



Frank Sinatra . . . 'Singin' in the Rain' For 140,000 at Rios' Maracana Stadium

by Patrick Maloney

When Al Siniscal, president and owner of A-1 Audio, was asked by Bob Kiernan of Sinatra Enterprises to provide the sound system for the Frank Sinatra Concert in Rio de Janeiro to be held during the summer of 1980, he readily accepted. The fact that the concert was to take place outdoors "in the round" in the 150,000 seat Maracana Soccer Stadium, made the event a challenge Al couldn't resist. After all it was only November of 1979 — which left him with at least seven months to prepare for the concert. Eminently qualified to do a show of this size, A-1 Audio is experienced in all phases of the professional audio field and enjoys a reputation for providing reliable high-quality sound systems for star performers such as The Doobie Brothers, Paul Anka, Barry Manilow, and many others.

However, as Al got a little further into the planning of this show, he started encountering a few problems. Yes, the show was in the summer but summertime in Rio comes in January, not in June! The seven-month lead time shrunk to a month-and-a-half. Another problem was the fact that Brazil is situated in the tropics. It rains in the summer in the tropics — it rains every single day. In fact, the reason that the Stadium was available at all was because very few people like to play or even watch soccer in the rain. Why the promoters wanted to take the risk of doing a show with that much hazard of rain is perhaps another story. Nevertheless they did and A-1 elected to cope with it.

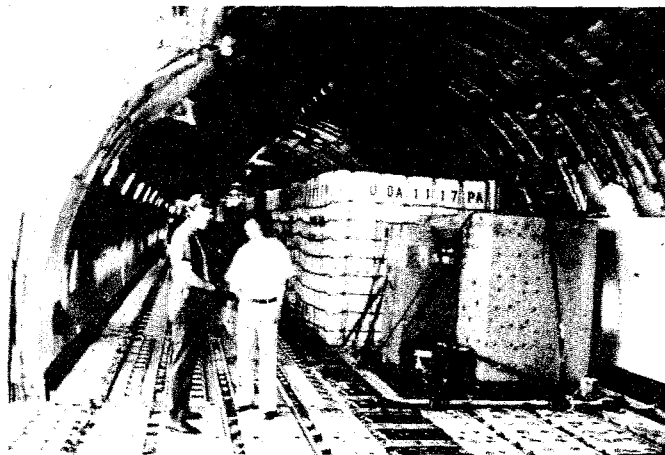
Coping with doing a show outdoors with an expected audience of over 140,000 people is challenging enough for any audio company. The additional fact that it was to be televised "live" throughout South America only added to the complexity. Having to do it in the round presented its own unique set of problems. But the very real possibility of doing it in the rain created an acute situation to be reckoned with!

The People

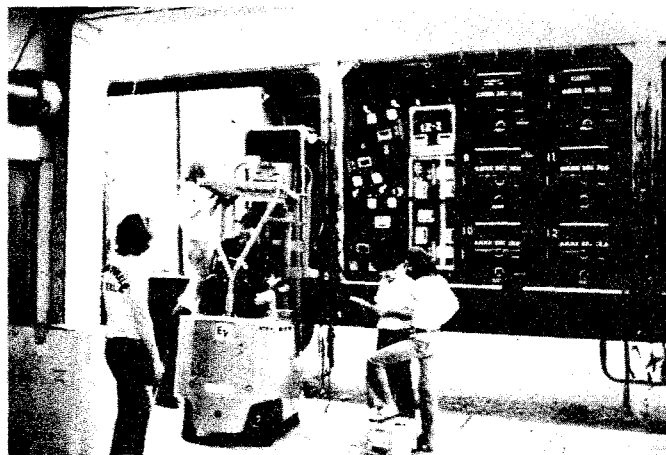
Bob Kiernan was the overall designer and production manager of the event working very closely with **Carlos Scorzelli** representing Artplan Publicidad, the Brazilian promoters. Bob, who has been with Frank Sinatra for many years, was responsible for mixing the sound as well as calling the lights, so he was in total control of the show. **Bobby Ross**, head of engineering at A-1 Audio, laid out all of the equipment and planned most of the show with the production staff that was going to Rio. The three people from A-1 who actually operated the show were Al Siniscal, Grey Ingram, and Pat Weber. **Grey Ingram** is chief engineer for the Doobie Brothers and is, according to Al, "a very knowledgeable engineer who knows electronic equipment in and out. We felt that since we were going as far away as Brazil we had to be totally self-sufficient because there were no local service stations anywhere to fix anything." Bob Kiernan specified that Al himself had to go if A-1 was going to do the show, as Al knows every resistor and wire in the system. The third person, **Pat Weber**, is presently an independent engineer who is working maintenance at Record Plant, Los Angeles, and who teaches a sound reinforcement course at the University of Sound Arts. Aside from being a qualified technical person, he also speaks Spanish and some Portuguese — the main language of Brazil. As it turned out, Pat's interpreting helped with the installation tremendously. The promoter did supply an interpreter, but since there were many tasks and activities happening concurrently there weren't enough interpreters around to get everything done in time. As a general comment about working where interpreters are necessary, they are rarely technically knowledgeable. So Pat was able to do a better job in this respect. Going to a foreign country without arranging for a full-time interpreter or bringing one yourself is a mistake you'll only make once!

