

Source Oriented Reinforcement and Virtual Surround

- ◆ Overview, concept, history
- ◆ Psychoacoustics, Haas, Precedence, Kuttruff
- ◆ Source Oriented Reinforcement (SOR)
- ◆ TiMax intro, hardware, software
- ◆ Virtual Surround, image definitions
- ◆ Show control, timeline, midi, RS232, smpte, CD, wav, relay

Out Board Electronics



TiMax Seminar



OUTLINE SUMMARY OF WHAT THIS SEMINAR COVERS:

A brief overview of Out Board's different product sectors past and present,

A look at some of the psychoacoustic theory behind delay-based localisation, and listen to some of it's effects,

Effective control and exploitation of these psychoacoustic processes leads to something known as "Source-Oriented Reinforcement"("SOR"),

An introduction to TiMax hardware and software,

Introduction to TiMax "Image Definitions" and Virtual Surround,

Outline of TiMax showcontrol system, Cue and Event trigger formats.

Source Oriented Reinforcement and Virtual Surround

Overview, concept, history _____

- ◆ Out Board Electronics - TiMax
- ◆ Moving fader systems - OEM, Midas, Amek
- ◆ Analogue surround solutions, Octopus, SS2
- ◆ IBEX Programmable Chain Hoist Control 
- ◆ Plumbing (AC Power)Dept - Motor Control, AC
Distro, Safety Testers 
- ◆ Specialist engineering - control systems, sound design
support, console automation, Millenium Dome BabelPhisch 



OUTBOARD ELECTRONICS OVERVIEW AND HISTORY:

OEM moving fader components for Midas XL4 and Fairlight (Amek OEM)
Fame consoles

Octopus motorised fader, routing and analogue surround matrix, used for
Miss Saigon helicopter in original London West End production. SS2
console automation system - Amek, Soundcraft, Midas (e.g.Phil Collins
tour)

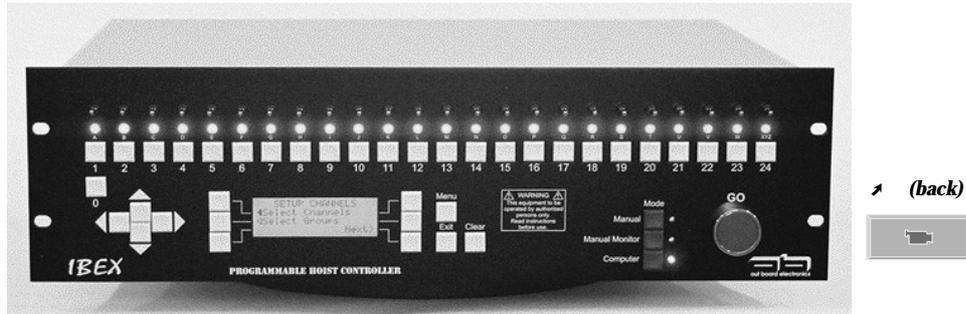
IBEX cue-sequenceable programmable chain hoist controller - *Robbie
Williams* and *Roxy Music* 2001 tours, with Vari-Lite UK.

“Plumbing Dept”-- AC power distro, Motor controllers, electrical safety
PAT testers and Cable Tester, with automatic testing, logging and
networking using our custom SAVANT database system.

Specialist engineering -- sound design, console automation (Soundcraft
Europa fader and switch automation, Midas XL4 on-board automation
system), Millenium Dome “BablePhisch” control console for Soundweb,
DAR and Pro-Tools systems for Central Show.

Source Oriented Reinforcement and Virtual Surround

◆ **IBEX Programmable Chain Hoist Controller**



- ◆ Reliable and simple to use, standalone automated chain hoist positioning with or without encoders



IBEX PROGRAMMABLE HOIST CONTROLLER

New, standalone automation processor to drive chain hoist motor 3-phase controllers.

Allows up to 24 motors to be programmed to run independently or in groups, all under a set of user-defined cue sequences.

RS232 port for laptop connection ONLY for monitoring and showfile backup. IBEX has its own inbuilt computer (no moving parts such as disk drives, all solid state memory) so it doesn't rely on Windows etc to hang and move stuff about in the air.

First debut tours for IBEX are with Vari-Lite UK, for the 2001 Robbie Williams worldwide stadium tour, and Roxy Music revival tour.

