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$3.95
FEB '94

Australia's **Entertainment Technology** Magazine

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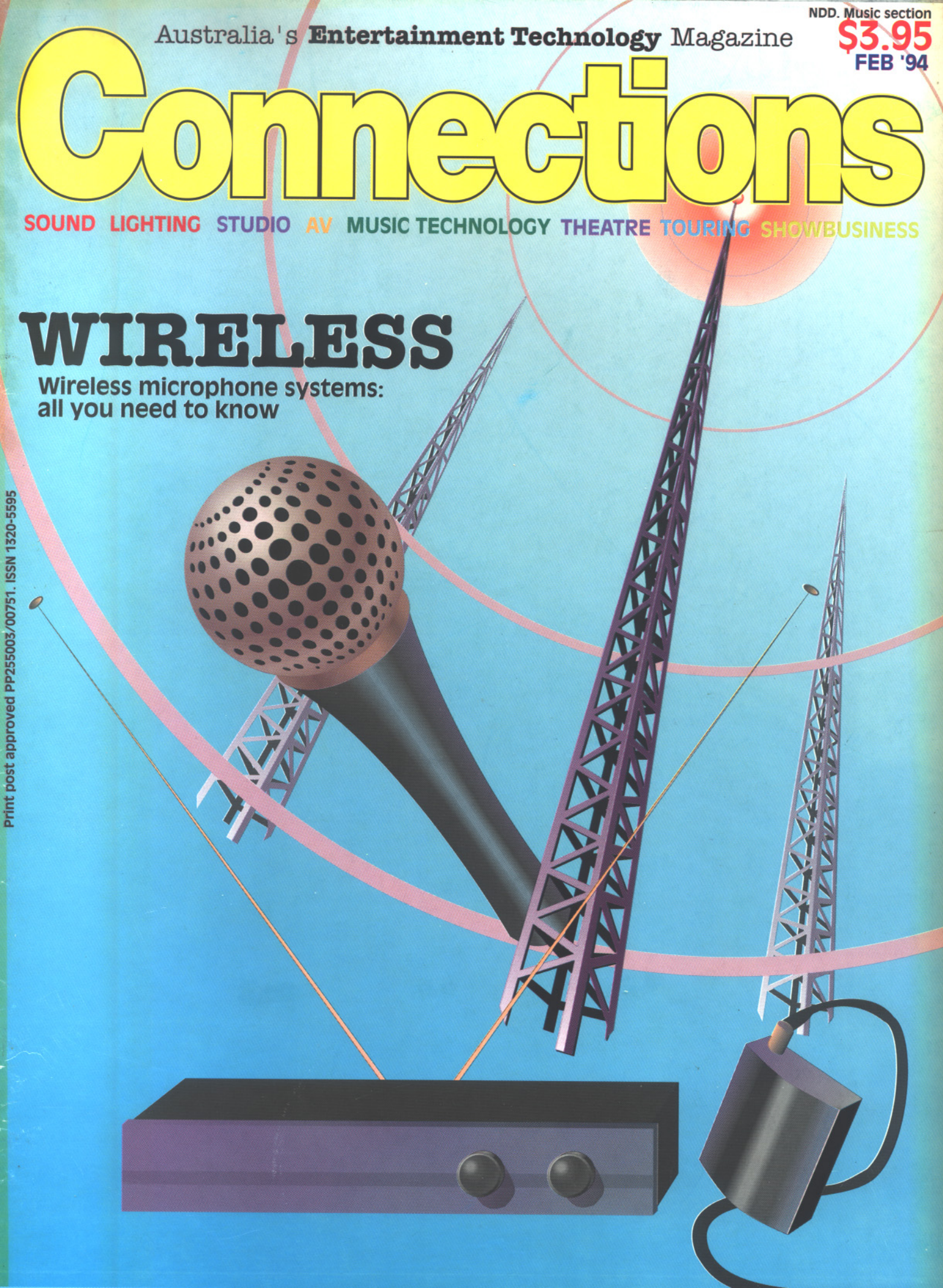
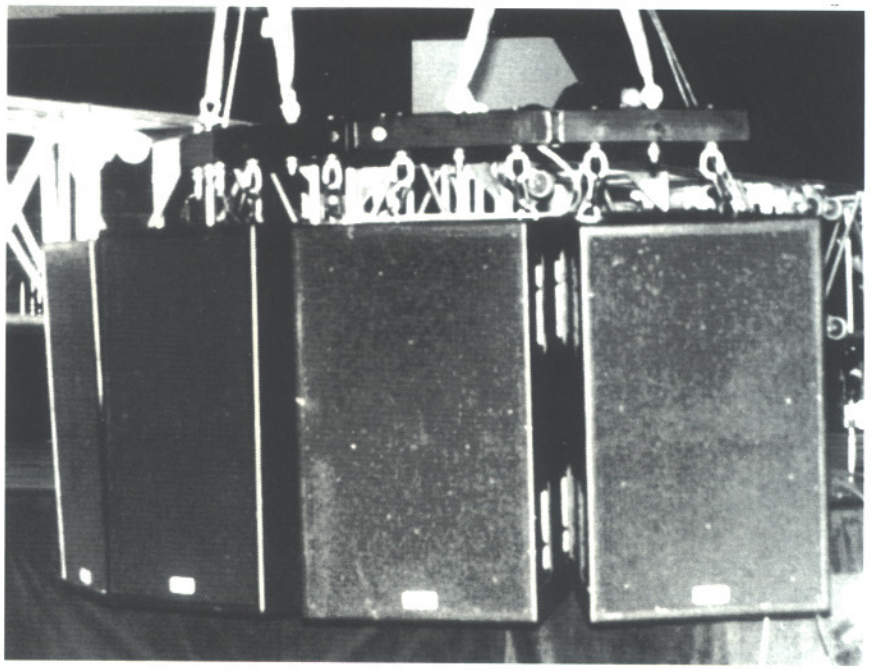


