digital avant-garde through 2D/3D software, computer numerically controlled (CNC), computer-aided design and computer-aided manufacturing (CAD/CAM) and rapid prototyping (RP) technologies that go beyond software-related aesthetics and parametric constraints. In order to push the boundaries of experimental applied research in the rapidly changing discipline of architecture, the NURBSTERS challenge the dichotomy of style/structure within the digital discourse [see image 10], and communicate systematically gained practical experience and knowledge through manufacturing.



Images 11–12 (above)  
Screens of laser-cutting and  
water-jetting machinery, Taiwan  
and Portugal (2005).  
Photograph: Marjan Colletti.

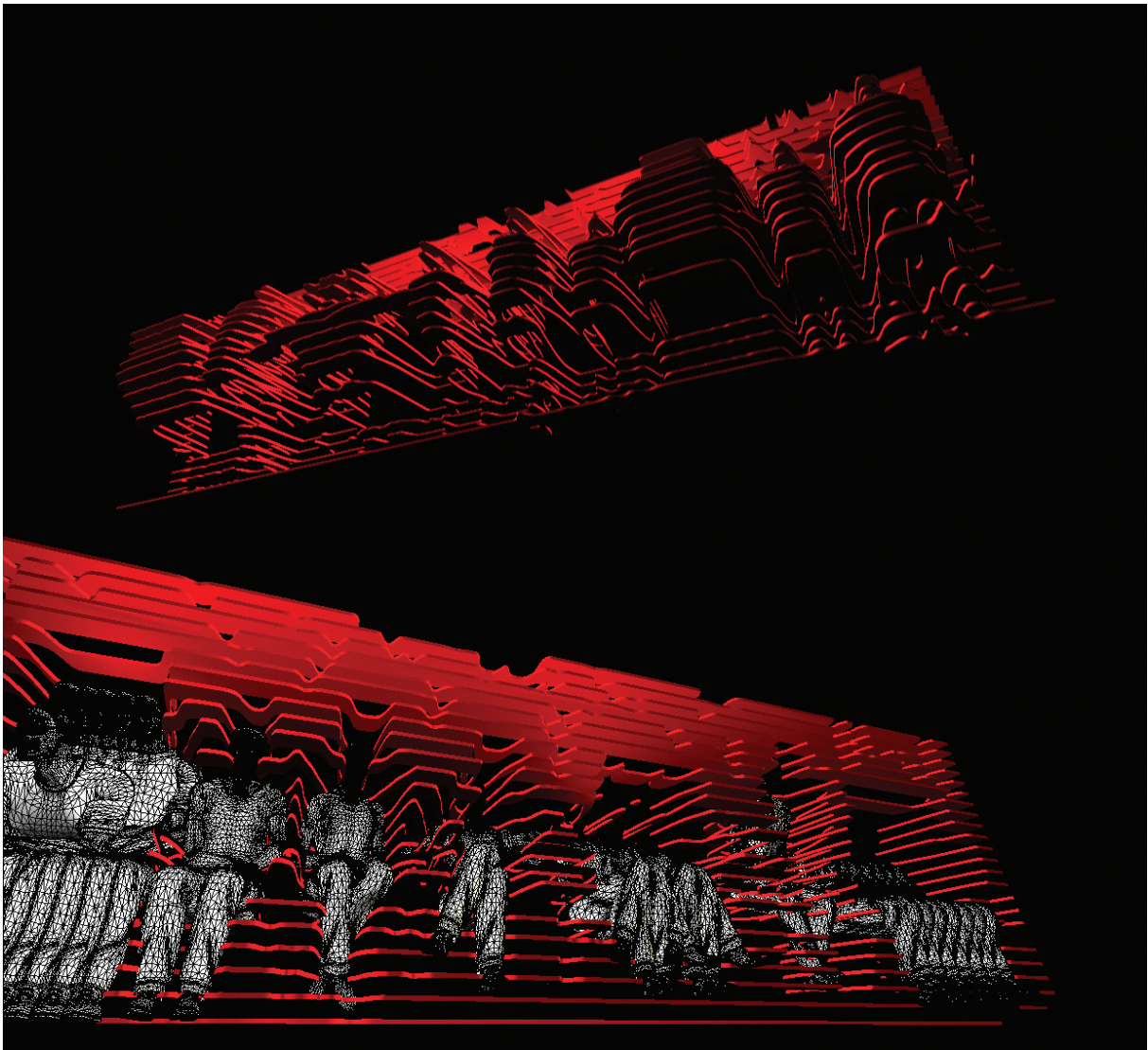
Image 13 (below)  
CAD file of aluminium sheets  
prepared for laser-cutting, with  
patterns and folding lines,  
marcosandmarjan, NURBSTER IV  
(2005).

## Aims/Objectives

(1) To develop a file-to-factory design methodology bridging the gap between digital architectural theory and the built environment.

The file-to-factory design approach of the NURBSTERS makes use of innovative CNC, RP, and CAD/CAM technologies to link the design-computer to the manufacturing-computer. (images 11–12) The series is completely developed using 2D and 3D CAD software, in which it is possible to fully comprehend, test and simulate complex 3D geometries that in an analogue approach would lack experimentation and rigour. The design is then finalized taking into consideration qualities of the material (thickness, elasticity, size), qualities of the process (2D cutting, 3D milling, printing and thermoforming), and the constraints of the machine (precision, bed size). A computer file (image 13) is then sent to the manufacturer without the need for further drawings and printouts, saving time and resources. This process allows optimized and unique geometric and formal multiplicity at standard or even lower costs.





