Lighting&Sound international
DIGITAL EDITION
July 2010
www.lsionline.co.uk

Cruise Special Focus

L&SI Digital looks at entertainment on the high seas . . .

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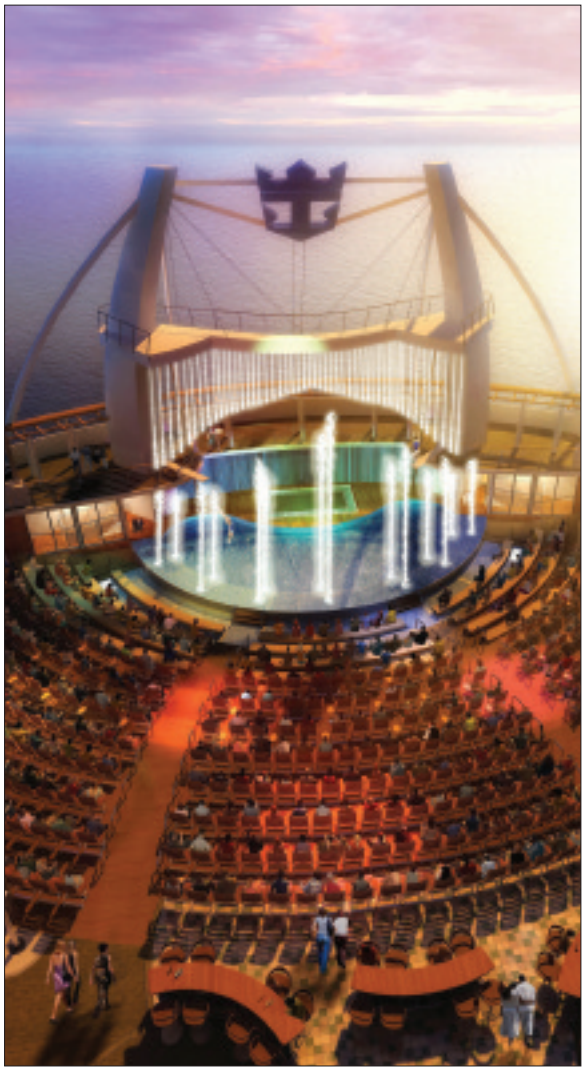
High Tide for Cruising

The cruise industry has seen phenomenal growth, and the future looks set for more. L&SI looks at just how all that investment stacks up . . .



The Oasis of the Seas' Aqua Theatre represents the new heights of shipboard entertainment technology.

The last time L&SI covered a cruise ship in-depth was in our July-August 2008 issue when we looked at Royal Caribbean International's *Independence of the Seas*. At that time she was - along with her sister-ships in Royal Caribbean's Freedom Class, *Freedom of the Seas* and *Liberty of the Seas* - the largest cruise ship in the world. Measuring 339m (1112ft) in length, and capable of carrying 4370 passengers served by 1360 crew, the ship now operates from Southampton, England.

But she's no longer the biggest, of course, as you'll see from our main feature. That title now belongs to *Oasis of the Seas*, the first vessel in Royal Caribbean's Oasis Class, soon to be joined by *Allure of the Seas*. Oasis measures 360m (1181ft) in length and is the first cruise ship able to accommodate over 6000 passengers (6296 to be exact), served by 2165 crew members. Each Oasis class ship costs $1.4bn to build.

For such an enormous investment to be justified, there clearly has to be a thriving cruise market and a conficence in future growth. Consider the following figures:

• The total world cruise and ferry market is estimated to be worth approximately $26.78 billion USD (£17.75 billion) in 2010 - a 7.4% increase over 2009. Europe's share of that market is estimated at £4.78 billion (27%) and North America's about 53%.

• Globally, the cruise ship market has seen an annual passenger growth rate of 8.2% since 1980. It is predicted that the world's cruise fleets will carry 18.4 million passengers worldwide during 2010, and the number will rise to 21.3 million for 2013 as more new vessels come online.

• Nearly 4.5 million Europeans booked cruises in 2008 - a 10.5% increase over 2007, and a 165% increase over 1998. The UK, Germany, Italy, Spain and France together accounted for 80% of these passengers, with most - nearly 1.5 million - coming from the UK.

• In Europe alone in 2008, the industry generated €32.2 billion of goods and services, employed more than 311,000 people and paid a staggering €757 million to Europe's travel agents. And if that isn't enough, there is predicted to be significant growth potential in the market for some time to come.

Clearly, the growth of the market has been extraordinary. The strategies behind this growth have included the introduction of shorter cruises, additional ports and destinations and of course the inclusion of new on-board entertainment activities to meet the demands of the customers. The arrival of "mega-ships" such as Oasis of the Seas is increasing both the profile and the capacity of the cruise market, while further lowering the per passenger cost with economies of scale.

Staying Afloat

Of course, like any other tourism sector, the cruise industry suffered from the effects of the recession, with 2009 witnessing a big drop in profitability as operators slashed prices to retain passenger

Contents:

A total of 13 new ships are due to be launched in 2010, with a total passenger capacity of 28,886. In 2011 and 2012, another 13 new cruise ships will come online:

2010 Launches

Cruise Line	Name	Capacity	Sails	Cost (USD)
AIDA Cruises	AIDAblu	2,174	January	$513m
Costa Cruises	Costa Deliziosa	2,260	January	$548m
MSC Cruises	MSC Magnifica	2,550	March	$548m
Celebrity Cruises	Celebrity Eclipse	2,850	April	$698m
P&O Cruises	Azura	3,076	April	$535m
NCL Norwegian	Epic	4,200	May	$1.2bn
Ponant Cruises	Le Boreal	264	May	$150m
Seabourn Cruise Line	Seabourn Sojourn	450	June	$250m
Pearl Seas Cruises	Pearl Mist	210	June	$64m
Holland America Line	Nieuw Amsterdam	2,100	July	$567m
RCI	Allure of the Seas	5,400	August	$1.4bn
Oceania Cruises	Marina	1,260	September	$530m
Cunard Line	Queen Elizabeth	2,092	October	$708m
TOTAL		**28,886**		**$7.7bn**

2011 Launches

Carnival Cruise Lines	Carnival Magic	3,652	Spring	$738m
Disney Cruise Line	Disney Dream	2,500	Spring	$899m
Costa Cruises	Costa Favolosa	3,012	Spring	$726m
AIDA Cruises	unnamed	2,174	April	$557m
Ponant Cruises	L'Austral	264	May	$150m
Seabourn Cruise Line	unnamed	450	Summer	$290m
MSC Cruises	MSC Meraviglia	2,550	June	$548m
Oceania Cruises	unnamed	1,260	July	$530m
Celebrity Cruises	unnamed	2,850	Autumn	$798m
TOTAL		**18,712**		**$5.2bn**

bookings. Rising fuel costs also had an impact and as a result, cruise operators put the squeeze on travel agencies, port and excursion agents to cut costs, while plans for new vessels were often put on hold.

However, there is a widely-held theory in the business that the cruise market holds its booking rates better than other areas of tourism because it offers such variety and value for money. Certainly there is evidence that bookings for the more glamorous end of the cruise market have bounced back very quickly, and even those operators who slashed prices the most are now feeling more positive about ordering new vessels.

Rising Expectations

As with every other statistic concerning cruise ships in the past decade, the scale, quality and ambition of on-board entertainments has increased steadily. With full-scale musical productions being established on Royal Caribbean's latest giants (Oasis of the Seas has *Hairspray*, while its forthcoming sister ship, Allure of the Seas, will feature a production of *Chicago*), entertainment afloat now offers more than many a land-bound theatre venue.

When Norwegian Cruise Lines (NCL) launches Epic this summer, it will feature the first Ice Bar at sea, and a theatre show by the Blue Man Group in the 685-seat Epic Theatre. On the same ship a dinner show called 'Cirque Dreams and Dinner' in a 265-seat theatre-in-the-round, will combine music and acrobatics, while elsewhere there will be a 280-seat comedy club, a 200-seat jazz club and a 13,000sq.ft Las Vegas-style casino.

Aside from the major showpieces of the larger cruise ships, there are a wealth of additional bars, nightclubs (for adults or children), retail, dining and other environments on board ships and ferries of all sizes which require sound, lighting and audio-visual equipment of various kinds. All of this provides an attractive market for manufacturers of equipment with the right credentials and for installers with the specialist knowledge required in these environments.

Cruise Providers:

A.C. Special Projects Ltd
High Wycombe, UK
> **www.acspecialprojects.com**

Acoustic Dimensions
Coventry, UK
> **www.acousticdimensions.com**

AJS Theatre Lighting & Stage Supply
Hampshire, UK
> **www.ajs.co.uk**

COMS UK
Kent, UK
> **www.coms.uk.com**

FUNA GmbH - Nachrichtentechnik
Emden, Germany
> **www.funa.de**

HMS Group
Nantes, France
> **www.hmsgroup.com**

HSL Group
Blackburn, UK
> **www.hslgroup.com**

Innovation Productions
Huddersfield, UK
> **www.innovation-productions.com**

Jaffeholden HQ
Norwalk, USA
> **www.jaffeholden.com**

J R Clancy Inc
Syracuse, USA
> **www.jrclancy.com**

Marquee Installations
Surrey, UK
> **www.marqueeinstallations.co.uk**

MAVCO
Worcestershire, UK
> **www.mavco.com**

Nautilus Entertainment Design
San Diego, USA
> **www.n-e-d.com**

Project International
Essex, UK
> **www.projectinternational.co.uk**

Sound Advice PA Installations
Hampshire, UK
> **www.soundadvice.co.uk**

Stage Technologies Limited
London, UK
> **www.stagetech.com**

TED AV
Luton, UK
> **www.teduk.com**

Van Berge Henegouwen
Roelofarendsveen, The Netherlands
> **www.bergehenegouwen.com**

Ship-Shape Installations

L&SI technical editor James Eade offers an introduction to electro-technical installations aboard ships . . .