Print post approved PP255003/00751. ISSN 1320-5595

Flying Speaker Systems

By ANDREW T. MARTIN*



Modular Grid system manufactured by ATM Fly-Ware. Photo courtesy ATM Fly-Ware, carson, CA USA.

The practice of rigging loudspeaker systems has become an integral part of high quality sound reinforcement production services. Flying loudspeakers is no longer confined to large scale touring companies: in fact, it is commonplace for small audio rental companies to provide flying hardware systems for a good portion of their productions.

The rental market demand for flyable loudspeaker systems has generated a need for safe and reliable loudspeaker rigging hardware systems. Many loudspeaker manufacturers offering flyable loudspeakers have done so by utilizing hardware components from the aircraft cargo control industry. These types of systems can be difficult to array and often do not lend themselves to smaller loudspeaker array configurations. Recently, some loudspeaker manufacturers have started to implement rigging hardware that is requirement specific. These types of systems work in cooperation with after market flying hardware systems to provide the user with a comprehensive loudspeaker flying hardware system for a wide variety of uses and array sizes. There is a trend toward this type of cooperative rigging system concept due to the cost savings and acoustical advantages to the end user of the loudspeaker system.

Since there are many types of rigging hardware systems in the sound reinforcement marketplace, this article will examine many of the aspects associated with various rigging systems for both portable and permanent installation applications.

The primary concern for anyone flying a loudspeaker system should be safety, a consideration which begins with the loudspeakers themselves. Most of the flyable loudspeakers available from professional loudspeaker manufacturers have been designed and rated for overhead suspension. However, there are structural limitations to any loudspeaker with rigging hardware, and it is always a good idea to ask the manufacturer for a copy of the certification on the loudspeaker prior to rigging. For touring rental companies, a copy of the certification on the loudspeaker system and the rigging hardware system should accompany the system at all times.

RIGGING HARDWARE

Loudspeaker attachment points will vary from manufacturer to manufacturer. Therefore, most loudspeaker rigging hardware systems are not compatible. However, there are a few common rigging hardware designs that are worth reviewing. Perhaps the most common rigging hardware system in the marketplace today is the aircraft cargo control pan fitting. This type of hardware has been the most implemented hardware in the past, however new loudspeaker designs have moved away from the aircraft cargo control pan fittings. Another common form of attachment hardware is the aircraft cargo control track. Here again, new loudspeaker designs are moving away from this type of hardware. The newest type of loudspeaker hardware system is the threaded hole or nut plate system. This type of hardware enables the user to choose how to attach to the loudspeaker depending upon the specific use of the loudspeaker system (see Figure 1, on next page).