Images 14–15  
Renderings of ergonomic features  
developed with the aid of 3D  
human forms, marcosandmarjan,  
NURBSTERS IV and V (2005).

(2) To develop various typologies of interior and urban furniture designs that can be enlarged to the scale of private dwelling and public spaces.

The size and scale of the NURBSTERS locates them in the domain of interior and urban furniture design, which considers modularity and mass production, as well as structural stability and tectonic presence. The NURBSTERS utilize state-of-the-art 3D CAD software packages to design precise ergonomic pieces to fit contextual, mechanical and bodily attributes. (images 14–15) Furthermore, NURBSTERS VII and VIII apply the research to the development of a smaller private housing unit and an open public structure. Again, the projects synthesise style and structure, ornament and engineering. (images 16–17)

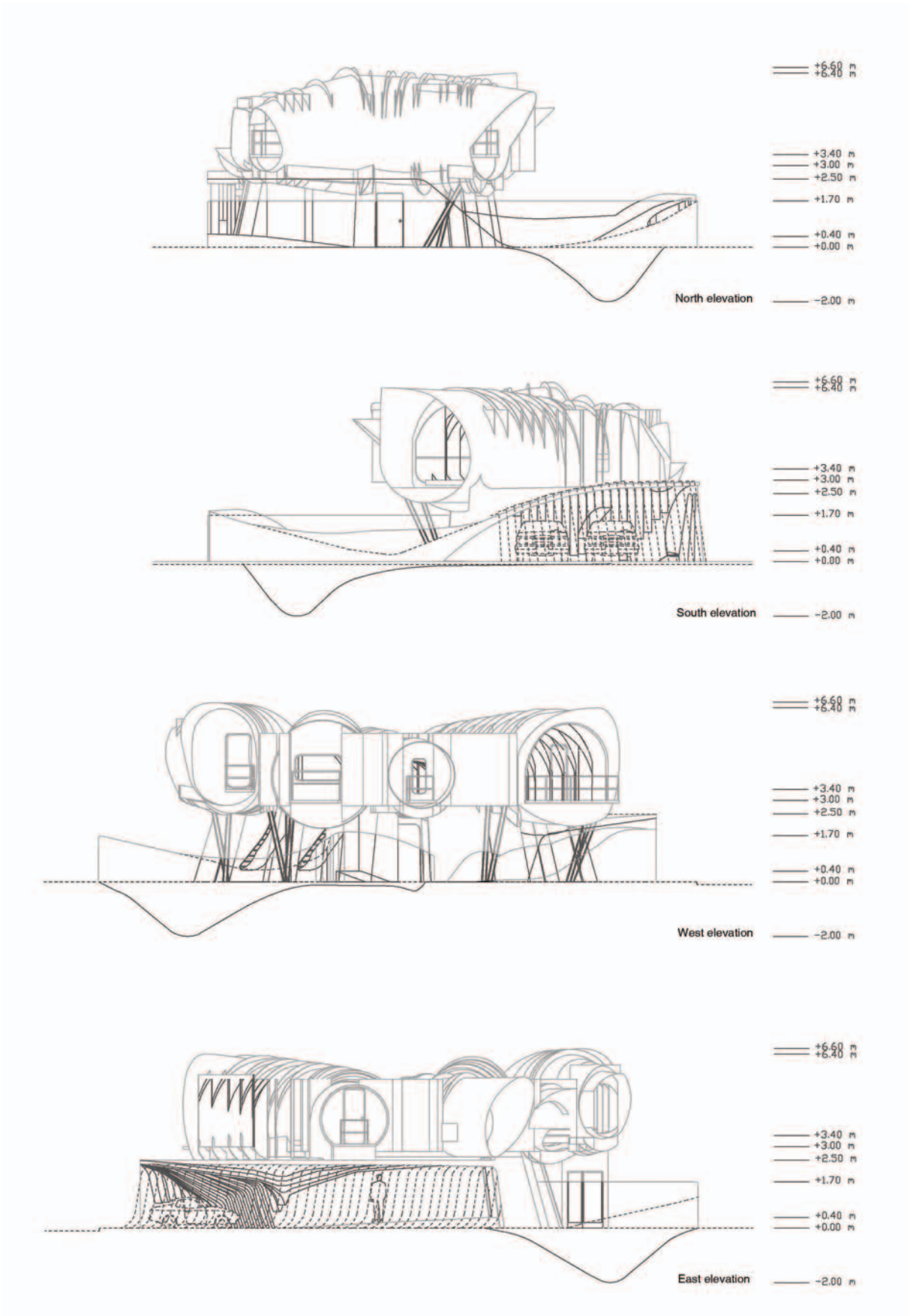


Image 16  
 Drawing showing how  
 typologically, and tectonically,  
 use, inhabitation, ornament  
 and structures are integrated,  
 marcosandmarjan, 'Elevations' of  
 NURBSTER VII (2005).