From top:

Allure of the Seas, sister ship to Oasis of the Seas, during fit-out.

The Oasis of the Seas main theatre, two months from completion.

Oasis of the Seas' Studio B, two months from completion.

Photos: © Royal Caribbean International.

If you are involved with installations of entertainment technology or related equipment on dry land then you will no doubt be familiar with the guidance, standards and legislation that affect the way the installation is designed and installed. While they can be somewhat burdensome at times they are there for three simple reasons: to ensure that the system will work effectively, will not give anyone an electric shock and will not start a fire - three undeniably valuable objectives.

Ships, however, are a different beast entirely. The installation methods differ, the electrical supplies differ and the safety requirements and operating environments are both more demanding than their shore-based equivalents. As such, installing lighting, sound or video systems in boats does require some experience of those environments as well as knowledge of the different safety regulations.

Today's vessels have an increasingly extensive use of computer hardware and software control and monitoring systems as well as more sophisticated passenger/crew safety equipment which has enhanced the need for electromagnetic compatibility considerations as well as a more widespread use of fire retardant/resistant, low smoke, non-corrosive, halogen-free materials. Ship propulsion systems are also making a return to electrically based plant and as the electrical power requirements of modern ships continue to increase, so too is there a trend to higher operating voltages for general power, propulsion and machinery auxiliary supplies.

Environmental Considerations

The two prime environmental elements to factor in to ship board installations are the weather and vibration. The weather is pretty much self-explanatory - for equipment installed outside, driving rain, salty sea spray and extremes of temperature are a given factor, so equipment has to be specially protected or designed with that in mind. Indoors, most of the above do not apply, except that salty moisture-laden sea air is still prevalent, so things can rust pretty quickly.

Anyone who has been aboard a ferry or other large vessel will be well aware of the levels of vibration that continuously permeate the whole structure. This has ramifications for cable and equipment installation as well as the more mundane hanging of light fixtures; cables must be of a robust enough type and flexible (i.e. stranded, not single copper conductors) and must be protected from the effects of vibration, particularly where crossing through bulkheads or other penetrations. This is often achieved by running the cables through conduit or by using edge protection (such as grommet strip): if not, you can be assured that something will chafe through the cable eventually.

Equipment too must be fixed in a reliable manner and items such as dimmers, lighting bars, loudspeakers or equipment racks should be secured to a bulkhead bracket using bolts with shake-proof

washers, locking nuts or threadlock adhesives. Perhaps the biggest problem is hanging lights and speakers from the ceiling as they will wobble considerably when at sea; trying to dampen the oscillations can be a challenging task.

There is no easy fix for this and it is best to design out the problem from the beginning by ensuring that the lighting design is not so critical that movement of a light fixture will upset the look too dramatically and to keep mountings as rigid as possible. Dropping hanging points on long lengths of studding through a ceiling void, for example, is guaranteed to give rise to a wobbling problem and if the load is heavy, such as a speaker or big moving light, then the metal studding may work-harden through continued flexing and eventually shear.

Equal consideration should also be given to scenery and other large heavy objects such as floor-mounted loudspeaker stacks: in rough weather the pitch and yaw of the vessel can be tremendous and items with a moderately high centre of gravity are very much at risk of toppling over. Safety bonds for hanging fixtures are to be recommended: while technically not necessary if the fixture is permanently mounted, the level of movement and vibration puts them at risk and as such a safety should be installed to a point other than the main hanging bracket if possible.

Electrical

Aside from selecting and erecting the correct cables, power supplies and configurations differ, so care has to be taken when connecting lighting and similar power circuits. The four-wire (three-phase and neutral) system as found in the UK land-based installations is rarely, if ever, encountered. The reason for this is that ashore neutrals are connected to ground to enhance protection against electric shock and fire, which in turn allows circuit protective devices to operate effectively. On a ship, however, electrical equipment is often regarded as 'essential' - navigational equipment and the ship's steering gear are two examples of equipment that you would not want to be isolated from the supply by the operation of protective devices!

By using an isolated neutral (i.e. one not connected to the ship's hull) a short to the hull will not cause high currents to flow and thus protective devices to operate, so essential services can be maintained.
As a result, the ship-board supply is usually a Delta wired three-phase configuration and there is theoretically no shock risk; a person touching the hull and a live wire won't get a shock as there is no earth return path.
There is, however, enough capacitive leakage to ensure that isn't normally true in practice and this leakage can also give rise to unexpected results when using sensitive digital multimeters. However, supplies for 'public' use - and that includes entertainment lighting systems - are usually fed through transformers, again with a delta wired secondary, but with one leg connected to ground and supplies derived across each winding as usual. As such, an earth return path exists which enables protective devices to operate for the protection of electric shock, although care should be taken when selecting devices as earth fault loop impedances may vary between phases.

Standards & Legislation

The following is a guide to the relevant standards and legislation that affect the installation of electrotechnical services aboard larger vessels - pleasure craft or mobile/fixed off-shore units have differing sets of regulations accordingly. Pretty much everything is covered in the IEC 60092 series of standards which is referenced in the International Maritime Organisation (IMO) - Safety of Life at Sea Convention (SOLAS). SOLAS is applicable to all commercial seagoing ships of 500 gross tonnes and above, whereas for commercial ships below this level the mandatory requirements for electrical installations are usually set by the National Flag State Authority where the ship is registered.

Many such Authorities worldwide rely on the IEC 60092 standards in preference to developing their own, and the UK has its own enhancement in the form of BS 8450, which is designed to cover areas that IEC 60092 "lacks entirely" or "does not cover adequately" according to the foreword.
A selection of relevant sections of the IEC 60092 suite are listed in the table and Batt Cables (www.batt.co.uk) has an excellent technical section which lists all the relevant cable types for marine use. For working on ships in dock, the HSE has useful guidance in the form of a free publication HSE 730/11: Temporary electrical installations in ship building and ship repairing.

Training

The British Marine Electronics Association (BMEA) has a range of courses for electronics installers, technicians and marine electricians. While obviously geared towards marine electronics (such as safety systems and communications) these both give valuable insights into the nature of electrotechnology on board vessels and are also recognised qualifications within the marine industry. More information can be found via **www.bmea.org**

The Maritime and Coastguard Agency also has a useful section on legislation and guidance at **www.mcga.gov.uk**

British Standards

BS 8450:2006: Code of practice for installation of electrical and electronic equipment in ships.

BS IEC 60533:1999: Electrical and electronic installations in ships. Electromagnetic compatibility.

BS IEC 60092-301:1980: Electrical installation in ships - Equipment. Generators and motors.

BS IEC 60092-303:1980: Electrical installation in ships - Equipment. Transformers for power and lighting.

BS IEC 60092-304:1980: Electrical installation in ships - Equipment. Semiconductor convertors.

BS IEC 60092-101:1994: Electrical installation in ships - Definitions and general requirements.

BS IEC 60092-201:1994: Electrical installation in ships - System design. General.

BS IEC 60092-202:1994: Electrical installation in ships - System design. Protection.

BS IEC 60092-302:1997: Electrical installation in ships - Low-voltage switchgear and controlgear assemblies.

BS IEC 60092-401:1980: Electrical installation in ships - Installation and test of completed installation.

BS IEC 60092-306:2009: Electrical installations in ships - Equipment. Luminaires and lighting accessories.

BS IEC 61363-1:1998: Electrical installations of ships and mobile and fixed offshore units - Procedures for calculating short-circuit currents in three-phase AC.

Oasis of the Seas

Royal Caribbean International's latest and greatest class of ship, the Oasis of the Seas, is simply the largest passenger ship ever built. The ship, built at STX in Turku, Finland, is more than a floating city on the sea; it's also filled with the latest and greatest in entertainment technology, provided by the leading manufacturers in the industry. A cadre of firms were involved, including system integration from FUNA, TV Tools and Lightinen, just to name a few. "It's the closest to a Las Vegas resort that I have seen," remarks FUNA senior vice-president Marc Goossens.

The man behind the technology is Christopher Vlassopulos, head of Entertainment Technology & Technical Design for RCI in new building. "We've relied heavily on our knowledge and experience from previous ships," explains Vlassopulos.

RCI has a sizable fleet of ships of various classes, all of which are based essentially upon the same design. "They follow the same form, so it's not so radical going from one ship to the next," notes Vlassopulos. Consequently, certain areas on Oasis are indeed similar to ships commissioned in the past, and much of the equipment is the same from venue to venue, ship to ship. Vlassopulos explains, "Our ships are operated and maintained by our folks, who work on a six-month contract, so we try to make each ship similar to the others, and try to keep the gear consistent."

Royal Promenade

The first area that guests experience on Oasis of the Seas is the Royal Promenade, a multi-use space that functions as a meeting hall, a retail/dining space and an entertainment space. Above this massive 18m (60ft) wide by over 122m (400ft) long space is an illuminated, colour-changing ceiling. "In the past, on the Voyager, we've used neon, which is great and it does what it does," Vlassopulos says philosophically.