Source Oriented Reinforcement and Virtual Surround

◆ *Plumbing (AC Power) Dept*



3-Phase AC distro controllers for 4, 6 and 12 CM Lodestar Chain Hoist Motors.

Also available, VCM6 dual-purpose 3-phase six-channel chain hoist controller switchable between CM Lodestar and Verlinde chain hoist motors or combination of the two.

All controllable from the IBEX Programmable Hoist Controller.

Source Oriented Reinforcement and Virtual Surround

◆ *Millenium Dome "BabelPhisch" Console*



↗ (back)

- ◆ Audio control of Soundweb system and transport control of DAR and Pro-Tools for Central Show.



Source Oriented Reinforcement and Virtual Surround

The Psychoacoustics

- ◆ Haas, history and theory
- ◆ Precedence effects, -- *demo*
- ◆ Kuttruff effects -- *demo*
- ◆ Comb filtering, echo perception -- *demo*
- ◆ Cocktail Party Effect -- *demo*
- ◆ Speakers, Spaces & Senses

Electro-/Room-/Psycho-acoustic symbiosis



A LOOK AT SOME PSYCHO-ACOUSTIC PHENOMENA:

Haas Precedence Effects - the human brain localises to not just what is louder but also what it hears first, even if it's less than 1ms "early". This results in "time panning" which will inherently draw the listener to the *preceding* sound from the nearest speaker to them. Haas Effect must therefore first be CONTROLLED, to eliminate the inherent problems it can cause, then EXPLOITED, for creative purposes. Pro-active application of Haas delays can make a mix easier to achieve by helping maintain real separation between sources.

Limits of "effective Haas region" for pro-active localisation are:

1-10ms -- Comb Filtering range, where relative arrival times are so close that they comb filter, causing phaseyness to the combined sound. Filtering in the speech band at 1kHz, drops half an octave for each doubling of relative delay, so is eliminated by 10ms.

30+ ms -- Echo Perception Threshold, where relative delay appears as echo. Kuttruff adds a third delay speaker in between to "smear" echoes together

So, between 10ms and 25-30ms is a useful region of Haas delay that can be used for image localisation. (DEMO)

Cocktail Party Effect shows how two voices on two separate speakers (i.e. from different localisations) are easier to understand than if they are both coming from both (DEMO)

PREMISE: The three S's, Speakers, Spaces and Senses -- for years we have learned how to precisely control and combine the first two, but for an ultimate outcome in terms of image clarity, intelligibility, energy, audience immersion and message impact, it is vital to be sympathetic to the listeners' Senses I.e. deal with psychoacoustics.

The future in progressing quality audio reproduction, either for "stereo" or "surround" (which both currently only really work in the middle-of-the-couch sweet spot) lies in understanding and managing the fundamental "symbiosis" between Speakers, Spaces AND Senses, I.e. Haas time delay based localisation..

Source Oriented Reinforcement and Virtual Surround

Source Oriented Reinforcement (SOR) _____

- ◆ Premise, absolute panorama , beyond stereo
- ◆ Level / delay matrix, localisation zones
- ◆ *Missa di Iubileo* at Rome Coliseum 
- ◆ *Tosca* at London Royal Albert Hall 
TiMax Image Definitions setup -- *demo*
- ◆ *Edinburgh Military Tattoo*, Scotland 



SOURCE-ORIENTED REINFORCEMENT (“SOR”):

So, we arrive at the premise of developing an “absolute panorama”, beyond the constraints of “stereo”, which is mainly a convenient delivery medium that really only works on headphones or in the middle-of-the-couch sweet-spot, or “virtual surround”, beyond conventional “discrete surround”, which is also very sweet-spot dependant.

Implementing this requires an audio matrix with level and delay adjustment available at every crosspoint, which then allows virtual localisation zones to be created, to which a range of sources can be applied in order to localise them effectively for all audience members distributed over a wide area.