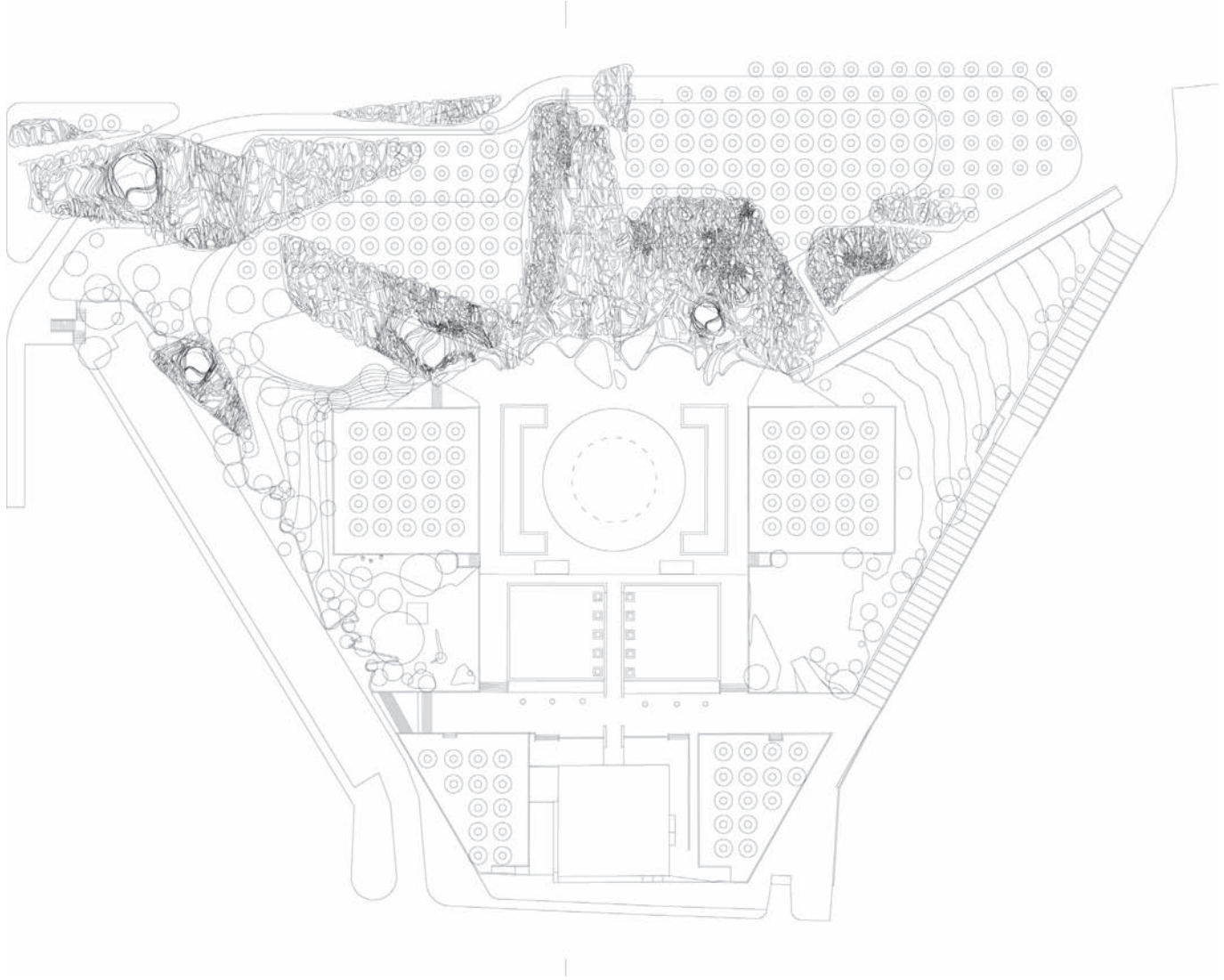


Image 17  
Drawing showing how  
typologically, and tectonically,  
use, inhabitation, ornament  
and structures are integrated,  
marcosandmarjan, 'Roof Plan' of  
NURBSTER VIII (2006).

