Background shot: Jellyfish and Coral chandeliers, interior of Bubble Theatre during *Dragon's Treasure*. Inset: The elliptical dome of the Bubble Theatre with color-changing LED exterior skin.

Life in a Bubble

Macau's City of Dreams gets a major new multimedia attraction

By: Julie Harper

The City of Dreams—Macau's latest landmark project—is a major entertainment and casino resort designed to challenge the dominance of Las Vegas as the world's premier gaming destination. Located opposite—and in hot competition with—the Venetian Macao Resort Hotel, this major complex incorporates a mega-casino, more than 200 retail outlets, 20 restaurants and bars, three luxury hotels (Crown Towers, Hard Rock, and Grand Hyatt), a 47-story apartment block, and the iconic Bubble Theatre, host to a high-definition media presentation entitled *Dragons Treasure*.

The Bubble Theatre is an extraordinary achievement, but the attractions begin when you walk inside the door of the complex.

Photos: Jason Goldenberg

The Vquarium, complete with mermaid, at the City of Dreams entrance.

Inside the Vquarium

Located at the main entrance to the City of Dreams is a "virtual aquarium"–the Vquarium. Originally intended to be a live aquarium measuring 30' high by 150' wide, it was reconceived to become a single, seamless piece of curved acrylic, with the "aquarium" rear-projected on to a screen provided by Stewart Filmscreen. A system of water jets (from Backstage Technologies, of Winter Park Florida and Wiltshire, England) sends water cascading down the front of the installation. Kraftwerk Living Technologies, of Austria, provided the audio/video technology and playback/show control, including 16 DLP projectors, a 16-channel server structure, and a Meyer Sound audio system.

Water textures are rear-projected onto this surface, alongside underwater scenes from a series of Rosco X24 X-Effects projectors. The highlight of the aquarium scenes is a group of mermaids (the result of green-screen animation by the Orlando-based firm Falcon's Treehouse), who appear much to the audience's delight.

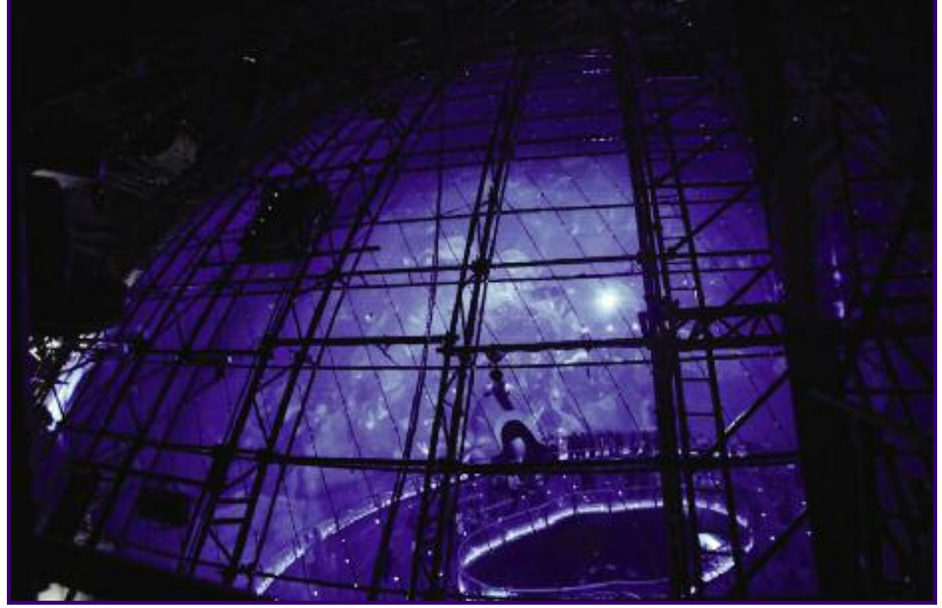
Media and lighting are synchronized with the lobby's lighting system to create a series of pre-programmed changing environments, ranging from volcanic to arctic, and incorporating the entire area into one experiential theatrical environment. The aquarium feature presages the Bubble show's water theme and the magical virtual world the audience is about to encounter inside.

The Bubble Theatre, with its elliptical, color-changing dome, has become the icon of the City of Dreams. At night, the dome is illuminated by more than 160 Artistic Licence Fire-Brand FB-312 color-changing LEDs; the company's Color-Tramp control system runs animation and patterns across the Alucobond skin of the roof. (Alucobond is an aluminum composite material.) The theatre's entrance is a triangular wedge that cuts through the Bubble itself, edged with Element Labs' Versa TUBEs and backed by water-textured and frosted glass. Across this plays a media display of water ripples, custom-made by Bryan Barancik, of the lighting-design firm Lightswitch, which are color-coordinated to reflect the state of play of the show inside.

