

Comba's 2008 Summer Games Wireless Solutions

A Watertight In-Building Solution for the National Aquatics Center in Beijing



About the Water Cube

The National Aquatics Center, also known as the "Water Cube", was one of the most dramatic and exciting venues to feature sporting events for the Beijing Games in 2008. Located inside the Green and north of the Beijing central axis, it reinforces the historical and cultural features of Beijing city.

The Water Cube was built alongside the Bird's Nest for the swimming events on the Olympics. With a capacity of 17,000 people, the center consists of:

- 97,529m² of floor space
- 2 underground levels
- 4 levels above ground

After the games, the center became a recreational facility open to the public. It was also used for sound and light shows during summer 2009 and also hosted a production of Swan Lake where it was converted to a ballet theater.

Background

The National Aquatics Center occupies a total land area of 65,000m², in which the underground component is at least 15,000 m². The National Aquatics Center was the venue for swimming, diving, synchronized swimming and water-polo finals during the Summer Games. The total seating capacity is 17,000, including 6,000 permanent and 11,000 temporary seating (removed after the Games).

Comba Telecom was contracted to supply a robust and seamless wireless in-building communications systems for the Center and other Game venues.

Structural Layout

Area: 97,529 m²
Floors: 2 floors underground and 4 floors above ground
Length: 183m
Width: 177m

Each level had the following facilities:

Floor	Functions
F4	Lounge Hall
F3	Lounge Hall
F2	Spectator Stands
F1	Spectator Stands, Lounge, Shops, Washrooms
B1	Pool, VIP Area, Staff Room, Equipment Room, Athletes Room, Referees Room, Press Room
B2	Parking Lot, Equipment Room, AirCon Room, Communications Room, Transformer Room

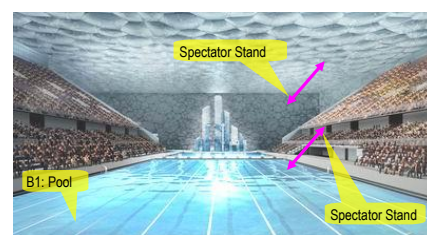


Fig 1: The Center consisted of six levels including two levels of spectator stands

Cell Allocation

In the National Aquatics Center, estimated traffic mainly originates from the spectator stands. Thus, spectator stand is a key point to cell allocation and capacity configuration. The spectator stand is divided into several areas.

During the key events, the activity scope and time of communications usage, user activities and activity cycles changes, which brings unpredictable traffic spikes that may occur repeatedly during the day.

After extensive capacity analysis, Comba divided the Center into the recommended cell allocations for PHS and TETRA as specified as below (figures 3-5):

PHS System (4 PHS cells)

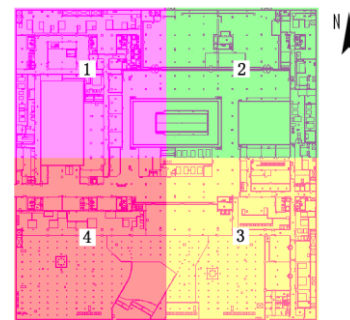


Fig 2: PHS Cell Allocation (level B2)

Case Study

Water Cube, Beijing 2008 Summer Games, China

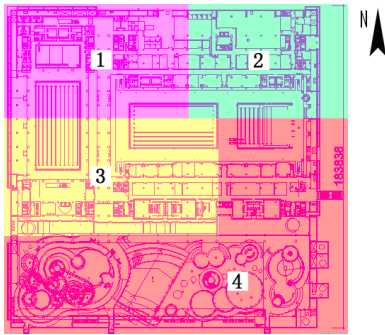


Fig 3: PHS Cell Allocation (levels B1 – F2)

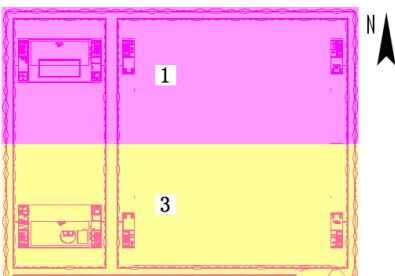


Fig 4: PHS Cell Allocation (levels F3 – F4)

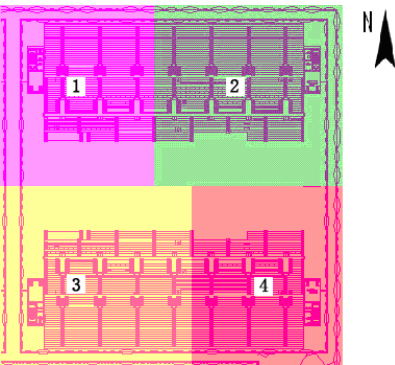


Fig 5: PHS Cell Allocation (Spectator Stands)

