



# Iconic titanium sphere still shining

Photo: Wikimedia Commons, Mark J. Nelson

Anyone who has spent time in Tokyo will probably have seen the iconic sphere on top of the Fuji Television Network building. Constructed of titanium, it has been an icon of the city since its construction.

Text & images courtesy of Kikukawa

The Fuji Television Network building is one of the most distinctive buildings in Japan. Located in the waterfront area of Tokyo's Minato district, the ultra-futuristic building was designed by the architect Kenzo Tange and completed in 1996. It serves as the corporate headquarters of the Fuji Television Network and houses several studios.

The 25-storey building consist of two towers connected by three enclosed



The 1,350 ton titanium observation sphere was an engineering marvel at the time.

pedestrian bridges, called 'sky corridors' which are supported by four steel columns. The corridors help to strengthen the overall structure, making it highly earthquake resistant.

## Titanium ball

The centrepiece of the building is the titanium sphere measuring 32 m in diameter, and weighing 1,350 tons. Inside the ball is an observation platform which is open to the public, offering unobstructed views of Tokyo and Mount Fuji.

Raising the ball into place was a major engineering challenge which took a total of 9-and-a-half hours. It was balanced horizontally on, and supported by, three beams, before being raised to its finished height of 123 m by hydraulic jacks.

The titanium sphere was constructed by the metal architect Kikukawa. The massive globe consists of a number of small panels constructed of titanium to avoid corrosion which could otherwise occur due to the building's seaside location. In order to fabricate the globe



Raising the sphere into place was a major challenge.

with a high degree of precision, the company pioneered the use of 3D-CAD in its product engineering.

Although titanium is a high-strength metal, which can be difficult to process, the Kikukawa team were able to use their accumulated expertise to produce this iconic design.

Project:	Fuji Television Network, Spherical Observation Room
Material:	Titanium TP270C (JIS H4600 Grade I) - ASTM GRI equivalent
Thickness:	0.8 mm
Metal Finish:	Dull finish (ND-15)
Sphere diameter:	31m
Client:	Fuji Television
Architect:	Tange Associates
Completion:	1996
Location:	Minato-ku, Tokyo

# Art Tower Mito a beacon for large-scale titanium projects

Art Tower Mito is a comprehensive cultural facility symbolized by the 100 meter tall titanium tower which was opened in 1990 to commemorate the 100th anniversary of Mito, Japan, as an official city.

*Text & images courtesy of Kikukawa*

The 100 m tall titanium tower is composed of 28 contiguous tetrahedrons (triangular pyramids) placed on top of each other, each set at a different angle. Kikukawa participated in the metal construction of this monumental project.

## The first large-scale Ti project in Japan

Titanium was chosen for the façade of the tower as it captured the architect's vision to "choose high-quality materials to build architecture that lasts".

Titanium is known to be a maintenance-free material with excellent resistance to corrosion and weathering. It is 60% lighter in weight than steel, and is superior to other metals in both strength and workability.

Despite such superior properties, the usage of titanium is limited in architecture due to its high material cost. This project pioneered the use of titanium on a large scale within Japan: consequently, it was also Kikukawa's first attempt to implement titanium panels on such a large scale.

Regardless of these conditions, Kikukawa was able to provide high-quality titanium panels by collaborating closely with the metal sheet provider and through repeated experimentation.

## 9.6 m titanium equilateral triangles

The titanium tetrahedrons composing Mito tower are formed from 57 equilateral triangles with each side measuring 9.6m. Each triangle is formed with 8 pieces of 1.5mm thick hairline finished titanium of roughly 1050mm width, ranging in length and



*The Mito tower is constructed of almost 18 tons of First Grade titanium.*

shapes from trapezoids to triangles. The corners where the panels meet the structural truss are joined using 1.5mm stainless steel cut in  $\phi 95\text{mm}$  half circle. The backing frames are composed of bent 1.5mm stainless steel assembled into a unit.

To ensure the integrity, wind resistance, and water sealing, the panels and frames were carefully designed and calculated. This is evident in details

such as the 230mm risers at the edge of the panel.

## Stainless steel fittings & louvres

The observation floor at 86 meter high has 70 circular windows of  $\phi 432\text{mm}$  and  $\phi 670\text{mm}$ . The window system has excellent airtightness and is equipped with an opening/closing mechanism. The cross-section of the window reveals that the glass window is placed



Built in 1990, the tower was a cutting-edge project in terms of its design, use of titanium and implementation.

between the interior and exterior fittings. The 120 mm thick exterior fittings are tapered, and the interior fittings are 280 mm thick cylinders, both pre-assembled into a unit at the factory. Other triangular sides of this tower are equipped with a single line of  $\phi 432$ mm circular windows.

The titanium triangles at the foot of the tower are equipped with louvers towards the bottom. These louvers are formed by hairline finished 1.0mm thick stainless steel bent into a Z shape.

### Installing large panels sky-high

The 9.6 meter assembled equilateral triangular panels are each roughly 1 ton in weight. Thus, their transportation and installation required consideration from the detailed design stage.

Frames and hardware for transportation, ground assembly and suspension were designed and fabricated, as well as a system to pull in the lifted panels to the structural truss. The actual installation was achieved by equipping the panels with bespoke hinges so that they could be pulled and adjusted into place with bespoke rod-shaped installation hardware.

### A symbol of Mito

It was a true pleasure for Kikukawa to participate in this monumental project. Art Tower Mito is now known by many as the symbol of Mito City, and it is also one of the most well-known works of

the Pritzker Award-winning architect, Arata Isozaki.

This was a cutting-edge project in its design, large-scale usage of titanium and its implementation. It is projects like these that challenge our expertise and hone our metal-crafting technology which expands our ability to provide comprehensive solutions for a variety of architectural projects.

### Project Art Tower Mito

Abbreviated

Name: Art Tower Mito  
 Client: Mito City  
 Architect: Arata Isozaki & Associates  
 Contractor: Construction Joint Venture: Taisei Corporation, Takenaka Corporation, Totetsu Kogyo Co., Ltd., Akui Corporation

Completion: 1990  
 Location: Mito City, Ibaraki  
 Material: Pure Titanium FJIS Grade I, iASTM GRI equivalent  
 Material thickness: 1.5t  
 Finish: HL  
 Quantity: Approx. 17.8 ton

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