The theatre was designed to house *Dragon's Treasure*, a free, 360° 3-D cinematic experience conceived by Falcon's Treehouse. Combining high-definition digital video animation, a musical score composed by Academy Award-nominated Klaus Badelt, lighting, and special effects, the show is a 10-minute multimedia extravaganza described as "a totally immersive experience." The 500-strong audience appears to be transported below the City of Dreams, through the magic portal of the Bubble, to the ruins of the Jade Emperor's Palace where, in a submarine environment populated by dolphins, whales, jellyfish, and mermaids, the 300'-long Dragons of the Four Winds battle for possession of the mystical Pearl of Wisdom. It's no surprise that the show, the first of its kind in the world, won an Award for Outstanding Achievement (AOA) in the attractions category from the Themed Entertainment Association (TEA) at the end of 2009.

The principal lighting designer for *Dragon's Treasure*—as well as the Bubble's exterior and the Vquarium—is Norm Schwab, of Lightswitch: He was brought in by Geoff Benham, executive producer at Melco Crown Entertainment (owner and operator of City of Dreams), with whom Schwab had worked on the Crown Casino in Melbourne. "The brief was to create an atrium spectacular, which would be the focus of the casino and serve to draw people in," explains Schwab. "The intention was to create a story line that had relevance not only to the resort, but to Macau and China also, and was compelling to Asian and overseas audiences of all ages, and with no language barrier."

Photo: Jason Goldenberg



A view of the auditorium through the Bubble's inner dome showing structural framework by Kraftwerk Living Technologies.

Left: The center jellyfish winch, including service gantry for maintenance and repair. Right: One of the smaller "perimeter" winches for the four Coral and Jellyfish chandeliers.

Photo credits: Top: Jason Goldenberg; Bottom left and right: Courtesy of Fisher Technical Services

Originally envisaged as a video presentation, Melco Crown Entertainment allowed a great deal of freedom in the show's creation. The outcome is a mix of video, LEDs, lighting, and surround sound, making for a new experiential venue that redefines the boundaries between show and audience.

"For a project as ambitious as this, we needed something above and beyond the usual suspects," explains Schwab. "We were pushing the boundaries, and we needed more technical and programming abilities than usual, so we opened up to a diverse, and talented, group of people."

These included Falcon's Treehouse, the creative producer; Kraftwerk Living Technologies, for the Bubble screen and structural framework, audio, and video systems; Las Vegas-based Fisher Technical Services, for rigging and show control design; Jonathan Deans, of Without A Paddle, for audio system design; Celtic Engineering Inc., of Orlando, and Cinnabar, of Los Angeles, for the scenery; Duluth, Georgia-based Xnth Degree, for MEP; and Ptarmigan Consulting Ltd and Artistic Licence Asia, both of Hong Kong, for the complex business of overall systems integration.

An ellipsoid dome 65.6' in height, 118' long, and 88.5' wide was a challenging shape to deal with, and, with very little room in which to squeeze the amount of technology involved, it presented a unique set of challenges. "The space was parabolic in one direction and elliptical in another," says Schwab. "This gave it a sexy, beautiful shape, which fitted

the casino's underwater 'bubble' theme—we just had to figure out how to utilize it!"

Kraftwerk Living Technologies was responsible for the fabrication design and installation of the dome's inner and outer trussing structure, the projection surface, and the video and audio technology. The 18,290 sq. ft. projection surface consists of specially coated and perforated sheet metal panels, each designed in its own unique shape to give the dome a totally seamless finish. These are integrated into a complex steel structure over an aluminum substructure, behind which is concealed the sound and automation equipment. The payload for the screen, audio, lighting, and special effects totals some 60 tons.

Onto this, Lightswitch layered 10,000 Cool Dotz LED pixel points—provided by Lighting Science Group –at 18" intervals, along with strobes, moving lights, and larger LED fixtures within and behind the perforated dome. In addition, several moving elements are able to penetrate into the audience area through portals. These include chandeliers shaped in the form of jellyfish and coral. The show's media—developed by Peregrine Pixels with production supported by Amalgamated Pixels—was then manipulated by Kraftwerk into 15 separate feeds, edge-blended to ensure seamless projection across the huge domed surface.

"We used 15 Christie Roadie HD+30K projectors in full resolution of 2,048 x 1,080 pixels and 60fps, aligned to project one uniform picture of 36 megapixels on the dome," says Thomas Gellermann, head of R&D for Kraftwerk. "The projectors can each be realigned automatically using a newly designed calibration system with high-definition cameras."

Schwab designed the lighting to blend into, and expand upon, this rich video content: 18 Barco High End SHOWGUNs dazzle through apertures and chandelier traps in the perforated ceiling, while 46 Philips Vari*Lite VL3000 and VL3000Q Spots protrude though the perforated mesh to drip water and fire effects on the audience below, emulating the video content. Programming for both the moving heads (supplied by Solotech) and LEDs was carried out by Lightswitch's Seth Rapaport. Water effects generated from 44 Rosco X24 X-Effects projectors augment the Ptarmigan-supplied ETC Selador X7 LED strips, set in the floor at the base of the dome to provide washes of color up the curved sides.