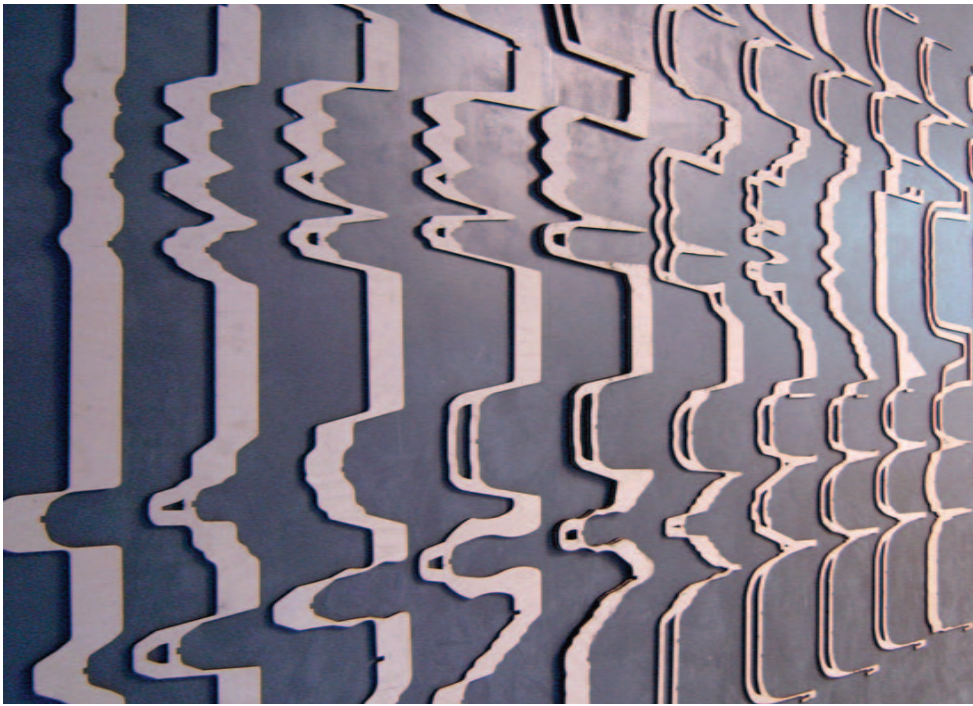


Image 18 (above)  
The positive cut-outs, before  
assemblage, marcosandmarjan,  
NURBSTER V (2005).  
Photograph: Marjan Colletti.

Image 19 (below)  
The negative cut-outs, used  
as ornamental screens,  
marcosandmarjan, NURBSTER VI  
(2005).  
Photograph: Marjan Colletti.

(3) To create efficient and sustainable designs that maximize CAD/CAM cutting processes to attain positive and negative cut-outs for use as 3D objects and 2D screens.

In general a file-to-factory design process allows designer and manufacturer to directly share data without print-outs, consequently saving resources (paper, ink, electricity). Without time delay or language barriers, the data can be sent to local or remote manufacturers depending on project location and production costs. The NURBSTERS series reacts to sustainable issues by optimising the layout of the positive cut-outs on the boards and by re-utilising the negative cut-outs as ornamental dividing screens. (images 18–19)

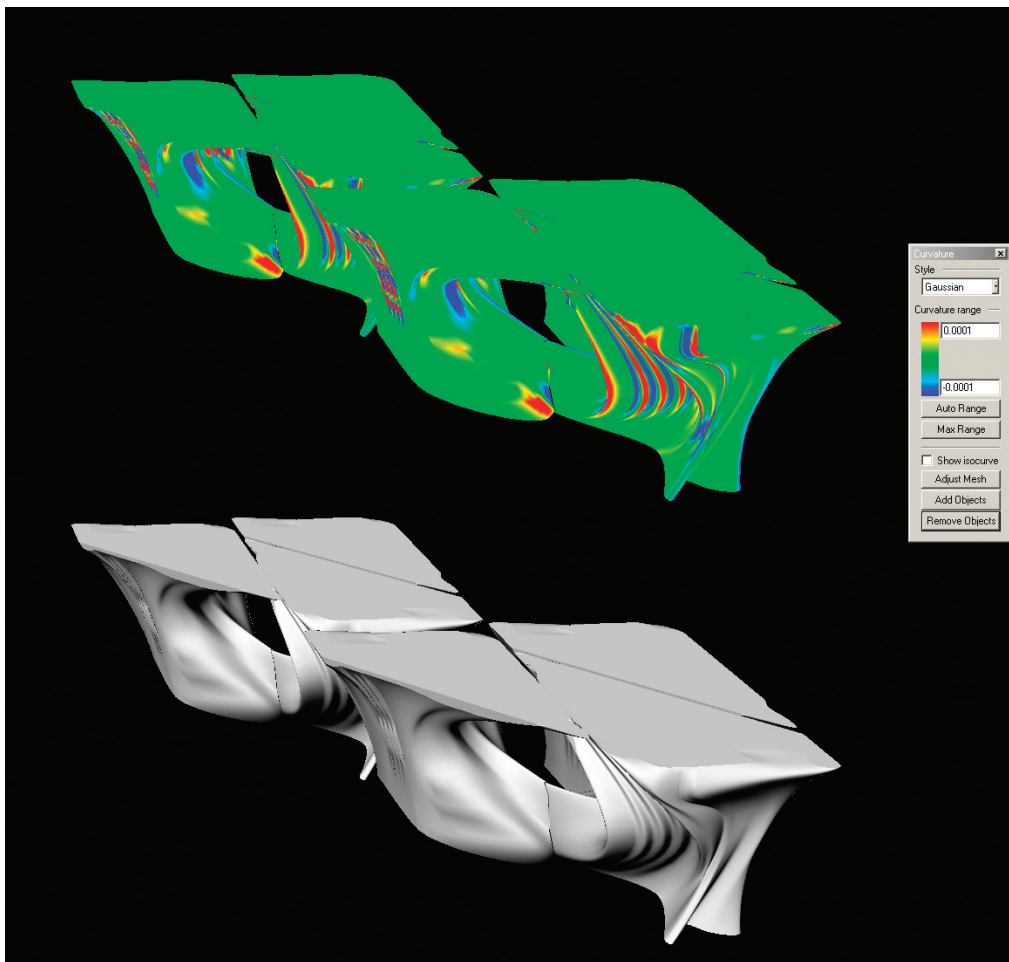


Image 20 (above)  
3D curvature analysis of drawn  
HI MACS® sitting elements,  
marcosandmarjan, NURBSTER IX  
(2007).