Some examples of this in action are:

- *Missa di Jubileo*, 200 orchestra and choir from the Rome Opera, performed in the Rome Coliseum to 300-400 “nearfield” audience members. (SEE LINK and HEAR *demo* of Image Definition setup)
- *Tosca* at London’s Royal Albert Hall, in the round, the first opera to receive praise for the sound system from the prestigious Sunday Times opera critic (who actually interviewed the sound designer in the article). (SEE LINK)
- *Edinburgh Military Tattoo*, 100 marching bagpipers and a stationary choir, TiMax is used to make the choir track with the marching pipes. (SEE LINK)

Source Oriented Reinforcement and Virtual Surround

◆ *Missa di Iubileo* at Rome Coliseum



↗ (back)



↘ (PLAN)



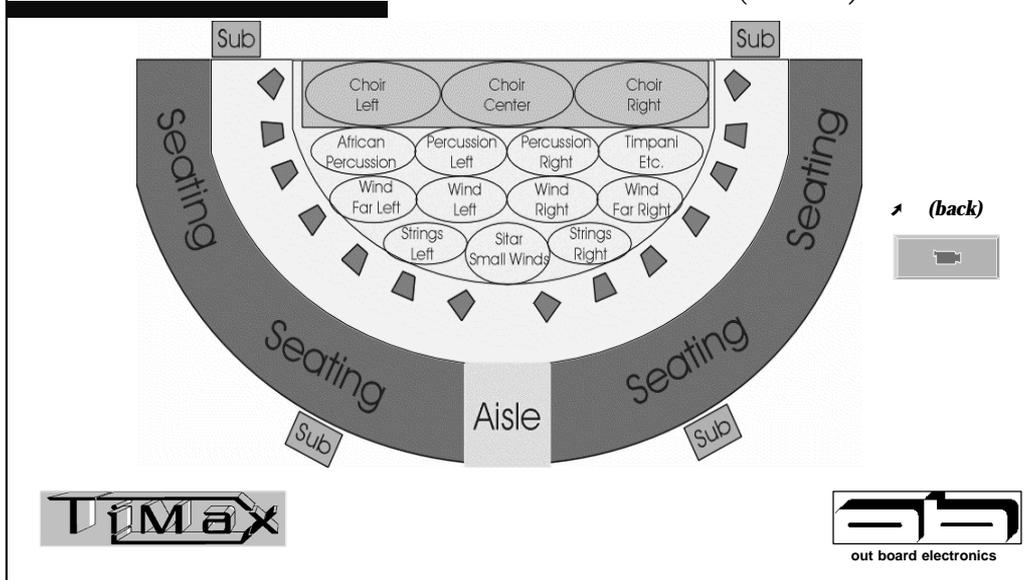
MISSA DI JUBILEO in the ROME COLISEUM

The first public music performance in the Rome Coliseum for 1500 years, the *Missa di Jubileo* was a specially commissioned piece performed by a 200 member opera choir and orchestra as part of the city's Millennium celebrations in July 2000.

The stage was set at one end of the arena (the far end as you look at the picture), and the performers played to a small invited audience of dignitaries seated in a semicircle around the orchestra. (I.e. as you look at the picture, the orchestra and choir would have their back to you) (SEE PLAN)

Source Oriented Reinforcement and Virtual Surround

◆ *Missa di Iubileo* at Rome Coliseum (PLAN)



ROME COLISEUM PLAN:

The orchestra was divided into 11 similar sized localisation zones, each containing logical groupings of instruments which were submixed together at the mixing console and fed into the TiMax Inputs. The choir was divided into three larger also, with each zone's mics submixed at the desk to feed TiMax Inputs, as for the instrument zones.

The orchestra was ringed by 14 small self-powered speakers sitting on the floor angled up towards the audience seating, which comprised of three arcs of chairs for a total of 400 people. 2 subs were added behind the orchestra and 2 behind the audience. Each speaker was fed from a TiMax Output, and dispersion was arranged so that each speaker covered its own seating area with minimal overlap into adjacent ones.

Measurements were taken from the centre of each instrument/choir zone to a seat at the centre of each loudspeaker's coverage area. This data was then used to compute delay times for entering into the TiMax Matrix Screen crosspoints, with delay values arranged such that, for every seating position, the acoustic energy from each instrument/choir zone reached the listener BEFORE that zone's amplified sound coming from the loudspeaker.