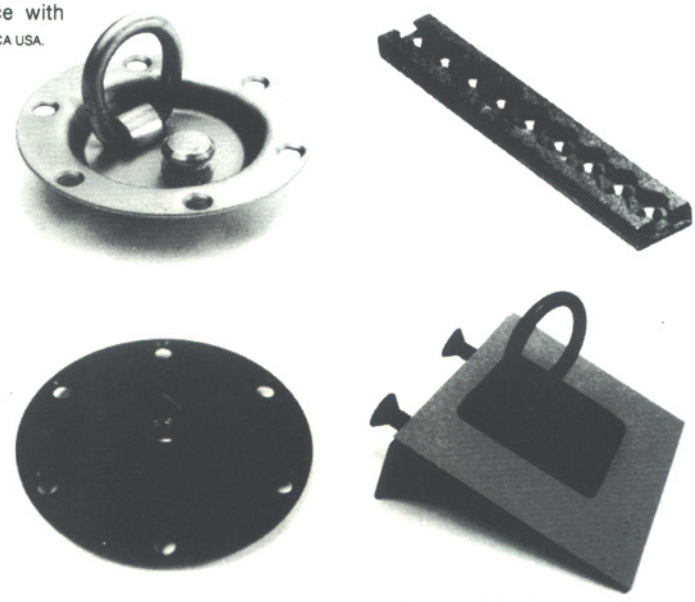
With most flyable loudspeaker enclosures, the external hardware component is fastened to an internal enclosure brace which helps to distribute stress through the loudspeaker enclosure. In some cases, the internal brace is the rigging hardware attachment point. Internal braces are usually small corner plates which distribute load from the top and bottom surfaces of the enclosure to the side panels of the enclosure. Internal braces can also be tied together so that loading is transferred through the enclosure via the through-enclosure bracing rather than by the enclosure side panels. With through-enclosure braces, the loudspeaker enclosure only needs to support its own weight rather than the weight of each consecutive loudspeaker below it.

As a general rule, the loudspeaker enclosure bracing and hardware is very strong and the weak link in the loudspeaker enclosure can be found in the joinery and/or material used to construct the loudspeaker enclosure. For this reason, it is important to know the working load limit of the loudspeaker enclosure, and what design factor the working load limit reflects. Most professional loudspeaker manufacturers calculate loudspeaker enclosure working load limits utilizing at least a 5:1 design factor. This means the point at which the loudspeaker enclosure breaks is five times greater than the working load limit. When considering working load limits, assume that the enclosure is suspended from only one point, this way if all other points fail, the enclosure will not fall. Also, if the enclosure is tilted at a severe angle, it is possible to have all of the load concentrated on only one of the enclosure suspension points.

The 5:1 design factor applies to all of the rigging hardware outside of the loudspeaker enclosure as well. It is the responsibility of the user to make sure that the design factor is adequate for every aspect of the rigging system: this includes the loudspeaker enclosure, the rigging fittings, the suspension truss, the steel cables, the fasteners, and the attachment to the structure. It is for this reason that hardware with working load limits stamped onto the part should be used whenever possible. If the hardware does not have a working load limit or ultimate load strength stamped onto the part, a copy of the certification for the part must be in the possession of the rigger when the parts are being used. This is particularly important for rental companies since certain venues concerned with liability issues are beginning to refuse rigging productions if these minimal requirements are not complied with.

Other safety factors associated with rigging loudspeaker systems include suspension of the loudspeaker array, load distribution, and suspension hardware. Much of the time the venue riggers will handle all of the rigging requirements down to the array suspension hardware. However, the house riggers will rely on the rigging hardware and equipment provided by

FIG 1: L-R; Kinedyne Ring and Stud pan fitting. Brownline Seat Track (AKA L-Track), Nut-Plate fitting, ATM Fly-Ware OSRIBI Internal Brace with OSRVI-3/8" fitting. Photo courtesy ATM Fly-Ware, carson, CA USA.



the rental company, and this hardware and equipment must be kept in excellent condition. While the venue riggers are charged with the task of safely suspending the loudspeaker arrays from the building structure, it is a very good idea for the individual in charge of the sound system to keep an eye on the riggers performance. Do not make the mistake of assuming that a rigger knows what he/she is doing just because he/she is doing it: many riggers have a lot of experience at doing the wrong things. To learn more about rigging, one can contact entertainment rigging supply vendors and inquire about rigging books and instructional courses. Also, one could partake in the ticketing program available in Australia, although this program is designed more for the construction industry. *(Still worth doing according to some I know. -Ed)* It is worth noting that only ticketed riggers are allowed to perform rigging tasks in Australia, although non-ticketed individuals can give instruction and guidance.

Some of the equipment that is of particular importance to the safe and reliable rigging of loudspeaker arrays includes; wire rope assemblies, shackles, locking steel carabiners, synthetic rigging slings, sling links, chain motors (hoists), motor distribution and control, safety harnesses, belay ropes and fittings, and pulleys. As a general rule, the lower cost items should be routinely inspected and discarded when they look worn or no longer perform their task properly. The higher cost items, such as the chain motors and motor control, should be routinely inspected and re-worked to bring them back up to specification. Some common areas of damage include; kinked, rusted, or stretched wire rope assemblies, shackles with widened jaws or pins that do not turn, carabiners without locking gates, synthetic rigging slings with holes worn in the cover or stiff sections within the sling, ropes with fibers torn or cut, and pulleys that wobble or rub.