Image 21 (below)  
Thermoformed HI MACS®  
elements, marcosandmarjan,  
NURBSTER IX (2007).  
Photograph: Marjan Colletti.

## Contexts

CAD/CAM technologies have long been established in the shipbuilding industry and are strongly expanding as a result of availability and affordability. So far however, these technologies have not drastically changed the way architecture is theorized, designed or produced. If at all, such expertise has been used for the mass-manufacturing of product design, and rarely for larger-scale structural, engineered parametric interventions such as sheds, roofs and high-rise buildings. The NURSBTERs employ a file-to-factory design methodology to develop experimental timber and steel structures, façades, skins, and ergonomic internal secondary structures, division walls and furniture pieces from innovative materials such as LG HI MACS®. (images 20–21)





Image 22  
NURBS geometry created to  
fit functional and machinic  
constraints, marcosandmarjan,  
NURBSTER V (2005).

## Methods

On a 1:1 scale, the design of the NURBSTERs is developed through intense CAD 2D and 3D modelling techniques. The manufacturing is performed through CAD/CAM technologies, especially laser-cutting, water-jetting and thermoforming. All the components are cut out of standard-sized MDF, plywood or metal boards by CAD-operated machines. A series of layered and notched sections creates a complex volume of NURBS (non-uniform rational B-splines). (image 22) They build up a complex object, fitting programmatic, structural, ergonomic requisites expressed through curvilinear and arabesque geometries, and reinterpret the traditional Chinese wooden cut-joint fitting technique ideal for quick assembly and disassembly. (images 23–24) The NURBSTERs' ornamental character expresses deliberate eccentricities within the precision and material efficiency of the CAD-operated process. (images 25–26)



Image 23  
The easy assembly and  
disassembly of the notched  
components, Marjan Colletti,  
Fragner Gallery, Prague, Czech  
Republic, NURBSTER III (2004).  
Photograph: Marjan Colletti.