However, since the creation of the Voyager class of ships, technology has indeed changed, and Philips Linear LED power-core QLX modules have replaced the neon. During the morning the ceiling typically is treated as an architectural element, with a light blue ceiling. As the day progresses, it changes colour gradually. "During the evening, we introduce movement in the ceiling - from port and starboard side to the center spine we actually have a very slow colour change, it's basically reversing in

The statistics alone boggle the mind: an ocean liner that is 360 meters (1,187 feet) long, 65 meters (213 feet) high, weighs 225,282 Gross Register Tons, can accommodate 8461 individuals (passengers and crew) and cost a staggering US$1.4 billion. It is longer than four football fields, can fit more people than the Royal Albert Hall or the Radio City Music Hall and features a 1350-seat theatre, a fully functional broadcast quality television studio that can also be transformed into an ice rink, an immense promenade/mall, and an outdoor amphitheater that is the home to the first ever theatrical water show on the sea . . .

by Sharon Stancavage

and out very slowly," explains Oasis of the Seas project director Richard Dixon of UK-based Project International Ltd, the lighting design consultants for the entire ship.

The most dramatic changes to the ceiling happen when it's in entertainment mode, which can be viewed by 3,000 guests nightly. Dixon says: "All the different scene effects that have been preprogrammed are selected through the Hog III or the e:cue, depending on whether it's the parade or the seventies night, or whatever they are doing - that way they can bring the ceiling to its full effect."

Programming of the LED ceiling took two weeks, and was accomplished on an e:cue system by Broadway veteran Aaron Sporer. "There's some 3,000 LED RGB modules in the ceiling, and they are all addressed individually," comments Dixon. Originally, there were 16 universes; through programming in blocks of nodes, it brought the total down to 11, with 56 show scenes in all. "Within the context of the entertainment programming, it is really running a low level or a low-res video colour shift - it is sort of a large pixellate, and then it goes much more dynamic for any fast show - because it's such a vast space, you don't see it as you would a vertical screen," remarks Dixon.

Working in tandem with the illuminated ceiling (which also features a laminar stream fountain with an impressive colour changing LED arm) is the entertainment lighting package. Vlassopulos says, "Along the entire length of the Royal Promenade we have 28 Elation Impressions (these manufactured by GLP in Germany) which are the LED wash lights, and we have 22 Martin MAC 250s." During special events, there's also a Martin Jem Hazer on hand.

LEDs are an integral part of the Royal Promenade, as well as the rest of the ship. "For us, we use LEDs wherever we can, it's just a huge advantage for us," remarks Vlassopulos. The LEDs are advantageous not only for their lower energy usage, but also for their long life. "From an operational point of view, the advent of LEDs takes away half our repair and maintenance problems with fewer lamps to change, and makes it much more manageable, since all lamp replacements have to be done in the middle of the night."

The ceiling isn't the only area in the Royal Promenade that pushes the state of the art. "In the Royal Promenade, in terms of sound, it's a rather large, rather difficult space- it has lots of hard surfaces, a hard floor, and no central place for audio," says Vlassopulos.

Top left: The Rising Tide Bar on the Royal Promenade.

Top right: The ice show in Studio B (top) and the unique Aqua Theatre (bottom and facing page).

Above: Central Park.

To create the best sound possible ("Tell me when you've been to a shopping mall that has good quality audio?" Vlassopulos asks) they turned to long-time audio partner Meyer Sound of Berkeley, California. "The Royal Promenade needed low frequency support to make it a true entertainment space as it was designed. Due to architectural limitations we had to come up with a subwoofer that fit inside the base of a streetlight," says Goossens.

Meyer R&D went to work and designed the MM-10. "They're the worlds smallest subwoofer, which we were able to get into the bases of the street lamps - it's twice the size of a PC sound system, it's about 20 inches high and 11 inches wide," notes Vlassopulos.

There are several varieties of the MM-10, each with different connections and installation options; the MM-10aC is the model that's installed on the Oasis. The frequency response of the MM-10 subwoofer is 33Hz to 228Hz; it has a 10" driver, a single-channel power amp and onboard processing. "The subwoofers worked out beautifully and are the perfect match for that space," says Goossens.

The main system in the Royal Promenade also includes 42 Meyer UPA 1Ps; the supplemental system comprises 28 Atlas FAP42TC speakers and six Atlas FAPSUB subs. "We supplemented the main system with the Atlas ceiling-mounted speakers to fill in these hard-to-reach areas and time-aligned them to the main system," reports Goossens. The space is also home to a variety of gear from Aviom, a wireless intercom system from HME, a standard intercom from Clear-Com, microphones from Shure, a Meyer Matrix3 including Wild Tracks hard disk playback and CueMixer control surface (which also can be found in all of the other large entertainment venues in the ship) and a Yamaha DM 2000 with a bridge and side panels.

Creating the Royal Promenade was, in the end, a group undertaking. "There was a number of people involved with physically putting this together, from FUNA, and from the entertainment industry, which is typical of Royal Caribbean," Dixon notes.

Opal Theatre

The Opal Theatre, which is host to *Hairspray*, and well as other productions, is indeed reminiscent of earlier vessels. "From a technology standpoint, the theatre is by and large a bare performance space, albeit we have a much bigger thrust on the stage into the house, but it's not wildly different from the 'Freedom' or the 'Voyager' series of ships," says Vlassopulos. While the basic layout of the theatre is the same, the technology used in it is not. "Technology has let us do a lot more than we could ever have done in 1999," states Vlassopulos. The technology in the theatre includes the standard theatrical gear from City Theatrical (top hats, donuts, barn doors), ETC (225 Sour Four luminaires of various degrees), cabling from TMB and dimmers from ETC, all of which are controlled by a Wholehog III console. There are also automated fixtures from Martin Professional, Wybron RDM-enabled ColorRam scrollers and two High End Axon media servers.

On the video side of the theatrical equation, Vlassopulos says: "We have two 103" Panasonic plasma TVs for IMAG on either side of the proscenium; there's also a Christie 16k front-centre projector and a Christie 16k rear projector on this particular ship."

The Opal Theatre's audio booth is also home to a Meyer Matrix3 Audio Control System that includes Wild Tracks playback. "The flexibility and endless potential of the Matrix3 created a new dimension for the shows. This, along with the Meyer sound system raised the bar for the cruise ship theatre and its potential to handle any type of entertainment," explains senior project manager Derek Warner from FUNA. The audio component also includes QSC amplifiers, Clear-Com and HME intercoms, and cabling from Whirlwind.

Studio B

Studio B, a venue that can also be found on other Royal Caribbean ships, functions as an in-house television studio, a general multi-use entertainment space and theatre with a retractable floor for an ice show. "The retractable floor allows us to cover the ice; we have disco parties in there, game shows - all sorts of different events," explains Vlassopulos.

On Oasis, however, there have been some modifications made to the floor. If the ice cover doesn't reach the correct temperature in the correct amount of time, "It freezes to the floor if you're not careful," Vlassopulos comments. To fix the situation, Vlassopulos and his team turned to STX. Vlassopulos says: "The ice floor was engineered by the yard, but this time we made sure underneath it has UHMVW, the nylon strips - there's no aluminum touching the ice itself."

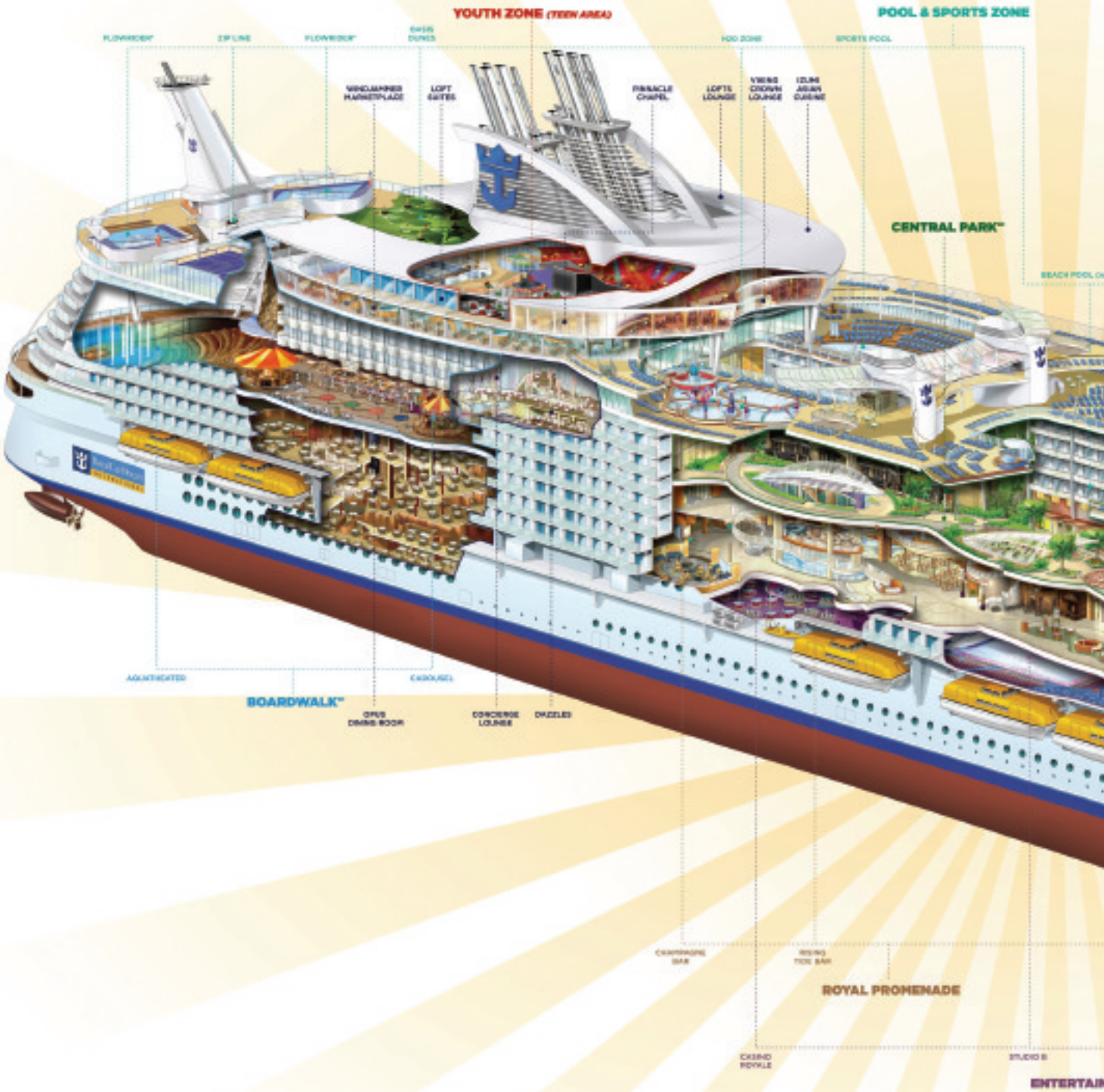
The lighting in Studio B includes 24 Martin MAC 700 washes, 14 Martin MAC 575 Krypton XTs, 14 Martin MAC 250 washes, 50 Acclaim X Bar HIPs which line the edge of the ice, and a wide variety of ellipsoidal fixtures from ETC. The majority of the cabling is provided by TMB; the gear also includes 40 Pathway 6202 Pathport C-Series with 2 DMX outputs.