As a result of continued market demand, rigging systems have become a necessity for the professional sound reinforcement company. The benefits of rigging loudspeaker systems is clear for the promoter of an event when one considers sight lines and seating availability. However, the practice of flying the loudspeaker system can be equally beneficial to the sound company if the rigging hardware system is thought through and performs well in many situations. Loudspeaker rigging system flexibility and ease of installation is of extreme importance. In many instances, a little extra funding to purchase the right flying hardware system up front will save a tremendous amount of aggravation and additional expense in the future.

SUSPENSION SYSTEMS

One of the more important user features of a loudspeaker flying hardware system is the ability for the system to control the loudspeaker within the array. While there are many variations of loudspeaker array suspension hardware systems, there are two basic types of suspension systems; the grid truss, and the modular truss.

The grid truss system is often found in the large scale touring production marketplace (see Figure 2). This type of system works well for large concert work since it is quick to set up and reasonably cost effective for large loudspeaker arrays. However, it does not work well for smaller venues or productions which require sound system modification from venue to venue. The grid truss system usually incorporates some type of adjustable pull strap in order to tilt the loudspeakers column by column in the vertical plane, hence the grid truss system is termed a vertically configured system. The horizontal splay angle between columns can be varied by moving the grid truss suspension points around, or in some instances the grid truss will have a swiveling bar for each column of loudspeakers. It is important to note that grid truss systems are usually not utilized when severe tilt angles are necessary from the loudspeaker array since the grid truss becomes very large in order to accommodate the space the loudspeaker enclosures need to occupy. The modular grid truss system is a variation of the traditional grid truss. With modular grid truss systems, the user is able to add as many columns of loudspeakers as the venue may require, and the splay angle becomes fixed between each column of loudspeakers. Modular grid truss systems are usually a great deal smaller than conventional grid truss systems.

The modular truss system is the most recent advancement in loudspeaker rigging hardware systems (see Figure 3 on next page). The modular truss system is designed to hold a group of loudspeakers together rigidly in the horizontal plane, hence the modular truss system is termed a horizontally configured system or planer system. Each loudspeaker in a modular system is treated as an individual module which can be assembled to the whole array in any position. Since each loudspeaker module is identical, the removal or addition of a module is simple and predictable. Each of the loudspeaker modules is held together in the horizontal plane with the use of connecting bars which can be a fixed splay angle or variable, depending on the design. Once a group of loudspeakers is held together in the horizontal plane, the entire group can be tilted without the use of additional adjustable pull straps. This is achieved by manipulating the center of gravity with the suspension points for the row of loudspeakers. By moving the suspension points toward the rear of the loudspeakers, the entire row of loudspeaker will tilt downward, and vise versa. Another feature of the modular truss system is the inherent wavefront coherency. Since the loudspeakers are held together in the horizontal plane at a fixed distance in space, the wavefront across the horizontal plane is coherent. Also, the modular truss system will allow adjustment of the vertical acoustic wavefronts when multiple rows of loudspeakers are arrayed.

LIABILITIES

A loudspeaker rigging hardware system that works well and looks good is a very beneficial asset to the sound reinforcement rental company and installer. However, there are many liability issues that are attached to the process of rigging loudspeaker systems. Firstly, there is a legal responsibility for the owner and user of the loudspeaker flying hardware system to ensure that the system is insured, safely designed and constructed, and that the system is used safely and appropriately. Insurance for a rigging system can be expensive, but it is a necessity for both the owner's and client's protection. The safe design and construction of the rigging hardware system is also critical.

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FLYING LOUDSPEAKERS (cont)

One must remember that any rigging system is only as good as the weakest link in the system. Many equipment failures can be avoided if the rigging hardware system is designed and then certified by a structural engineer, and if the builder is a professional fabricator with the proper equipment and knowledge to produce structural assemblies. Even if the system is designed well, built properly and insured, the ultimate success and/or failure will rely on the user and assembler of the system. This area is often overlooked by sound reinforcement rental companies and installers. As discussed earlier in this article, it is not the responsibility of the rigger to implement the rigging hardware system safely, ultimately that responsibility belongs to the owner and/or user.