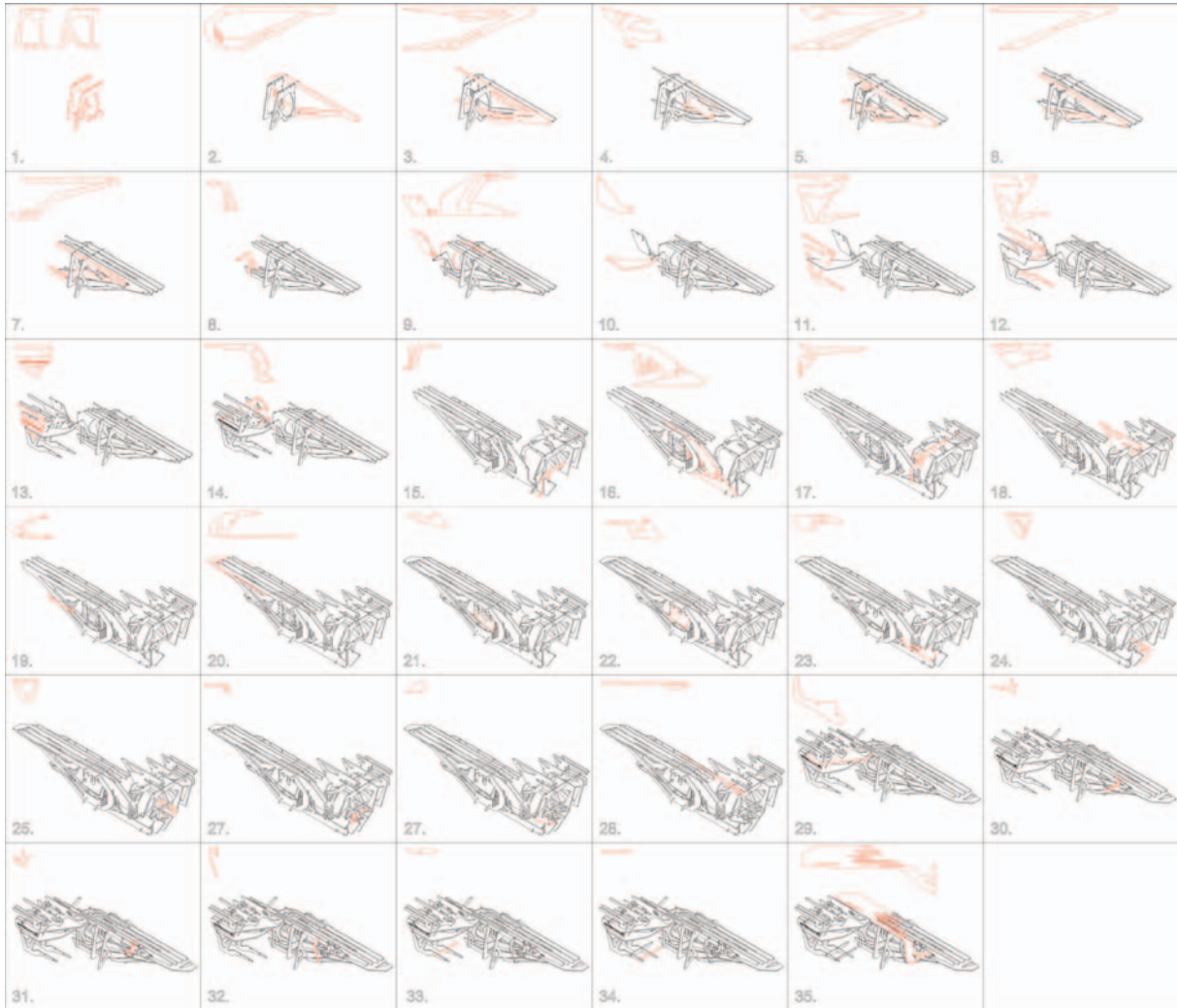
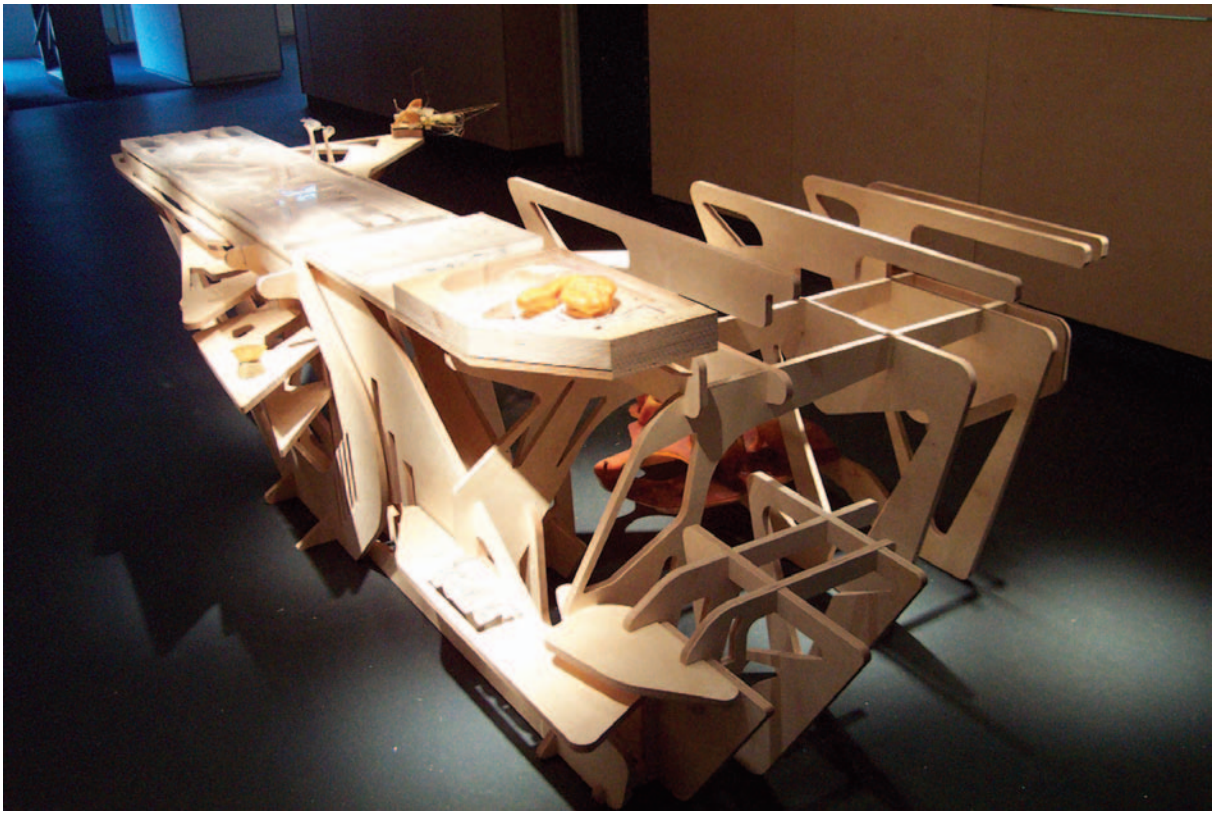


Image 24  
Assemblage drawings,  
marcosandmarjan, NURBSTER II  
(2004).



Images 25–27  
Details showing the structural, sculptural and geometric complexity that can only be controlled in CAD, marcosandmarjan, NURBSTER II, III, VII (2004–5).  
Photograph: Marjan Colletti.