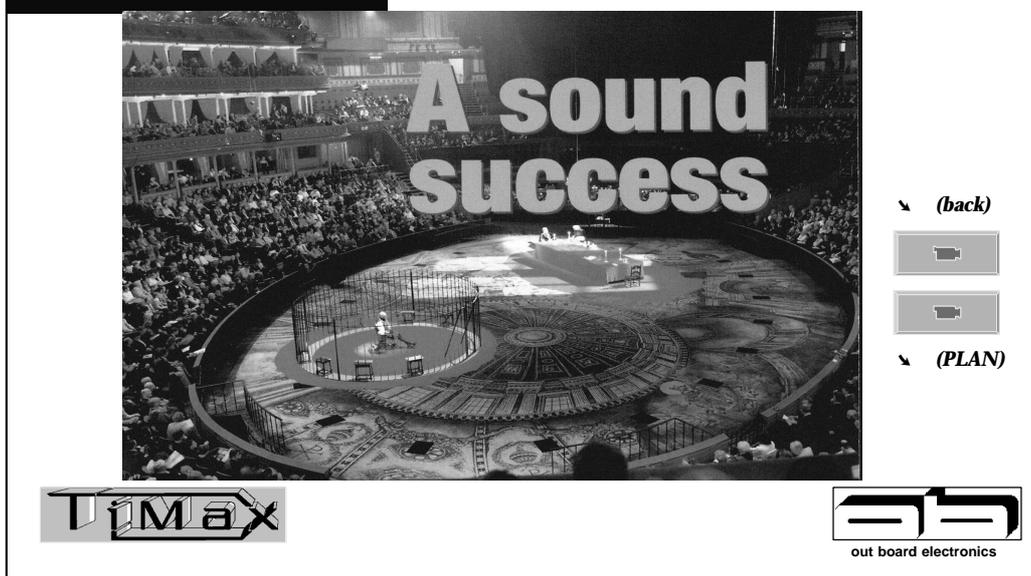
The result is that regardless of where they sit, everybody receives the same balance as created by the mix engineer, but with an authentic aural panorama that matches the visual perspective at their particular seating position. Without this TiMax implementation, the options would be to feed mono out of each speaker or probably to attempt to set up a series of "stereo" soundfields for different sections of the audience. In either case, it would be difficult to avoid the sound reinforcement system from conflicting with the complex, natural acoustic panorama created by the orchestra itself.

The outcome was not subtle -- the speakers were effectively inaudible until you put your ear up close, and the orchestra mix felt real and authentic due to the localisation effects, but solid and "present" due to the speaker reinforcement.

And, before you ask, yes it did take a couple of hours, but we (Robin and Dave) were in and out in less time than the SIM guys....

Source Oriented Reinforcement and Virtual Surround

◆ *Tosca* at Albert Hall



TOSCA the opera, in LONDON'S ROYAL ALBERT HALL:

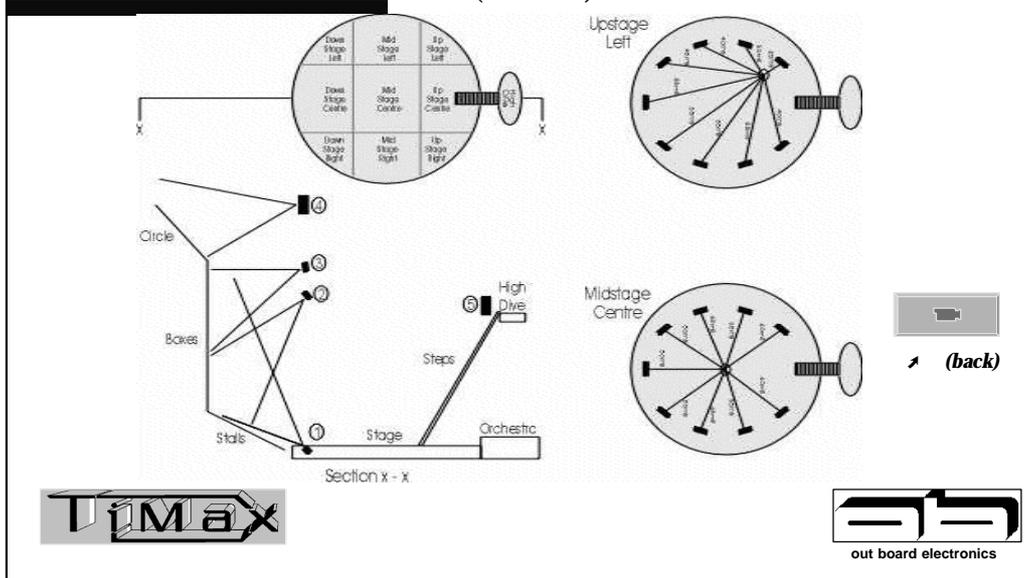
Part of a series of “popular opera for the masses” performances staged each year by impresario Raymond Gubbay, which have also included *Madame Butterfly* and *Aida* in previous years, these shows also move to weekly residencies at large touring arena venues, where they also use TiMax for localisation.