Another liability associated with loudspeaker flying hardware systems is the cost. Assuming the process is done correctly, flying loudspeaker systems is not an inexpensive venture. On average, a loudspeaker flying hardware system will cost between 10%-25% of the loudspeaker cost. As this article has discussed, it is not worth trying to cut back on the cost of the loudspeaker flying hardware since it can inevitably cost far more in the long run: in fact, a tragic accident will most likely put a company out of business. Flying hardware systems are an investment for the future: a company should not purchase a loudspeaker flying hardware system until the finances are there to do it right. Many companies will attempt to design their own rigging hardware systems thinking that it will save money, however it usually costs a great deal more than buying a flying hardware system from a reputable manufacturer. Once one considers all of the research and development (since the systems seldom work the first time), structural analysis and engineering fees for the certification, manufacturing costs for outside vendors with certified welders and fabricators, finishing costs, and destructive loading tests it becomes apparent that the cost of constructing a proprietary system can be in excess of 150%-200% of market available flying hardware systems. Another hidden cost is found when the company needs additional loudspeakers for a large production, however the sub-rental company operates with a different flying hardware system. As discussed earlier in the article, most flying hardware systems are not compatible; therefore the company needs an additional inventory of flying hardware in order to accommodate the occasional sub-rental. Standardization of a popular rigging hardware systems between rental companies is a much more economical option.

THE FUTURE

The future of the professional loudspeaker production industry holds a great deal of advancement for loudspeaker flying hardware systems. However, the industry must be careful and act responsibly in order to protect the industry from government regulation and restrictions. Sound reinforcement company owners need to work with loudspeaker manufacturers and rigging hardware manufacturers to exchange information and partake in training seminars.

Loudspeaker manufacturers have begun to cooperate with rigging manufacturers in order to provide cost effective and safe solutions for the users of their products. The future will bring more standardized products and hardware for flying loudspeakers. The future will also bring new materials into the rigging business. The advent of modular truss rigging hardware systems has opened new doors for lightweight materials such as fiberglass and polymer plastics.

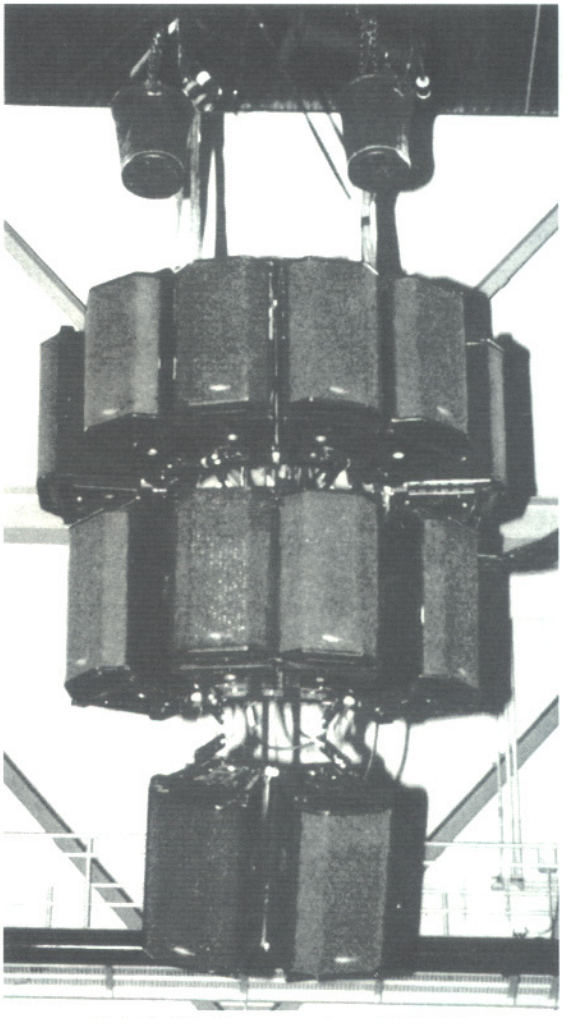

Fig 3. Modular Truss system from ATM Fly-Ware.
Photo courtesy ATM Fly-Ware, carson, CA USA.

The computer age will also touch the loudspeaker rigging industry. It is conceivable that servo motor driven loudspeaker flying hardware systems will work in conjunction with computer simulation and control software in order to steer loudspeaker arrays and optimize loudspeaker array performance from venue to venue.

As the field of loudspeaker rigging becomes increasingly more important, there is a large potential for innovative solutions to complicated problems. Be assured that loudspeaker flying hardware manufacturers continue to look for new flying hardware systems that will add safety and efficiency to the practice of flying sound reinforcement systems.

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