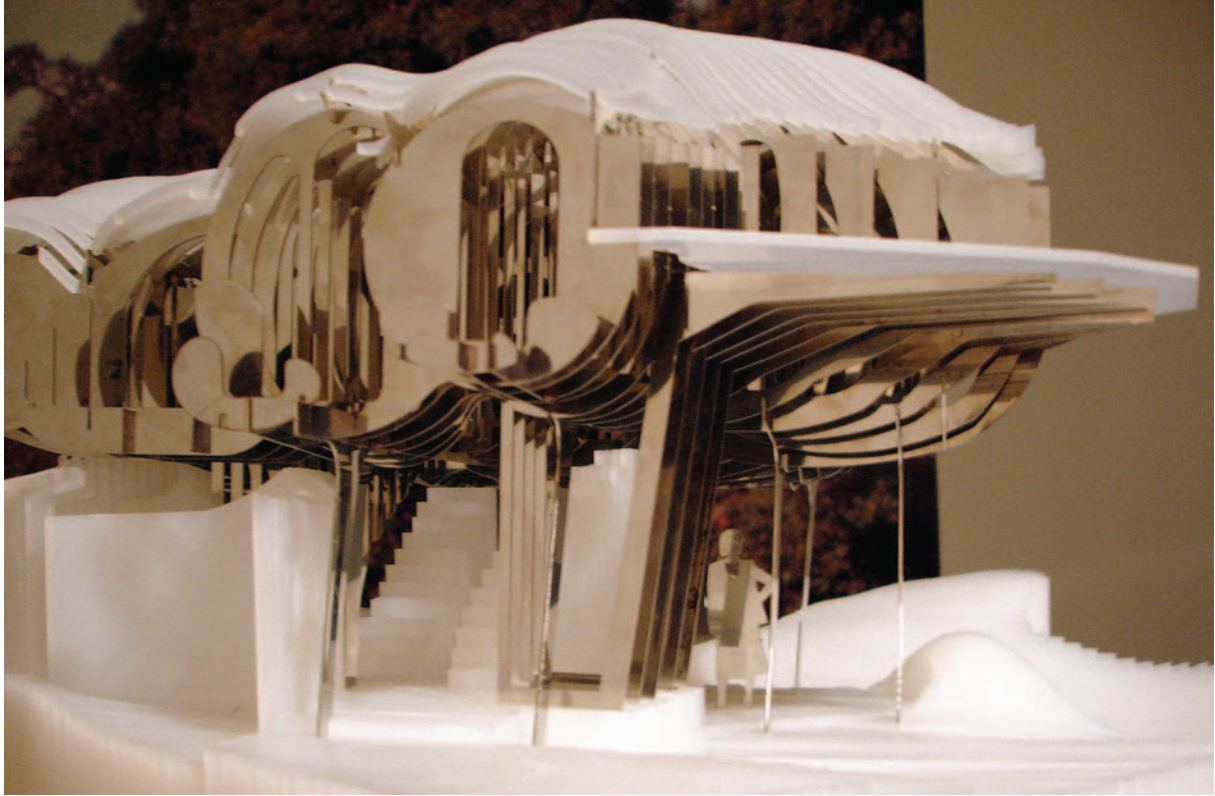




Image 28  
marcosandmarjan solo exhibition,  
Institute for Cultural Policy,  
Hamburg, Germany (2005).  
Photograph: Marjan Colletti and  
Marcos Cruz.

### Exhibitions

The NURBSTERS prototypes and installations have been exhibited in numerous places.

NURBSTER I was exhibited at the *Bartfest* in London and at *Mladá britská architektura* in Prague Czech Republic (2004).

NURBSTER II at the *Metaflux* exhibitions at the Venice Biennale Italy as well as in Lisbon and Aveiro Portugal and in São Paulo Brazil (2004).

NURBSTER III was exhibited in Prague, Bratislava and Kosice, Slovakia (2004-05).

NURBSTER IV was exhibited in Taichung, Taiwan (2005).

NURBSTER VII was exhibited in Lisbon, Portugal (2005), and in Badajoz, Mérida and Cáceres in Spain (2006).

NURBSTER VIII was exhibited in Badajoz and at the ARCO in Spain (2006).

NURBSTERS I-VIII at the *marcosandmarjan – Interfaces/Intrafaces* solo exhibition in Braunschweig and Hamburg in Germany (2005). (images 28-29)

NURBSTER IX was exhibited at the *Bartfest*, London (2007).

### Authored Articles

NURBSTERS have appeared in various authored articles, such as in the monograph *marcosandmarjan, Interfaces/Intrafaces*, (Wien and New York: Springer, 2005), pp. 12–25 [see appendix 1.1]; the book *META. morfosis: el museo y el arte en la era digital*, (Badajoz: MEIAC, Museo Extremeño e Iberoamericano de Arte Contemporáneo, 2006), pp. 136–140 [see appendix 1.2]; the book Yu-Tung Lin (ed.), *Demonstrating Digital Architecture: 5<sup>th</sup> Far Eastern International Digital Architectural Design Award*, (Birkhäuser, 2006), pp. 102–105 [see appendix 1.3]; the book Marcos Cruz and Marjan Colletti, 'marcosandmarjan architects', Pedro Gadanho and Luis Pereira (eds) *Metaflux*, catalogue of the Portuguese Official Representation at the 9th Architecture Biennial Venice, (Porto, Portugal: Civilização Editora/Instituto das Artes, 2004), pp. 123–131, p. 130. [see appendix 1.4].





Image 29  
marcosandmarjan solo exhibition,  
Architekturpavilion TU,  
Braunschweig, Germany (2005).  
Photograph: Marjan Colletti and  
Marcos Cruz



Image 30  
NURBSTER II, marcosandmarjan,  
participation at the Venice  
Biennale, Italy (2004).  
Photograph: Luis Pavão.