The objective always is “inaudible PA”, since a typical opera followers are highly distracted if the re-inforced sound is even slightly obtrusive.

Many different artists can be singing at different stage locations, either separately or together, and TiMax Image Definitions were used to create nine localisation zones on stage (plus one special “sky dive” localisation for the finale) in which different artists mic sources were placed, and moved by TiMax cues as they moved around the stage. (SEE *PLAN*).

Source Oriented Reinforcement and Virtual Surround

◆ *Tosca* at Albert Hall (PLAN)



TOSCA OPERA PLAN:

Nine localisation zones, plus a “skydive” zone for the finale, were created on the stage using TiMax Image Definitions, anchored on the (very powerful) acoustic vocal output from the artists, with the assistance of stage-lip speakers buried in the stage (see the black grilles in the stage on the photo).

The localisation zones defined by the TiMax Image Definitions were dimensioned about 12-14 feet across, such that, with appropriate localisation delays, the artist could move to either edge of each zone and just avoid the comb-filtering or echo-perception limits for all audience listening positions.

During rehearsal, the various artists locations were blocked out on stage and then placed onto the appropriate Image Defs for each scene. In performance, as they moved around and/or scene changes occurred, the sound engineer recalled different TiMax PlayList cues to re-localise any or all artists for that scene.

Source Oriented Reinforcement and Virtual Surround

◆ *Edinburgh Military Tattoo*



EDINBURGH MILITARY TATTOO:

Part of the famous Edinburgh Festival in Scotland, the Tattoo is an event for various marching military bands.

A choir is located at the far right end of the arena, with audience bleachers on three sides, the fourth side being bounded by the Esplanade of Edinburgh Castle. (SEE PLAN)

The band marches up and down the arena, so they can be anything from 10-15 metres from the stationary choir or up to 100metres away from them, leading to performance timing differences to most audience member furthest away from the choir.

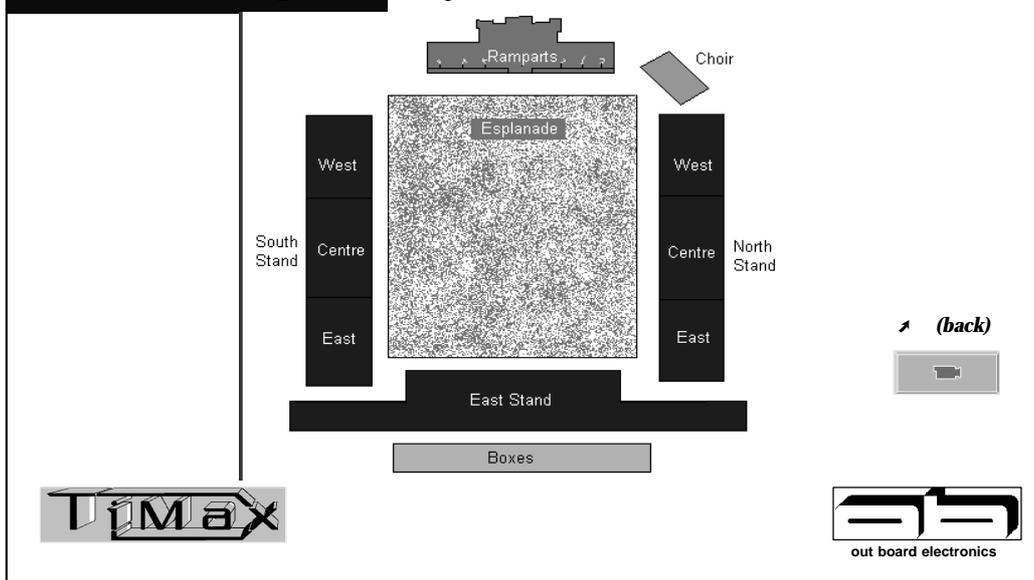
TiMax was used to “float” the choir over the top of the band and move the choir image up and down the arena to stay in sync with the band for all audience members.

The band was unamplified (if you’ve ever heard 100 bagpipes playing live you would understand why), but the lead piper was mic’d up to provide a foldback feed to the choir conductor on headphones. The choir were told to NOT listen to the band but follow the conductors batten, therefore eliminating actual performance timing errors caused by the varying distance of the band from the choir.

The same TiMax solution has been used three years running now.