- 4 PHS cells included in the swimming center; 4 units of 1C7T BTS deployed as source signal;
- 14.925Erl provided by each 1C7T BTS to meet PHS service requirements;

PHS Cell Coverage Summary

Coverage	Cell	Signal Source	Traffic
NE Stand & Indoor	PHS Cell 1	1C7T BTS	3.738 Erl
NW Stand & Indoor	PHS Cell 2	1C7T BTS	3.738 Erl
SE Stand & Indoor	PHS Cell 3	1C7T BTS	3.738 Erl
SW Stand & Indoor	PHS Cell 4	1C7T BTS	3.738 Erl
Total	4	4C7T BTS	14.952 Erl

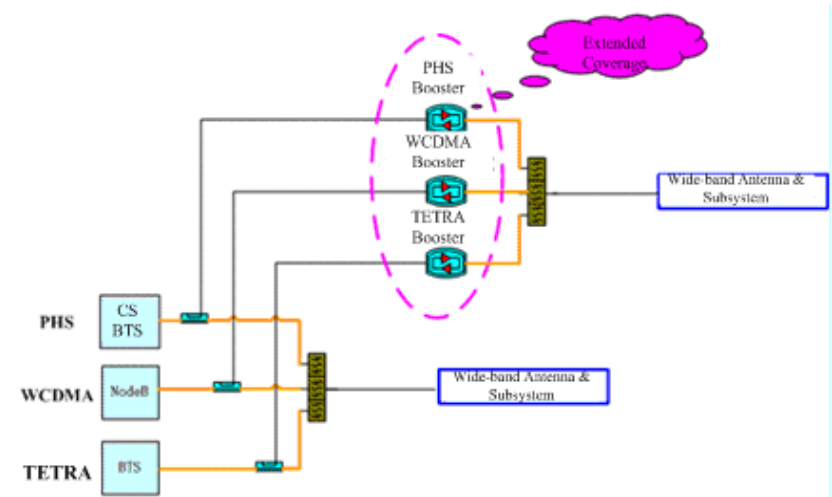


Fig 7: Extending coverage via active equipment

TETRA System (B2 – F4)

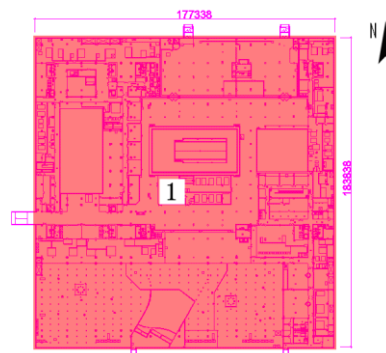


Fig 6: TETRA Cell Allocation (Levels B2 – F4)

For the TETRA system, the center was regarded as one single cell thus:

- Includes stand and indoor area
- 4 carriers configured for each cell;
- 9.01Erl provided by each cell to meet TETRA service requirement

Overcoming BTS limitations

Since the Center is quite large, typical limits of BTS power meant that the system would not be able to meet the coverage requirements.

In order to overcome this, Comba's solution involved deployment of active equipment to amplify signals. Shown above (in figure 7) is the active distribution schematic.

Challenges & Solutions

During the course of the project, Comba maintained close collaborative relationships with the operators, construction contractors, telecoms planning committees and various other parties to anticipate, address and overcome issues that invariably occurred.

Some of these included:

- Spectator stands are large and far away from antennas; PHS cells are small with handover and interference issues
 - Narrow-beam antenna and directional panel antenna were deployed and located according to calculations based on blueprints
- Drilling and welding on beams along the runways was not allowed for installation of antennas
 - Special design antenna mounting kits were custom produced to overcome this
- The venue required that feeders along the runways should not use hose tubing and that devices be kept invisible to the eye
 - Since traditional hard tubing was not suitable, price tubing was installed. Devices were installed in the electric box along the runway
- Real-time troubleshooting during system commissioning

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Photo Gallery



Fig 8 & 9: Narrow beam antennas installed along runway



Fig 10: Venue restrictions on welding and drilling meant antenna mounts had to be customized



Fig 11: Prica tubing was used to protect feeders

Comba Products and Services

- Network consultancy & design, installation, project management , commissioning
- Active repeaters for PHS, Tetra, WCDMA
- Narrowbeam antennas and directional antennas
- Wideband omni-directional indoor antennas and passive components
- Outsourced materials

For more information, contact your Comba representative, or visit <http://www.comba-telecom.com>

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