But it is the strobe and LED fixtures that are used to emphasize the on-screen action to spectacular chandeliers. "This gave us an unbelievable variety of intensity with which to highlight points of the action," explains Schwab. "We could emphasize a movement with a sparkle of the LEDs, amplify the effect with the star strobes, and ramp it up to supernova with the Atomics. Amalgamated Pixel created positive and negative mattes of the dragon, which, combined with particle fields and explosions in the Hippotizer [media server from Green Hippo], were used to create auras, trails, and magical sparkles. This was output into pixel-mapping software called Firefly, from Lighting Science Group. The use of the mattes saved us days of animation creation and programming time.

"Lightswitch, LSGC, and Kraftwerk labored long and hard on how to distribute and install the Dotz across the perforated skin and even across the moving traps hiding the chandeliers. Kraftwerk was then able to laser-cut the holes in the projection screen into which the prewired LEDs could be snapped for quick installation."

A similar technique was used for the jellyfish and coral chandeliers, where the LED points were pixel-mapped using the Hippotizer. "The time saved was enormous and in no small part due to the mathematical genius of the programmers—Kevin Pelletier and John Burne from, LSGC; Lightswitch's Cory Fitzgerald; and Ptarmigan's Chris Chew—who programmed the Hippo and MA Replay on-site, and Adam Rechner, Lightswitch's CAD manager," says Schwab.

Two extensive control networks underpin the show, one handling the 60 universes of LEDs in the dome and the second 55-universe network running the moving lights and non-screen LEDs. The main control is via two sources: A Hippotizer handles the LED pixels in the projection surface within the chandeliers and the Selador fixtures in the auditorium floor; a grandMA2 replay unit controls the moving heads and strobes in the main body of the theatre and strobes in the chandeliers, while sharing control of the Selador fixtures in the floor.

An Artistic Licence integration system merges the data streams from the two media servers via Art-Net, while all control signals for the DMX fixtures within the flown chandeliers are necessarily transmitted over a wireless data system. The integration system was orchestrated by the team at Ptarmigan Consulting.

"The design team required a lot of creative freedom in order to control fixtures with both media content and via a conventional console," comments Simon Fraser, of Ptarmigan. "To achieve this, we had to push the boundaries of both the MA and Hippo. Working closely with MA, we were able to output 24 universes of Art-Net from the consoles, which were subsequently merged with the Hippo output. It was quickly apparent that Art-Net was the only protocol that was supported by multiple manufacturers, and would allow us to support the creative team in the way that they anticipated."

Fisher Technical Services was responsible for all rigging and mechanical automation for the show, including the complex business of lifting the scenic elements, such as the six chandeliers manufactured by Cinnabar. The large central jellyfish is dropped in on a winch with a 26,000lb. capacity, which also carries a digital water curtain designed by Aquatique Show International, of Strasbourg. The water curtain forms a 13' diameter circle composed of innumerable jets of water, which can be programmed to turn off and on in sequence, effectively creating a series of animations within the water as it falls. The water tank is contained within the chandelier; Aquatique worked closely with Fisher on the docking system. This allows the chandelier to retract and refill with water between each sequence, and to move at speed while maintaining its balance to ensure it does not overflow.

With space at such a premium behind the perforated skin at the apex of the dome, the synchronized movement of the chandelier, trap, and the VL3000s above—which must turn to move out of the chandelier's way—results in a carefully choreographed sequence. Through the center of this flying piece, a secondary winch with 500lb.-capacity drops the Pearl of Wisdom though a segmented central trap door, illuminated by lasers from Excitement Technologies Group, of Addison, Texas, in one of the largest

Left: The central jellyfish chandelier with digital water curtain by Aquatique Show International. Right: A 3-D representation of the City of Dreams skyline prior to diving below the surface.

Left: Jellyfish during the show. Right: The Pearl of Wisdom descends, surrounded by lasers from Excitement Technologies Group.

Photos: Jason Goldenberg

One of two operator control stations—part of the overall Navigator-based show control system.

operating, full-color laser entertainment systems in the world.

The four smaller chandeliers—two more jellyfish and two corals—are brought in on 7,000lb. winches, beneath each of which are situated "eyelid" trap doors in the projection screen, which allow the scenery to pass through before closing to form a seamless, unbroken surface. The elliptical shape of the Bubble and the precise positioning required to make sure that each "eyelid" is imperceptible when in place—a vital criteria for the show's visuals—resulted in what Scott Fisher, of Fisher Technical Services, refers to as a "custom mechanical adventure. Each solid piece measures 10' across and is curved in both planes, resembling a big potato chip. It is lifted from above by an asymmetrical scissor-lift mounted on a track and then pulled back laterally to give clearance for the chandelier in the limited space between the skin and the roof."