As one would imagine, there is a multitude of audio in Studio B, and Meyer speakers feature again, including M1Ds, together with UPA-1P and UPJ-1P boxes, plus M1D and 600-HP subs, all of which are self-powered. There's outboard gear from Lexicon and TC Electronics, QSC amplification for the stage monitoring system, and a Yamaha DM 2000 digital console with a meter bridge and side panels. The microphone complement includes models from Shure, Neumann, Sennheiser, EV and AKG.

The broadcast component of the room is impressive. "We have four Sony BRC 300 robotic cameras, we have four connection points for handheld cameras, we have an extensive Clear-Com communications system, as well as fouir Lycian 1.2k spotlights," Vlassopulos says.

Aqua Theater

Oasis of the Seas is home to the world's first Aqua Theatre, a 600-seat amphitheater that features a 6.6m (22ft) wide, 15.7m (52ft) long, 5.4m (18ft) deep kidney-shaped pool that also includes a laminar stream fountain. "We definitely are not shy of trying something completely different, that's what happened with the ice rink,' explains Vlassopulos. The Aqua Theatre is substantial; it takes


YOUTH ZONE (TEEN AREA)
POOL & SPORTS ZONE
CENTRAL PARK℠
BOARDWALK℠
ROYAL PROMENADE


MAIN POOL
SOLARIUM
YOUTH ZONE (ADVENTURE OCEAN®)
VOYAGERS
EXPLORERS
AQUANAUTS
ON AIR CLUB
CONFERENCE CENTER
COMEDY LIVE
JAZZ ON 4
BLAZE
OPAL THEATER
VITALITY AT SEA FITNESS CENTER
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VITALITY AT SEA SPA & FITNESS

up a full 1/8th of the ship. Or, in Vlassopulos' words, "One complete fire zone." There are two shows in the venue: *Oasis of Dreams*, an evening production that's more theatrically oriented, and *Splish Splash*, a daytime dive show.

The production team at Royal Caribbean is eminently qualified to put on standard theatrical performances, including ice shows. However, a water show was indeed a new type of performance for them. "We know how to run a theatre, but it's a completely different story when it's underwater," confides Vlassopulos.

To fill in the missing pieces, Steven Michelman, a technical consultant through Fisher Technical Services Inc of Las Vegas, who has worked on numerous water shows, was brought into the fray. "There are safety concerns - you have a ship that is moving while you have performers that have no communication devices on them at all, and they're up on a high platform diving into a pool that is not very big compared to the height you are at," Michelman notes.

To assist the performers, there are four stagehands underwater - the two who do cues are on an underwater intercom system from Ocean Technology Systems of Santa Ana, California. The other two stagehands are Master SCUBA Divers who catch the divers, give them oxygen if needed and escort them off stage. The intercom system both above and under water includes equipment from Clear-Com, HME and FUNA.

The dives themselves can indeed be dangerous. "When the ship is stable, the divers' jobs are hard enough. But when it's rough and they bounce on the 3M-spring board, if the ship moves, the board moves, and they can miss the board on the way back down again. The performers have to be hyper-aware of the ship's movement at all times," says Michelman. This is actually less of an issue for them to dive from the 10m fixed platform. "They only need the platform to support them before they take off. They don't need it to be in the same position after they jump. Believe it or not, the divers that do both the 3m and 10m dives feel more comfortable on the 10m," Michelman explains. As for the divers themselves, RCCL, with the help of Michelman, developed a triple redundancy system that is used before each and every dive to make sure it is indeed safe to enter the water.

Inside the pool are two caves, upstage right and left. These areas are used for underwater prop storage, and although there is an exit via a ladder, Michelman recommended that the area be off limits to performers. Michelman explains: "Even though we have additional SCUBA regulators in place just in case a performer ends up in these areas, there are certain criteria that need to be met before the underwater stage staff enters those caves."

The *Oasis of Dreams* show also uses several props, most of which were fabricated by River City Scenic of Cincinnati, including a curtain on the lifts at the beginning of the show, a piece of driftwood, and large lily pads at the end. "The underwater stage staff work very hard. They go from pulling the curtain, at the opening, to helping a performer make an underwater entrance, to moving and presetting heavy, large props," explains Michelman. Soft goods for the production were sourced from the Rose Brand range.

The Aqua Theatre's kidney-shaped pool is home to three underwater lifts, provided by Handling Specialties of Grimsby, Ontario, Canada, the firm that also created the lifts for O and Le Reve in Las Vegas. "We've never done anything like that, we've never had such a large pool with three lifts inside it," Vlassopulos remarks. The space also makes use of seven Sony BRC 300 cameras, a Medialon show controller and two High End Axon media servers.

On either side of the pool are two 7m (23ft) wide Barco O-Lite 612 walls, used for both content and IMAG. "When we designed them,

Allure of the Seas

In December 2010, Royal Caribbean International (RCI) will debut the world's next largest and most innovative cruise ship, Allure of the Seas. Sister-ship to Oasis of the Seas, the Allure will raise the bar once again in terms of onboard amenities, including one of Broadway's longest-running productions, *Chicago: The Musical*, which will headline in the ship's 1,380-seat Amber Theatre. Following the at-sea debut of *Hairspray* on board Oasis of the Seas, this will be the second Tony Award-winning musical production staged at sea by Royal Caribbean Productions team.

The Allure of the Seas will also include a variety of other venues including a spectacle of music, dance and aerial acrobatics called *Blue Planet* that also will run in the Amber Theater; OceanAria, an aquatic production in the ship's open-air AquaTheater, an ice show extravaganza on the ship's ice rink, and spectacular parades in the Royal Promenade - plus everything else in between, from jazz to comedy.

Barco provided a 3m wide section of it, we hired a crane that held it in position and saw what it would look like when it was installed on the ship. Basically, we were able to see the performance of the thing outside before we even got them," Vlassopulos reveals.

The lighting, which is used predominately during the evening performance of *Oasis of Dreams* is awash (pardon the pun) in LEDs: specifically 14 Color Kinetic ColorReach with 8° lenses, 11 ColorReaches with 63° lenses, and 4 ColorReaches with 13° lenses. "We ended up changing the original spec for the LED fixtures to the Color Kinetics Color Reach. It is a very powerful fixture and designed for outdoor use. We had them custom painted to match the ship's hull color," comments Warner. The rest of the lighting package, all of which was installed by FUNA, includes two Martin MAC IIIs, two Martin MAC 700 Profiles, two HES DL3s, eight Elation DLED 108IP fixtures and two Lycian 2.5k followspots.

In regards to the audio in the Aqua Theatre, Goossens explains: "We were limited by the architecture for suitable locations for the line array speakers. The location and angle were far from optimal as they were designed by the architects and consultants."

The solution was a combination of speakers from Community and EV. The audio system also relies heavily on the Meyer Matrix 3 Audio Control System with Wild Tracks playback. "Wild Tracks is basically a server that allows us to program from various different points and it's all manipulated digitally," Vlassopulos explains. Wild Tracks is also the source for time code that is also synchronized with the ship's clock, and is used to control the audio for the fountain shows throughout the show.

The Oasis of the Seas is currently docked in Ft. Lauderdale, Florida, where it sails regularly to a variety of ports in the Caribbean, as well as Mexico. It will remain the world's largest passenger ship until the unveiling of Allure of the Seas in December of this year.

The Experts

L&SI Digital speaks to some of the leading players from the world of cruise ship entertainment technology . . .

The Client

Preston Bircher
Carnival Cruise Lines

Having started his career as an on-board technician, Preston Bircher is now Entertainment Projects & Technical Manager for Carnival Cruise Lines.

Can you briefly outline your responsibilities at Carnival?
I am currently technical director of Carnival productions, lighting designer for all 23 Carnival FunShip Production Shows (54 shows running concurrently), project manager for local entertainment systems and entertainment venues for all ships under design, construction, commission and delivery, and lastly, I'm on the team that writes the production shows.

Carnival Magic is due to complete next spring: how is that project progressing?
It's progressing nicely. Carnival Dream was the prototype based on the Carnival Destiny platform, that has been changed and updated to create the Conquest-Class, then updated again to create the Splendor-Class (a one-of-a-kind).