Source Oriented Reinforcement and Virtual Surround

◆ *Edinburgh Military Tattoo (PLAN)*



EDINBURGH MILITARY TATTOO PLAN:

Notes as per Photo slide.

Source Oriented Reinforcement and Virtual Surround

The TiMax implementation _____

- ◆ Hardware, current TiMax Rack Systems
- ◆ Software:
- ◆ Production level
- ◆ Show level
- ◆ Venue level
- ◆ Matrix screen, simple level/delay matrix control



TiMax, A COMPREHENSIVE LEVEL/DELAY MATRIX AND SHOW CONTROL SYSTEM:

TiMax Rack Systems, modular from 8 x 8 up to 32 x 32, new products, TiMax ImageMaker8 and 16 (more later)

TiMax software, unique, advanced approach to multipoint delay matrixing and localisation management.

“Productions” can involve different “Shows” (large, small, touring etc) which can be translated into different “Venues” (DEMO TiMax Show and Venue screens)

An introduction to a very simple/obvious way to control a level delay matrix can be seen in the Matrix screen, useful for large scale, static localisations (e.g. *Missa di Jubileo* in Rome Coliseum), where level/delay parameters will be fixed and predictable, and to some extent, easily measurable. (DEMO Matrix Screen)

However, the Matrix screen approach can be limiting.....

So, TiMax provides a further domain called Image Definitions to add greater flexibility, speed and ease of use of multiple localisations, with added creativity for animated localisations under PlayList showcontrol.

Source Oriented Reinforcement and Virtual Surround

Virtual Surround

- ◆ Virtual Image Definitions vs discrete speakers
- ◆ Effects screen
- ◆ Static localisations -- *demo*
- ◆ Dynamic, animated localisations -- *demo*
- ◆ Multiple sources, Effects screen update/edits
- ◆ Play List cue control



IMAGE DEFINITIONS AND VIRTUAL SURROUND:

TiMax localises to virtual “Image Definitions” set up on the Image Definition screen as a series of level/delay relationships between some or all speakers such that any input source(s) “applied” to that Image Def will be localised to that point in the room for all listeners/audience members. (SEE IMAGE DEFINITION SCREEN and DEMO)

These Image Definitions are then placed in an area on the Effects Screen, and inputs can be placed on Image Defs to localise to them, or can be moved between multiple Image Defs to perform an animated pans between them. (SEE IMAGE DEF SCREEN and DEMO)

Single or multiple source localisations (DEMO from PLAYLIST)

Dynamic, animated, single or multiple animated localisations, or “pans”. (DEMO from PLAYLIST)

Effects screen updates, edits, fade-in, fade-out per source in Update mode (DEMO from PLAYLIST)

Note that all this complex multi-source/multi-output activity can be managed easily via the cue PlayList Screen, which also offers multiple input Trigger and output Event formats for each Cue.

Source Oriented Reinforcement and Virtual Surround

Virtual Surround - Applications _____

- ◆ Robert Palmer 
- ◆ Witches of Eastwick - thunder rolls, tennis ball
- ◆ Wizard of Oz - yapping Toto, localising audio bounced off the stage from upstage.
- ◆ IBM European Conference, Barcelona
Atmos and acoustic journey for presenter walk-ons
- ◆ Men In Scarlet 



VIRTUAL SURROUND -- SOME APPLICATIONS

Robert Palmer, R'nB band, record company album showcase to a small, private club audience. TiMax used to localise artists on stage and create surround reverb/ambience.

Witches of Eastwick, London West End musical play of the movie , TiMax used for surround effects. (SEE LINK)

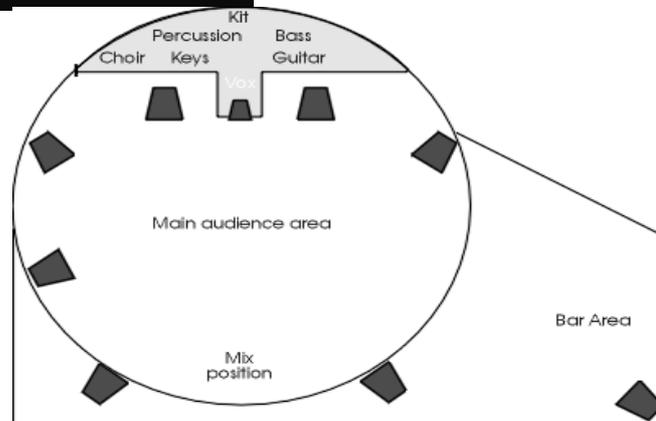
Wizard of Oz, USA touring musical play, TiMax used for critical localisation effects.