In addition, more than 20 smaller automated hatches were laser-cut in the screen—15 of them measuring 18" to cover the lenses of the Christie projectors and nine smaller 14" ones for the LN2 liquid nitrogen nozzles—the latter provided, along with all the special effects, by Backstage Technologies—which appear on cue to deliver dramatic bursts of breath from the mouth of the digitally animated dragon.

Each hatch is operated by pneumatic actuators, which pull the trap back and rotate it out of the way to allow nozzle access, and all of which must fit back into the screen as invisibly as the chandelier traps. All such sequences are precisely coordinated by Fisher's own Navigator automation system, with its SCU-1 show control unit. The latter provides the show control system for the entire *Dragon's Treasure* spectacular, coordinating all the action from the video, sound, lighting, and automation in a user-friendly format that enables the operators to interact fully with the show.

Fisher also provided the safety systems, including the emergency stops and anti-collision devices for the chandeliers, resulting in a fully self-sufficient system that can be handled confidently by a staff with little experience of this level of technology.

Dragon music

The musical score for *Dragon's Treasure* was composed and recorded as a huge production piece in keeping with the show's production values. It was recorded by the London Symphony Orchestra at Abbey Road Studios in London, with the orchestra arranged in the shape of the Bubble's ellipse to help replicate the way in which the sound system surrounds the audience in the venue. "The Bubble show was an interesting project," says sound systems project manager, Jason Pritchard. "We have done shows in the round before, but this one is different because the 'stage' surrounds the audience rather than the audience surrounding the stage."

"We split the string sections vertically, with the cellos closest to the audience, the violins just above their heads, and so on, to the top of the Bubble," continues sound programmer, Jason Rauhoff. "The result is a music experience unlike any I've ever heard."

The sound system is designed as a series of concentric rings of loudspeakers, beginning with a ring of 14 Meyer CQ-1s at the audience's eye level, then alternating between rings of single Meyer M'elodies and arrays of four M'elodies in turn as they range higher towards the apex of the domed screen. All of the units are mounted behind the screen and placed and focused to deliver the seamless soundscapes required to augment the projected and automated content. In addition, 14 Meyer 700-HP subs and 14 M2D-Subs are flown from the dome under the audience platform to provide tactile reinforcement of the visual image as well as sub bass sound.

The system is controlled by Meyer Sound's LCS series LX-300s, with WildTracks playback; it was installed by Kraftwerk. "The flexibility of configuration in the system allows us to have 48 channels of hard drive playback capability, as well as 24 physical inputs and 96 outputs," continues Pritchard. "Each speaker, or array of speakers, is individually connected to one of the outputs of the LCS system. LCS has the ability to route sound to any speaker individually and, through the use of SpaceMaps, dynamically move discrete sounds throughout the dome. This became of primary importance, as the sound of each dragon swimming or flying around the performance space can be treated as a distinct sound with a distinct path through the sound system. Those paths are matched to their visual position and automated to perform in sync with the video."

"We programmed each SpaceMap trajectory or movement to match the movement on screen precisely," adds Rauhoff. "This applied to music as well as the sound effects. For example, within the score there is a solo flute that portrays a little carp, which spends most of the film avoiding the dragons. I spent hours making his 'sound' travel with him around the bubble."

The complex video content dictated that the sound system be configured with 92 busses using 32 different SpaceMaps running 122 unique trajectories. Like every department connected with *Dragon's Treasure*, the experience is intense, with over 360 individual cues during the 10-minute show.

"The creative team has, in effect, succeeded in creating a new entertainment medium with this show," concludes Schwab. "The effects lend it theatricality beyond the capabilities of IMAX, a planetarium or a theme park and even beyond 3-D film. It is almost 4-D!"

"The scale of this show is so impressive," says Cecil D. Magpuri, president of Falcon's Treehouse and creative director for *Dragon's Treasure*. "The entire experience is so emotional and powerful; the only way to describe Dragon's Treasure would be 'epic'!"

Dragon's Treasure opened in October and will be followed by a permanent Franco Dragone water-themed show, designed specifically for the City of Dreams, which opens in its own purpose-built theatre within the complex later in 2010.

Some of the Bubble Theatre creative team.

Thomas Gellermann, project manager for Kraftwerk Living Technologies, and a representative from Christie Digital.

Glen Koch, special effects design and production for Back Stage Technologies, and Scott Miller, director of project management, Asia for Falcon's Treehouse.

Photo: Jason Goldenberg

Bottom photo courtesy of Falcon's Treehouse; Middle photo courtesy of Falcon's Treehouse