How does the process of equipping the entertainment facilities on a new ship begin?
Firstly there is a base specification - the specification that we are currently working with has a long history of adaptations. A ship concept and design has to have a signed contract before the operating company has a chance to create a full specification. Once that contract is signed, the ship builder sets aside a financial footprint for all the local entertainment systems that we then have to manipulate and convert into a usable specification for the equipment.

Nautilus Entertainment Design (NED) is the consultant and middle-man between Carnival Corporation and the respective shipyard. All communication is handled through NED so that there is one voice and one position for the Yard to work with.

NED and I work with the previous ship's 'as-built' specification and then update with new equipment as technology changes so rapidly. However, as each change occurs, the Yard will charge us for making the change - unless the older equipment is no longer manufactured. As technology moves forward, this task is more and more daunting. The replacement gear has a higher MSRP (Manufacturer's suggested retail price); regardless of the price we actually pay, we have to work with MSRP and then the Yard has a multiplication factor for changes to drawings and also for calculating heat-dissipation, weight and mark-up. We have a "zero-balance" that we work towards, but achieving this is difficult and NED has to recalculate once the Yard responds to our request. It's a tedious procedure, but we have to to create systems and venues that have to operate for at least 20 years with minimal maintenance and shoreside intervention. A difficult task at best!

> "...we have to to create systems and venues that have to operate for at least 20 years with minimal maintenance and shoreside intervention."

Nautilus keeps a running "Ship of the Future" specification that is based on the changing needs and incorporates a sensible "wish list" for when a contract might be signed and the CEO asks for one within a 24-hour period (yes, this happens). This is usually based on the USD vs EUR and other economic factors of that particular day or week. When is it a good day to sign an $800m contract?

What are your priorities when planning for a new vessel?
New vessels start with the Main Theatre, then onto the Cabaret Theatre, followed by the Lido deck's Seaside Theatre and other secondary venues - Jazz/Karaoke, Ocean Plaza, Dance Club, Piano Bar, Atrium, meeting rooms etc. There are also ancillary spaces, venues and crew-only spaces, as well as other public areas that are designed to have a Crew party space outdoors that usually isn't utilised for the guests on a daily basis. Carnival has monthly and bi-weekly special events for the officers, staff and crew of the ship to keep them all happy and having a fun time whilst working (how many land-theatres have their cast and crew living backstage?).

For a new build, once the space is defined for each venue we can start working with the interior architect as to how the space will function. The Main Theatre, for example, works in many directions simultaneously. The theatre shape is dictated by the nautical architect and engineering dept - for reasons such as the ship has to actually balance in the water; the consideration of life boat locations (usually embedded into the under-side of the balcony raked seating); abandon ship traffic patterns (the Main Theatre is a gathering place or muster/assembly station, for most of the ships), and other devices such as 'crash bulkheads' and other structural steel devices that keep the ship from cracking open like an egg in rough seas.

The theatre is a giant hollow cavity that has most of the interior support pillars removed for line-of-sight improvements. Thus, extra steel webbing must be inserted within the bulkheads and structural ducts - where they utilise steel air conditioning ducts that are placed to create a stability replacement for the missing supports around the giant five-deck theatre.

The audio and lighting work with the ceiling design which also must contain much steel and lateral structural ducts - creating many obstacles for gear placement!

The backstage is dictated by where the cabin accommodations are in the decks above the theatre as only a few cabins are "missing" so that the fly tower can squeeze in between them. Also, only so many square metres can exist within a Fire Zone and the vertical stair

The Palladium Theatre, aboard P&O Cruises' *Arcadia*.

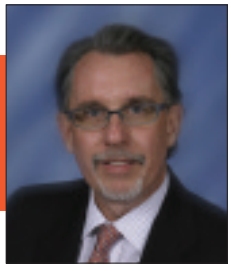
towers that allow the guests to escape up and down and disperse properly to each of the lifeboat/liferaft embarkation stations.

How closely are you involved with equipment specification?
NED and I work very closely together when assembling the specifications. As noted above, we keep a running tally for a new ship spec at all times. I also work with the operating technical division of the entertainment department to make sure that all needs are met, within financial reason.

What are the greatest challenges for a shipboard entertainment venue?
Costs; Dealing with the power issues onboard; Limitations of where support steel ends up, thus blocking and destroying perfect locations for equipment; Writing a specification years before a ship is built - then dealing with that specification for all sister ships for up to 15 years later.

The Consultant

Jim Tetlow,
Nautilus Entertainment Design



Jim Tetlow has worked as a lighting designer and consultant for television, theatre and architecture since 1975. His lighting awards include an Emmy Award in 1990 for Sesame Street. Tetlow has consulted on the theatres, lounges, and dance clubs for over 29 of the Carnival Cruise Lines ships. His responsibilities include the designs for all audio and communications systems, show lighting systems, automated rigging and mechanical equipment including full-height fly lofts and integrated control systems in each ship's showroom.

What services does Nautilus offer?
Nautilus works directly for the Owner, which in this case is Carnival Corporate Shipbuilding, which oversees the construction of all new ships for the various brands owned by Carnival, including Carnival, Holland America, Costa, Cunard, Princess, and Seabourn. During the design phase, we function as the theatre consultants, AV system designers, and broadcast system designers. On some ships we also become involved in special projects such as a 4D theatre, interactive photo gallery, or large exterior LED video displays. On other ships we are also involved in coordinating the architectural lighting to ensure that the architect's vision is correctly executed or developing some architectural lighting features such as RGB LED lighting effects. As the project progresses, we track the project to ensure that there are no additional costs and review the contractor drawings for compliance with the original design and to make sure that the entertainment equipment is being integrated into the decor. During the construction phase, we perform periodic inspections and then as the delivery date nears, we have a commissioning team onsite to test and verify that all of the systems are operating as designed and meet the Owner's needs.

> "...On a typical ship we will design the entertainmentsystems in approximately 24 different venues including some crew areas, although for the Queen Mary 2, there were over 40 venues."

What is the your latest cruise ship project?
This year we have five different ships being delivered. Already, we have completed the P&O Azura, Costa Deliziosa and Seabourn Sojourn. The Holland America Nieuw Amsterdam will be delivered at the end of June and then at the end of September, Cunard Queen Elizabeth. We are also beginning the designs for a new class of ships for Princess and continuing development of two ships for Carnival. Currently, all of these projects are being built in different shipyards in Italy, by both Fincantieri and Marriotti, but we have previously worked on ships built in Helsinki and France.

How long do projects typically take from start to finish?
For a prototype, our participation can take 21/2 to 3 years to develop, while a subsequent ship of the same class is more typically 18 months.

What are your key priorities in approaching a shipboard entertainment project?
First of all, we start with an analysis of the operational needs of the Owner. This ranges from the theatrical show requirements in the theatres to how the bars, restaurants, and dance clubs will operate, and the AV requirements in specialty areas such as the Health Club/Spa or photo gallery. On a typical ship we will design the entertainment systems in approximately 24 different venues including some crew areas, although for the Queen Mary 2, there were over 40 venues. Our next step is to work with the architects on integrating the hardware into the decor. There is a lot of focus on developing elegant interiors on ships and we try to obscure as much of the technology as possible. On a parallel path, we need to make sure that we are still within the equipment budget and that we have not incurred any additional costs from the shipyard.

> "... any increased efficiencies result in lower fuel consumption... The real priority is finding a replacement for the 50W MR16 lamp, of which there are literally thousands installed on each ship."

In which ways do shipboard projects differ from their land-based equivalents?
Two major differences come to mind. First of all, there is very little space onboard a ship in which to install the hardware, and even less storage area for spare and loose equipment. Over time, we have learned how to shoehorn in lots of technology into small spaces.

For a project about 10 years ago, after we presented the shipyard with the entertainment specification, we were told that they would only be able to fit a small amount of the equipment into the ship, and the rest would have to be towed behind in a barge! However, by the end of the design phase, we had managed to fit it all in with the help of the architects and the shipyard technical design departments. One example is in the theatres, where we typically will combine the FOH audio and lighting coves, which obscures the lighting gear and loudspeakers in a minimal amount of space.

The other difference from land-based projects is that the ships are in constant motion, with high vibration and frequent negative G-forces. What this means is that every piece of equipment must be secured tightly with vibration resistant fasteners. For the rigging systems, which are quite extensive in most of the theatres, all of the flying scenery needs to be guided in tracks along the offstage edges of the fly tower. Because the ship is a continuous steel structure, sound and vibrations are easily transmitted from deck to deck. Loudspeakers require vibration dampening mounts to minimise the transfer of vibration to adjacent areas.

How have shipboard entertainment venues changed over time?
When I first started working on cruise ships, lighting shows for Carnival in the early 1990s, the systems were quite simplistic and we were using some first generation automated scanners, such as Intellabeams. The theatres were two decks high with a minimum of rigging and no fly tower.

The first project I consulted on was Carnival Destiny which was delivered in 1996 and was a major step forward for entertainment venues. The 1000-seat theatre had an auditorium spanning three decks and a full-height, four-deck high fly tower with 31 automated line sets. There was a large turntable built into the stage and an orchestra pit that could descend from the stage level to the deck below. The special effects included ground fog, an LN2 fog curtain and a large water-cooled laser system. The disco was two decks high and contained over 500 video displays.

Since then, the venues have only become larger and more complex, with the current trend being the development of exterior venues on the upper open decks that include large-format LED video displays, commensurately large audio systems, and automated lighting to support live bands and large deck parties.

Which technical developments in recent years have led to significant improvements for shipboard entertainment systems?
Without a doubt, the increased use of IP network technology has changed the way systems work. I think it probably started with the lighting data being transported over ethernet, but now we are frequently distributing audio over IP, integrated control over IP and most recently digital video is being distributed shipwide. This has led to the development of both local area and shipwide entertainment networks.