IBM European Conference, Barcelona, atmospheric soundscapes and “acoustic journey” for presenter walk-ons.

Men in Scarlet, multimedia “son et lumiere” event, Royal Chelsea Hospital in London, TiMax used for wide surround soundscape for narration and war/battle sound effects. (SEE LINK)

Source Oriented Reinforcement and Virtual Surround

◆ *Robert Palmer*



Venue layout and speaker positions



ROBERT PALMER SHOWCASE:

Robert Palmer, R'nB band, record company album showcase to a small, private club audience. TiMax used to localise artists on stage and create surround reverb/ambience

Source Oriented Reinforcement and Virtual Surround

◆ *Men In Scarlet* son et lumiere



⋈ (PLAN)



↗ (back)



MEN IN SCARLET, ROYAL HOSPITAL CHELSEA:

Royal Hospital Chelsea was set up by King Charles 1st as a place for the old war campaigners to go and loive when they retire. Legend has it that the idea was the suggestion of his concubine, Nell Gwynne, famous in history as being the lowly fruit seller who seduced the King.

The *Men In Scarlet* event named after the coloru of the old soldiers retirement uniforms, was basically a celbration of British warmongering through the ages, with a narration by Dame Judy Dench and comples pre-programmed multitrack sound montage of battle noises from the Crimean war all the way up to World War 2.

Scrolling still picture images were projected on a screen hung over the white arched portico you can see in the centre at the back of the courtyard.

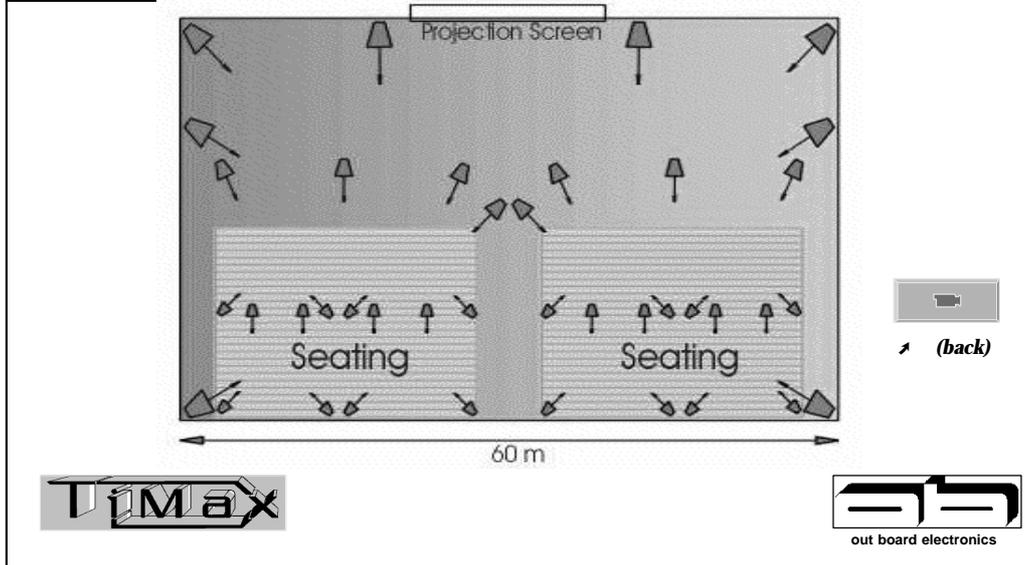
Covered bleachers holding 2000 people were placed across the end of the courtyard nearest to us, and the large grass area between them and the screen was the soundscape “performance area”.

The Great Hall and Chapel either side of the screen had multiple intelligent lighting systems inside, with gobos shining out through the tall windows, and strobe effects etc in the cloisters outside to simulate gunfire.

TiMax was used to create the multi-source surround environment, with static and dynamic localisation cues being triggered from SMPTE time code on the source multitrack (SEE PLAN)

Source Oriented Reinforcement and Virtual Surround

◆ *Men In Scarlet* son et lumière (PLAN)



MEN IN SCARLET PLAN:

You can see how the larger, frontal soundstage and rear surrounds are reinforced by additional, smaller speakers actually mounted in under the roof of the bleachers. All of these were added into Image Definitions “anchored” on the larger speakers forming the focii of the various Image Definitions

This meant that each bleacher audience was hearing the same panoramic and surround imaging, which TiMax was able to “project” outside the individual bleacher areas, by using Haas effect delay steering to localise audience members perception to the larger, more distant “anchor” speakers.