## Esteem Indicators

### Articles:

NURBSTERs also featured in articles by: José Pedro Sousa, 'Arquitectura digital portuguesa', *Arquitectura e Vida*, 71 (May 2006), pp. 56–61; Simon Shu, 'Avant-garde Architecture Exhibition from British Archigram School', *FCU News*, 1 (June 2005), p. 6; Huei-ling Chen, 'Splinelwall', *Central Daily News*, (12 March 2005), Taichung City Events Section, p. 7; Chih-Yun Ye, 'Inhabitable Wall', *China Times*, (12 March 2005), Taichung City Events Section, p. C2; Wen-Wen Yuh, 'Digital Architecture', *United Daily News*, (12 March 2005), Taichung City Events Section, p. C2; Andrea Kopernická, *British Council Slovakia News*, autumn and SME (9 and 19 October 2005) [see appendix 2.1]; Shui Liu, 'Space and Emotion' (second part) *Interior Design + Construction*, 129. (May 2005), p. 102 [see appendix 2.2].

### Press release/general notes:

NURBSTER III has been mentioned in many Czech, Slovak and Polish newspapers and magazines, such as *The Slovak Spectator* (17 and 24–30 October 2005); the *Korzár* (30 April 2006), *Staromestské listy* number 1; *Új Szó* (18 and 26 January 2006), *SME* (6–7, 19 and 21 October 2005); *TASR* (4–5 October 2005); *Sport* (4 October 2005); *Hospodářské Noviny* and online at [www.ihned.cz](http://www.ihned.cz) (2004); *Architekt* (2004); *British Council Slovakia News Autumns* (2005); *A&B Architektura & Biznes* (December 2005).

### Interviews:

Radio and TV interviews on NURBSTER III with Marjan Colletti for *Rádio Expres*, *Markíza*, *SME – Kultúra*, *Arch*, *ABS* and others (2005).

### Reviews:

The theoretical and practical techniques used to manufacture the NURBSTERs have been reviewed in: Yu-Dung Lau, 'The Future of Digital Architecture', *Taiwan Architecture*, 11 (2005) pp. 62–67 [see appendix 2.3]; and Shang-Yuan Chen, 'Multimedia Functions with Digital Design', *Taiwan Architecture*, 11 (2005) pp. 80–83 [see appendix 2.4]; Joao Albuquerque, 'Da Forma ao Componente na Era Digital\_NURBSTERs', *Arquitectura e Vida*, 84, Lisbon Portugal (July 2007); Shang-Yuan Chen and Ming-jen Cheng, 'Building an Adaptive Evaluation System: A Design Education Application', *Computer-Aided Design & Applications*, v. 3, ns 1–4 (2006) pp. 49–58 .



Funding:

The NURBSTERs have been manufactured with grants and sponsoring (approx. £42,000) from academic and commercial institutions, such as: The Great Britain Sasakawa Foundation grant, £3,600 (2004); The British Council Czech Republic and the British Embassy (2004); The British Council Slovakia (2005); Lasindustria Lisbon €2,000 (2005); Chun-Sheng Industry Limited Company Taichung (2005); Feng Chia University (2005); iCP Institute for Cultural Policy Hamburg €16,000 (2005); Bartlett ARF £3,000 (2006); Westcut Waterjet Melksham and Roskopf und Partner Germany €4,550 (2007).

Model prototypes of the NURBSTER I-III are part of the iCP Institute for Cultural Policy collection.

An early NURBSTER resulted in an invitation to hold a workshop and seminars about the making of the NURBSTERs, at the *FCU & Bartlett Digital Architecture Workshop*, at Feng Chia University, Taiwan (2005).



## Appendix 1: Related Articles by Marjan Colletti and marcosandmarjan

NURBSTERS have appeared in various authored articles, such as:

(1.1) marcosandmarjan, *Interfaces/Intrafaces*, (Wien and New York: Springer, iCP, 2005), pp. 12–25.

(1.2) marcosandmarjan, 'E-greenhouse (El Coral)', in Antonio Cerveira-Pinto (ed.), *META.morfosis: el museo y el arte en la era digital*, (Badajoz: MEIAC, Museo Extremeño e Iberoamericano de Arte Contemporáneo, 2006), pp. 136–140.

(1.3) Marcos Cruz and Marjan Colletti, 'Nurbster I & II, Bartsters and Splinywall', in Yu-Tung Lin (ed.), *Demonstrating Digital Architecture: 5<sup>th</sup> Far Eastern International Digital Architectural Design Award*, (Birkhäuser, 2006), pp. 102–105.

(1.4) Marcos Cruz and Marjan Colletti, 'marcosandmarjan architects', in Pedro Gadanho and Luis Pereira (eds), *Metaflux*, catalogue of the Portuguese Official Representation at the 9th Architecture Biennial Venice, (Porto: Civilização Editora/Instituto das Artes, 2004), pp. 123–131, p. 130.





## Appendix 2: Critics' Reviews

Sample of Reviews/Articles:

(2.1) Andrea Kopernická, *British Council Slovakia News*, autumn and SME (9 and 19 October 2005) Slovakia (2005).

(2.2) Shui Liu, 'Space and Emotion (second part)' *Interior Design + Construction*, 129 (May 2005), p. 102.

(2.3) Yu-Dung Lau, 'The Future of Digital Architecture', *Taiwan Architecture*, 11 (2005) pp. 62–67.

(2.4) Shang-Yuan Chen, 'Multimedia Functions with Digital Design', *Taiwan Architecture*, 11 (2005) pp. 80–83.

(2.5) Anon., *Arquitectura e Vida*, 71 (May 2006) p. 130.