Certainly this is still a rapidly evolving area, but we certainly see it as the future for distribution and control of nearly all the entertainment systems. Otherwise, we are finally seeing some good, practical LED lighting fixtures that can be used in the larger venues. We have been using small LED fixtures for lighting bands in small lounges for several years, but now there are many more good options available. LED video displays are improving in quality and resolution and at the same time the cost is dropping, making them attractive for more applications.

Digital audio desks have allowed us to save space, both because of the smaller control surface, but also because we have been able to delete some of the outboard processing that was previously required. These desks also provide increased functionality and more consistent shows due to their preset recording capabilities.

> "...now we are frequently distributing audio over IP, integrated control over IP and most recently digital video is being distributed shipwide."

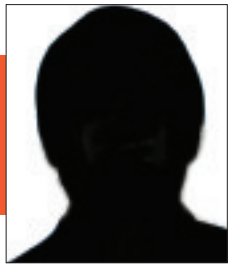
What future technical innovations would make a difference to what is possible?
I think that thechnical innovations are already being developed at a rapid rate that will increase production capability. What is more important is innovations for energy reduction and sustainability. Everything on a ship is powered by onboard electrical generators and any increased efficiencies result in lower fuel consumption, which is desirable from both a cost and sustainability standpoint. I think the day is approaching where in the theatres we will be able to replace the 750W halogen PARs and profiles with 200W or 300W LED fixtures. The real priority is finding a replacement for the 50W MR16 lamp, of which there are literally thousands installed on each ship. We have yet to find a product with a comparable output, colour temperature, and high CRI that fits into the same size ceiling cut-out.

Cost has also been an issue, but we are seeing the prices for LED lighting dropping rapidly and we remain hopeful that there will soon be high quality products at the right price. Beyond lighting, any increases in efficiency in other electronic components, whether they be amplifiers, PCs, or video displays will result in not just reduced electrical consumption, but also reduced air conditioning requirements, which are also powered by the same generators. In the long term, the price of fuel is only going to rise, which makes innovations in energy efficiency a priority for us.
> **www.n.e.d.com**

The Tamarind cabaret venue on P&O Cruises' *Ventura*.

The Designer

Derek Warner,
FUNA



Derek Warner, senior project manager for FUNA International, has a background in audio engineering and technology which he uses to help create top-of-the-line, robust entertainment technology packages for cruise ships and other venues. He began his career as a sound engineer on cruise ships and then for a variety of Las Vegas venues including the Bellagio, where he was an audio tech for Cirque du Soleil's O. He later joined TDI which became a FUNA International company.

What services does FUNA offer?
FUNA International Group is a global design, engineering, integration and consulting firm based in Emden, Germany. It has over 37 years of experience integrating a variety of complex systems, and is well established in maritime projects - vessels of all types including cruise ships and superyachts - but also serves a variety of land-based developments. FUNA has successfully completed over 150 cruise ship projects including eight of the 10 largest cruise ships, as well as four of the world's largest superyachts. Our client list includes Royal Caribbean International, Princess Cruises and Disney Cruises Lines among others.

What is the your latest shipboard project?
Currently working on *Allure of the Seas* for RCCL. This is the second ship in the Genesis Class ships, sister ship to Oasis of the Seas which sailed last October.

Can you outline your approach to a cruise ship design project?
Understanding the client, their system needs and their on-board operations is very important in cruise ship design, especially when designing systems which can be operated by users of different levels. Designing with products which are "tried and true" is another approach we rely on to minimize the service calls as the ships are constantly moving around the globe.

In what ways does designing for shipboard entertainment differ from land-based equivalents?
Space is a premium on a ship. Being able to integrate into the architecture, reducing the size of the necessary technical rooms is a high priority when designing for a ship. Also, anything that will be installed on an outer deck of a ship is exposed to an extremely harsh environment: ships have quite extensive systems out on deck and we are always pushing manufacturers to develop methods for their products to deal with the weather on top of a ship. The sun, salt air, water etc can destroy equipment very fast if not built for this environment.

To what extent do you need to be aware of specific shipboard restrictions?
The marine industry has some very strict standards and procedures which must be adhered to primarily for safety at sea. The electrical installation codes are very specific for shipboard installation. The cruise lines themselves have rules which they enforce as well. All of these details are very important and our design teams must be aware of them.

> "...we are always pushing manufacturers to develop methods for their products to deal with the weather on top of a ship. The sun, salt air, water etc can destroy equipment very fast..."

What are the biggest design challenges?
Integrating systems into small, confined spaces and making sure we can maintain access to the necessary equipment. Visual aesthetics are a big concern, being able to integrate into the architecture to hide the equipment yet provide the necessary technical elements can be a challenge, especially when many venues are multi-purpose.

> **www.funa.com**

The Installer

Mark Morley, TEDAV.

How long has TEDAV worked in the cruise ship market?
TEDAV's been refitting cruise ships since our first full trading year in 2007. Ocean Village 2 was our first, in March 2007. Personally, I've been designing, specifying and project-managing cruise ship refits since the late 1980s - approximately 40 separate projects.

How has the onboard technology changed in that time?
The first cruise-ships I worked on did not have dedicated entertainment venues - they had "lounges" in which entertainment was staged. These were comfortable, but had very low ceilings and tiny stages. For instance, the theatre onboard P&O's Canberra was originally an open-air deck-quoits pitch, which had subsequently been built over. The venue's ceiling was about 2m above the deck and installing lanterns and loudspeakers was (literally) a headache! The other problem was power, as none of the venues had been provided with a dedicated entertainment power supply and adding a power supply during a refit was usually prohibitively expensive (even assuming there was sufficient capacity in the generators to start with). Before one could design a system, one had to know what power was available; this dictated the quantity of luminaires one could use.

The mains power onboard a cruise ship is either 110V or 220V three-phase, no neutral @ 60Hz. In the '80s and early '90s, this presented a real problem in electronic equipment selection, as many products - such as dimming, sound-reproduction and amplification kit - could not function with a 60Hz supply. The lack of a neutral line meant that both legs of a 220V power-supply cable were live and all MCBs therefore had to be two-pole twin-sensing. Dimmers had to have separate two-pole MCB boards to protect the outgoing lighting circuits. Transformers (for instance, to power Tivoli lighting, which was ubiquitous at the time) had to be bespoke manufactured with twin fuses on the primary supply. If the ship ran on 110V, that could also be a headache, as European-sourced equipment often had to be modified to function with a 110V supply. Today, most kit is multi-voltage and the serious manufacturers of dimmers have specific versions of their kit designed to be compatible with ship supplies.

In the late 1980s, all control equipment onboard was analogue. Ship's crews were amazed at the facilities offered by Zero 88's revolutionary Eclipse lighting desk, with its separate plug-in chase-generation and sound-to-light modules. Revox reel-to-reel tape recorders were required equipment and blank recordable CDs cost £25 each from Canford Audio.

In the early '90s I was asked to review and comment on the Entertainment equipment proposals for P&O's proposed 'Gemini Project', which had obviously been prepared some years before and included a requirement for Strand Patt 23s! The 'Gemini Project' morphed into the Oriana and then her sister the Aurora. Oriana was launched in 1995 (fitted-out by Glantre Engineering) and, by then, the luminaires had been changed to ADB generic lanterns and Clay Paky moving mirrors. To the best of my knowledge, Oriana was the first British cruise ship to have a purpose-built theatre.

Today's ships use the very best in entertainment technology and many West End theatre crews would envy the equipment specifications - large numbers of moving heads and LED washlights, fully-powered flying systems, automated stage revolves and the very best in control equipment.

"In the late '80s, all control equipment on board was analogue. Crews were amazed at the facilities offered by Zero 88's Eclipse lighting desk."

The other technology that has changed is general communications. If one was refitting a ship in the 1980s somewhere far away, such as Singapore, one had to ensure that absolutely everything had been shipped-out to the docks in time - if it wasn't waiting on the docks, you had a big problem. If there was a snag, and documents had to be urgently sent to the UK, they went by Telex. After writing down all the information, one had to join the queue of contractors waiting outside the ship's comms office, hand over the document and wait for a secretary to type-out the information. A brief (and expensive) call to the UK informed the office that a Telex had been sent and someone there had to get in a car, drive to the local Telex bureaux and pay them a few pounds to pass-over the print-out. Any reply required a reversal of the process. There was no way to transmit any images of any type. On today's refits, we send manuals, photos, drawings etc in seconds via email - all for free. It's easy to forget how difficult problem-solving once was.

How much specialist knowledge/training is required for marine installations?
Ships vibrate all of the time and the atmosphere (even inside) is saline. Equipment has to be good-quality and installed to a very high standard. Everything has to be bolted down so that it can't move in a storm (a heavy rack could cause massive injuries if it started flying around a control-room). On open decks, all fixings have to be aluminium or high-quality Stainless Steel and you can't clamp a steel item to aluminium (they'll corrode in the saline environment). Most open-deck kit will last at most three years in fully-operational condition. All installed cables in a ship have to be glanded wherever they pass through a partition (to prevent chafing from the vibration) and any cables passing through a deck or water-tight bulkhead have to be pressure-sealed to prevent water bursting through, should the ship suffer an accident. In essence, installers - especially electricians - really need to know what they're doing. SOLAS (Safety Of Lives AT Sea) rules whatever you do onboard.

What are the key requirements for equipment installed on a cruise ship?
1 - Good quality kit manufactured by mainline companies, for which spares are easily obtained all around the World. Cutting-edge technology or kit from a new manufacturer is not a good idea - best to use well-proven kit.
2 – The kit MUST match the requirements of the venue and specification MUST be based upon venue requirements FIRST, rather than favourable profit-margins.