The outcome was so realistic that on one night FIVE different people were overcome by emotion and had to be stretchered out by paramedics.
(or possibly it was the free booze available on the lawn prior to the performance..)

Source Oriented Reinforcement and Virtual Surround

TiMax Show Control _____

- ◆ Play List, input and output triggers
- ◆ Timeline
- ◆ MIDI
- ◆ RS232
- ◆ SMPTE/EBU
- ◆ CD, Hard Disk wav file playback
- ◆ Relay Closures



TiMax PLAYLIST, FOR SHOW CONTROL:

Explanation of the PlayList, using TiMax software, to show the various Cue input Trigger formats, including internally generated TimeLine, MIDI Note, Program, SMPTE, RS232, CD etc.

(DEMO PlayList Screen and Maintain/Edit Cue dialogue box)

Explanation of same for Cue output Events, (DEMO PlayList and Events Screens)

Source Oriented Reinforcement and Virtual Surround

New TiMax Products, New Markets _____

◆ **ImageMaker8 and ImageMaker16**

- ◆ *IM8* , 3U, 8-in/8-out, XLR, PC interface
- ◆ *IM16* , 4U, 8-in/16-out, XLR, PC interface
- ◆ All sizes of venue, theatre, music, church, retail...
- ◆ Music, theatre, corporate production rentals...
- ◆ Son et lumiere, special events, dance clubs...
- ◆ Themed zones, rides, soundscapes, film...



NEW TiMax PRODUCTS, IMAGEMAKER8 and 16:

Two new, standalone, cost-effective non-modular variants, using exactly the same technology and high performance of TiMax Rack Systems, with substantial cost savings by eliminating modularity and expandability. Also uses the same TiMax software.

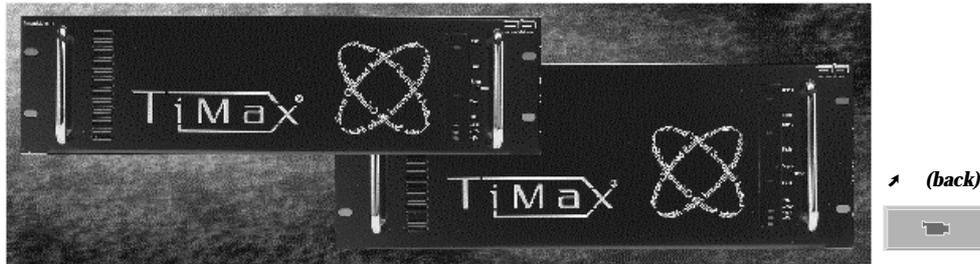
Opens the door for TiMax to be sold into a much wider range of applications and customer base, as listed....

Recent varied customers have included:

- *On Stage Audio*, Detroit, for Chrysler Jeep/Viper and GM new MPV product launches at the N. American Motor Show (2 x IM16's)
- *Hotel de France*, Jersey (near France, not near NYC), Atrium bar atmospheric soundscapes off harddisk of crickets/birds/streams or waves on the beach, seagulls etc, plus music localisation to either the bar or the stage. (IM16)
- *Dimension Audio* and *Delta Sound* UK for corporate events, such as Vauxhall (GM) new van launch, British Telecom promotion in Paris etc.(IM16's)
- *Fabric* nightclub in London, for enhanced, "Big Wide" enhanced stereo spatialisation, DJ controlled MIDI sample triggers and pans, interfacing with the lighting board for light chases, smoke machine, ceiling fans etc (IM8)
- *Shopping mall* in S. Africa, for atmospheric soundscapes and dual position live band localisations. (IM16)

Source Oriented Reinforcement and Virtual Surround

◆ ***TiMax ImageMaker8 and 16***



- ◆ The new multi-purpose, entry-level TiMax ImageMakers -- same technology, same software as TiMax Rack Systems, but at much lower price points



TiMax IMAGEMAKERS:

Notes as per main page.

**Source Oriented Reinforcement and
Virtual Surround**

Thank You and Good Night

Merci at Bon Soir



THANK YOU AND GOOD NIGHT