How do you think changing technology will affect the cruise market in the future?
Kit that consumes less power will always be popular, as it can make a dramatic difference to the loadings imposed on ships' generators. Compare the consumption of a row of PixelPars to an equal number of 1kW parcans! Low-maintenance kit is also a boon, as the crew's time is very tight and equipment needs to be reliable and to require minimum servicing. Finally, Kit that works on the open deck: a moving light that can withstand the rigours of open-deck life, without having to live in a Tempest housing, would sell very well indeed.

The Technician

Nick Herring,
Carnival Splendor

California resident Nick Herring is just 19 years old and has recently been promoted from on-board cruise ship technician to manager of entertainment technology aboard Carnival Splendor. He has recently signed up for his third six-month contract.

How did you come to work on cruise ships?
After I graduated High School I decided to apply to a variety of major Cruise Lines, Carnival being my favourite. Lucky for me, they were interested in me too and I was offered the position of entertainment technician - lighting. During my second six month contract I had the honour of taking on the extra duties of being the senior technician aboard the Carnival Legend. Currently I am on the Carnival Splendor as senior entertainment technician but I am proud to say that I have just been promoted to the newly formed position of manager of entertainment technology for the Carnival Splendor.

There are not too many places where you can get experience in maintaining and operating the technologically advanced equipment that we use and at the same time work with state-of-the-art laser systems, pyrotechnics and other types of special effects used in our shows.

It was a tough decision, and working on cruise ships means a lot of time away from home, friends and family but the experience is invaluable.

Can you briefly outline your duties?
My duties as the lighting technician include operating the lighting and special effects for the shows as well as repairing, cleaning and maintaining the moving lights, conventional fixtures and the special effects in the main theatre. As the manager of entertainment technology, I will oversee the daily operations of the technical entertainment systems, plus a team of highly skilled AV and entertainment technicians.

How many of you are there on Carnival Splendor?
There are five entertainment technicians (lighting, audio, stage manager, automation and a secondary lounge technician), as well as three AV technicians (two broadcast technicians and an editor).

What are the unique challenges that you face in your day-to-day work?
One of the unique challenges that I face in my day-to-day work would be the amount of maintenance that goes into keeping the lighting rig 100% for the shows. Aboard the Carnival Splendor, we have three large scale production performances each week. With 84 moving lights consisting of VL2500 spots and washes, VL3500 profiles, Cyberlight CL Lithos and MAC 250 washes, they need a lot of tender loving care mainly because we are on a moving ship. Conventionals need to be refocused from time to time and cleaning is almost a daily job. Some nights I can't perform the maintenance that needs to be performed due to rough seas so that's the most challenging part.

> "Conventionals need to be refocused from time to time and cleaning is almost a daily job. Some nights I can't perform the maintenance ... because of rough seaas."

What are the biggest restrictions to shipboard entertainment installations?
Surprisingly enough Carnival Entertainment pulls off some amazing feats when installing shows on various vessels. Space is definitely limited on cruise ships but a lot of thought is put into how things will work and what can be done with the space provided. The typical lifespan of a show on a Carnival ship is about seven years or so.

What technical innovation would make your job easier?
As it pertains to the Carnival Splendor, the technical innovation that has gone into this theatre and its shows is quite impressive. My job is a lot easier because of the seemless integration of AMX touch panels and wireless control systems. The main theatre on the Carnival Splendor has some of the most advanced equipment out there. The entire lighting rig is controlled by a grandMA Light and an ETC Expression 3 for everyday activities. A Yamaha PM5D controls the audio.

Above all,

Above: The auditorium of the multi-purpose Playhouse theatre.
Right: A cut-away view of Azura..

The cruise ship industry is booming and P&O Cruises' newest ship, the 115,000 ton, 3,080 passenger Azura knows how to attract its customers with the best entertainment afloat. Geny Caloisi reports on how P&O Cruises has taken the opportunity to enhance the consistency and reliability of the ship's technical entertainment installation . . .

Azura was launched in April 2010 by prima ballerina Darcey Bussell. Built in two years by Fincantieri in Italy, Azura is modern and sophisticated in its design. Fully integrated with seamless technology, its aim is to attract both first-time cruisers and experienced cruising passengers alike. It is family friendly and follows P&O Cruises' traditional style: fine dining, afternoon tea, a million pound art collection featuring contemporary British artists, and ballroom dancing on the ship's three dance floors, including the atrium, which hosts regular dance evenings.

Structurally, Azura is the same as P&O Cruises' Ventura and Princess Cruises' Grand-class vessels, but in each new ship the design is pushed one extra step further. P&O Cruises has in-house shows on six of its seven ships, and a great deal of attention has been paid to the way its Playhouse Theatre is set up. The multipurpose theatre offers three shows a night every night, from a repertory of seven, plus guest entertainers. This would not have been feasible if it wasn't for the latest application of audio and visual technology.

P&O Cruises entertainment sound and light manager Phil Yeomans emphasises: "This is the most technologically advanced cruise ship we have in the fleet."

Consultant Jim Tetlow of San Diego-based Nautilus Entertainment Design, who designed and specified all of the audio-visual, lighting and special effects on board, comments: "Immediately after the delivery of the previous P&O Cruises vessel, Ventura, which was delivered in the spring of 2008, we began discussions as to what they would like to change for Azura. We then took requests from P&O Cruises entertainment and developed the modifications so that it meets their requirements and fits into the budget."

Although delivered on time, the journey was not easy. Tetlow continues: "As it was a sister ship to Ventura, based originally on the Princess Grand class, there was not too much development needed from the construction point of view. However, with a February commissioning for a March delivery, we had a lot of problems with severe weather that delayed the completion of the large LED video display for the open air cinema. Fortunately, the installation and commissioning were completed just prior to delivery at the end of March."

entertainment

The technical systems installation, including lighting, AV and audio, was carried out by Kezia Group. The moving lights installation was conducted by HSL Group Holdings Ltd, following the formation of a direct relationship between lighting manufacturer Robe and P&O Cruises.

The Playhouse Theatre

The Playhouse is the heart of Azura's entertainment facilities. A multi-functional room with capacity for 820 people, The Playhouse runs three 45-minute shows every night of the week. And, of course, it is well equipped, with a specification that sets the standard for all the entertainment and lesiure areas throughout the ship. The lighting rig features more than 70 ETC Source Four profiles and 60 Source Four Pars (around 70 ETC fixtures are fitted with Morpheus ColorFader scrollers), more than 100 intelligent lighting fixtures from Robe, with lighting control from an MA Lighting grandMA system and DMX distribution from Pathway Connectivity. There are also two Robert Juliat 1800W Victor followspots, Scenic projection is from six Christie Roadster S+12K projector in conjunction with Robe DT7000 DigiSpots.

The Playhouse also features a 56-input Yamaha PM5D/RH digital mixing console; a d&b audiotechnik Q-Series PA system with T10, E0 and E8 fills; a Peavey Nion DSP system and Clear-Com intercoms. Show control is from an Alcorn McBride V4 Pro, with touchscreen interfaces from AMX. Atmospheric effects are provided by Ultratec and MDG Fog. It is a typically high-spec set-up.

Yeomans explains: "The Playhouse can be compared with any West End theatre, the main difference being that we run a different show every night of the week. Given that all cruise ships have limited space, we have implemented clever use of AV technology to achieve outstanding results on every show." He added: "What we need here is flexibility. The shows vary and can range from a full band playing music, to a magician, to a full-on dance and acrobatics show. The equipment we have installed has to cater for all these needs and be reliable. This room is a multi-purpose space, so we needed to create a rig that gave us these capabilities."

Steve Bee, entertainment production show manager at P&O Cruises' in-house theatre company, Headliners, was once an actor and singer himself, so when he made the transition to show director, he knew what was needed to produce top quality performances. He says: "People that come on these cruises know about variety shows. They have seen high-tech entertainment programmes on TV and they expect to be properly entertained when they are on board. We have to retain their attention for the whole 45 minutes of the show."

Bee says that this was one of the most challenging projects he's been involved with. "We built a brand new rig for brand new shows on a brand new cruise ship, so there was a great deal of detail. On the night of the premiere everything worked wonderfully."

Ordinarily, shows are prepared six months before the launch of the ship. Of course, the cast had to carry out the rehearsals off site because the theatre was still under construction: this was done at Headliners' rehearsal studios in London. As soon as the company was able to get on board, they had only a small window of

photo: Mike O'Dwyer.

photo: ChrisTaylorPhotography.com

Left: The Manhattan cabaret stage.

Below: The Planet Bar.

Facing page: The impressive Atrium.

opportunity to run through the whole show and to see the full effect. Everything needed to work.

So, Azura has a different show every night, with different themes and costumes; the shows need to be West End style with the latest technology, yet the ship has limited space and strict safety regulations. Obviously, using the right technology wisely is one of the keys to getting the job done.

A prime example of this is the use of scenic projection to minimise the set required for the various shows. On each side of the stage are three Christie Roadster S+12K projectors which project onto retractable Steward screens. These are used as part of the set, extending the stage to the sides and bringing it closer to the audience.

Rigged above the stage are the five Robe DT7000 DigiSpots - amongst many other Robe moving lights, including dozens of 700AT Profile and Wash fixtures, plus 575AT and 1200AT Profiles and Robin 300 Beam fixtures. The DigiSpots can project both still and moving images and are driven in the same way as any other moving light from the lighting console. The projection screens used for the different shows vary in size, shape and position within the stage, but the flexibility of the DigiSpots means they can always find their target.

HSL's managing director Simon Stuart, who managed the installation, comments: "The main advantage of the Robe projector light is that they provide different textures and sets without having to have the physical set on board, taking up a minimum space."

Steve Bee adds: "We wanted to use the projection in different areas within the stage. Obviously, we are limited by budget and we couldn't have 30 projectors pointing at different places on the stage, but the Robe DT7000 DigiSpots can be redirected to any angle within the stage."

Mick Hannaford, managing director at Robe UK explains: "Unlike traditional AV projectors, the DigiSpots are designed to move the same way as a light would move. So from a central location you can decide where the image is going to go and set it exactly to the screen. Everything is done from the desk. It's the link between the video industry and the lighting industry."

The DigiSpots are not just moving projectors, they also carry an integrated media server. All the content needed for the show is uploaded into the five units on the theatre rig and these are then controlled from the grandMA lighting console. Using the media server software, which has been wholly developed by Robe UK, the content is uploaded by drag-and-drop and welded together across the screens using Dataton's multi-display software, Watchout.

Hannaford adds: "People in the lighting industry who want to provide video can now do that without having to know too much about it. You don't need a separate video engineer or a separate video desk. All the content can be assembled on a laptop, uploaded into the product and run, just as they would anything to do with lighting. It can change the way a show is put together."

Support Structures

P&O Cruises took a new approach when deciding how they wanted to deal with the equipment they invested in for Azura. Above all, they wanted consistency and reliability in the equipment (a key requirement, given that things can go wrong in the middle of an ocean when it's not that easy to simply change a faulty piece of equipment for a new one) backed up by excellent technical support. It was this quest for consistency that led P&O Cruises to establish a direct relationship with the UK office of Czech Republic-based lighting manufacturer, Robe Lighting.

Phil Yeomans says: "After looking over many different moving light manufacturers and suppliers, the Robe equipment range ticked all the right boxes for our needs, plus the competitive price and three-year guarantee they offered. Ships are a very demanding environment and we require a lot from the equipment - the robustness is an important factor to us."

He continues: "The production company, Headliners, required a large amount of projection capabilities including front, rear and moving projection, so the DT7000s where a natural choice. With this option it gives me the flexibility to continue moving the shows technical support forward as more are developed over future years."

Hannaford says: "The direct deal with Robe includes three years' full warranty and it is exclusive to this deal. But we know the product and its reliability, so we are confident. The whole package is based on

photo: Mike O'Dwyer.

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From top:
Malabar - a club-style venue in the middle of the ship, with a stylish Indian theme;
Manhattan - the late night venue with cabaret shows and disco dancing;
The SeaScreen open-air cinema.

Facing page:
Left: Gareth Willox, deputy production manager, Sound, with Yamaha PM5D/RH.
Right: L-R: Mick Hannaford of Robe Lighting UK, Simon Stuart of HSL Group and Phil Yeomans of P&O Cruises.

changing the way we normally sell our products, into something a bit more suited to the cruising industry. It's not just about original purchase, or price. It's also about getting return on the investment and capitalising on the products. So when you walk back onto the ship a year later, and it's no longer all sparkling and new, you can be sure that the equipment you have still works 100%."

But Robe UK could not have provided that level of support without the contribution of HSL. Hannaford says: "We only sell kit in boxes, HSL makes it happen." He adds: "This is a ground-breaking deal because it's bringing together the manufacturer, the guys that put it together, and the customer's experience and needs. This is actually what defines how this package works."

HSL's Simon Stuart adds: "We meet with the customer on a regular basis. P&O Cruises gets to see and use new products to check if they are suited to their needs. They can try them out in our offices or they can trial them on the cruise ships . . . The most important thing is to introduce products that are reliable and don't break down when the vessel is out at sea. Once they reach a decision, they can be sure the installation and our technical support will be with the cruise ship along the way."

Sound Investment

That quest for consistency, reliability and support also led P&O Cruises to choose Yamaha as a partner for its audio requirements. The sheer amount of Yamaha equipment in use throughout the world is another benefit to cruise ship installations. There's the familiarity - the majority of engineers will be familiar with the Yamaha user interface - a factor which is enhanced, in the Azura's case, by Yamaha equipment already being used on board other ships in the fleet, Ventura and Arcadia, allowing technical crew to transfer seamlessly between ships.

Again, reliability is a fundamental requirement, compounded by the salt-laden air of the sea environment. Corrosion is an ever-present threat, but Yamaha's desks are built to cope with such challenging environments. And the global presence of Yamaha equipment means that, if a replacement was required, it could be sourced quickly at the next port of call.

Karl Christmas, Yamaha's deputy general manager for Commercial Audio (UK), says: "Passengers pay a great deal of money for a cruise and so they, quite rightly, demand the highest standards from all aspects of the experience. The combination of reliability and flexibility - together with ease of use and familiarity for the technical crews working in a high-pressure environment - makes Yamaha equipment the ideal

photos: ChrisTaylorPhotography.com

solution. We are very pleased that Yamaha has been chosen for Azura and the other P&O Cruises ships."

Phil Yeomans says: "We have a number of ships that have been successfully running a range of Yamaha desks onboard. Again, we have a good relationship directly with them and are happy to continue this relationship for this project. The range of desks from PM5D/RH, M7CL/48 down to the 01Vs means we can utilise this wide range of product for our various venue requirements but still keep the same manufacturer to minimise training and spares costs."

A Walk Around

On boarding the cruise ship, one of the first things the visitor encounters is the 'wow factor' of the three-storey high atrium - the lively social hub of the ship, where nightly ballroom dancing takes place to the accompaniment of a live band. To cater for its audio needs, the Atrium has a rack-mounted Yamaha 01V-96V2 digital console with 24 inputs and 14 outputs. Nearby on the same level as the Atrium is The Whitewall Art Gallery, which regularly offers lectures from curators.

The Planet Bar, high up on Deck 18, is a tranquil and elegant Jazz bar. On one side, windows provide wonderful panoramic views, while on the other, six 103" Panasonic plasma screens work together to take passengers on a virtual journey, showing scenes from a different continent each night, while the theme is also reflected in the drinks and canapé menus.

Pacific 7, the production company which also provided the footage for the Metropolis bar on Ventura, created this new content for the six themes. The filming took two years to complete. The Panasonic screens can be used to display either individual content or to show panoramic views, with the content again combined using Dataton Watchout. Audio is again looked after by a rack-mount Yamaha 01V-96V2 digital console; sound is provided via Renkus-Heinz PNX loudspeakers, with amplification from QSC CX Series amplifiers and DSP from Peavey Nion.

There are three dance floors in total on Azura. The Atrium dance floor is big enough to take about eight couples dancing, while the Malabar and Manhattan bars have bigger spaces.

Manhattan is a late night venue with cabaret shows and disco dancing. The stage lighting rig features 14 Robe fixtures including 250 Club Spots, 250XT moving mirror lights and 170AT Profiles. There are also plenty more ETC Source Fours and S4 PARs, many fitted with Morpheus ColorFaders, plus Atomic strobe and Wizard Extreme effects from Martin Pro. Lighting and effects are controlled from an MA Lighting grandMA ultra-light console. A Yamaha M7CL/48 consoleis on audio duty, while Renkus-Heinz PNX loudspeakers deliver the sound.

The seating area is partitioned and there are relay screens above the different tiers of seating and some more by the stage. Three cameras record the action on stage so that nobody misses anything. The whole place has colour-changing LED lighting from Pulsar: the ChromaDome LED fixtures embedded in the walls, partitions and columns constantly change its feel and mood.

Malabar is a club-style venue in the middle of the ship, with a stylish Indian theme inspired by the smart hotels of Mumbai's Marine Drive. Its semicircular stage, which features piano recitals and cabaret acts, features a similar lighting rig to that in Manhattan. The audio demands here are met by a Yamaha M7CL/32 digital mixing console (32-channel, custom-configured), and as with the other leisure areas onboard, Sennheiser mic systems, Peavey Nion DSP and Renkus-Heinz PNX loudspeakers are in evidence.

The Great Outdoors

The SeaScreen is Azura's open-air cinema in the main pool area. The 7.5m wide by 5m high screen is a Barco OLite 612 LED screen (12mm pixel pitch) with processing from a powerful Barco D320 Lite Digitizer. A light detection system raises or lowers the intensity of the screen depending on the ambient light levels. Although Azura is not the first cruise ship to have a giant LED screen, it is the first British ship to have one.

The Mica line array loudspeakers from Meyer Sound are flown in hangs of eight (including bass cabinets) on either side of the screen, plus six delay cabinets beneath the balcony, provide coverage over the whole deck area, while there are also Sennheiser headphones and an IR hearing assist system available for hearing-impaired passengers. The cinema is used to screen current blockbusters, as well as for playing interactive games. In the evenings, the sun loungers are transformed into comfortable beds with cushions and blankets to enjoy the shows. Passengers can even get cinema-style snacks.

The ambience of the SeaScreen changes according to what is being shown. Four Martin MAC 700 moving heads in weather-proof enclosures are positioned atop columns around the upper level of the cinema, and are able to provide coverage of the area as required. LED wash units complete the spectacle. Sound in this area, which includes a small stage, is managed via a Yamaha 01V-96V2 digital console (24 input, 14 out). A performance stage in the next top deck area features Martin MAC 2000s in weatherproof domes, along with further Robe AT700 fixtures and custom Robe ColorSpot 2500E followspots - developed between Robe, HSL and Phil Yeomans.

Azura has many innovative features to enchant its passengers, and the new direct relationships between operator and equipment manufacturer have provided an additional level of assurance for the passengers that the shows will go on.

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