continued overleaf





— loading the M-1's ...



... aboard the 747 —

Shipping

Physically moving all this equipment to Brazil was quite a task in itself. Steve Olikier, of A-1, was responsible for most of the arrangements for consolidating and shipping the assembled equipment. Two 40-foot airline trailers, each containing a total of four M-1 containers had to be used. M-1 is a designation given by Pan Am to the largest airline cargo container in the world — which is 8 feet by 10 feet by 8 feet high. This container will only fit on a Boeing 747 outfitted for cargo exclusively — there isn't enough room for passengers when one of these is put aboard the plane (see Figure 2). Pan Am simply dropped the containers off at A-1's facility in Hollywood, and A-1 Audio personnel actually loaded the containers themselves using their own forklift (see Figure 3). Permanently marked on the warehouse floor at A-1 Audio are the sizes of all the various airline containers presently in use. Equipment is stacked up within these boundaries to get an idea of about how many containers will be needed for the shows they do. Additionally, the company has a full 4 foot

by 4 foot loading dock-size scale so that everything can be accurately weighed before the containers are loaded.

The equipment was delivered to the airport four days before the plane was scheduled to depart. Not content to simply turn over the equipment to the airline and hope to see it all again in Brazil, Al took several steps to verify his containers' location all the way down the line. "I personally went down to LAX and went into the Pan Am 747 that our equipment was supposed to be on. I was at the airport prior to the loading, I watched our containers being loaded on the plane and then I crawled up into the airplane and personally verified the container numbers. It doesn't pay to just take someones word or rely on a handwritten sheet of paper. If the plane left and you didn't get a container on that plane, you're out of luck because there wasn't going to be another cargo plane capable of this kind of load for another week. Also, because of the scheduling of the planes, the containers had to be transferred onto a different 747 at an intermediate stop between Los Angeles and Brazil. We flew someone to that intermediate airport who supervised the transferring of

the equipment from the first airplane to the second one. This was also arranged with the respective airport personnel ahead of time, because normally they don't allow anyone to go into a 747 freightliner. We feel these steps are necessary because a shipment of this size and importance does not happen by itself. What if someone were to go home early and forget that we had to have all these containers on a specific flight? There are no excuses because when we have to do a show, we have to do a show!" Are these precautions worth the effort? Anyone who has ever shipped equipment through O'Hare Airport, in Chicago, knows how easy it is to lose something, and it's usually the case with the microphones!

Once the equipment arrived safely in Rio and cleared Customs (another whole story), it had to be transported to the Stadium. Again, careful pre-planning was called for and extra time was allowed to overcome this obstacle. Obstacle? What's so difficult about moving 25 tons of sound gear through the streets of Rio? Well, the main thing that must be considered is that in many countries such as Brazil, all the transportation equipment that is commonplace in the United States is

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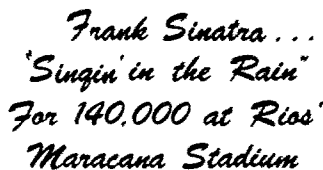
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Eventually all the gear got loaded onto four of these festively decorated vehicles which then made several trips back and forth to the Arena. At the airport there was a single forklift available at the Pan Am Terminal. At the Coliseum they used "Brazilian Forklifts," which consisted of about 25 laborers and a

According to Al, doing shows South of the Border takes at least four to five times longer to set up than similar shows in the U.S. In Brazil the basic laborers are paid about \$80.00 a month (there are no union regulations to deal with) so almost everything is a brute-force task, with little mechanical

Moats? Of course, there were the moats to contend with. Well, apparently Brazilian soccer matches are very exciting events and when you've got 150,000 very excited people in one place, moats come in real handy. At the edge of the playing field was the inner moat which was 10 feet deep by 8 feet across. Bordering this was a service road that was about 4 feet below the playing field, so someone would have to jump 8 feet across and 4 feet up to get across this first "moat." There was a second moat right in front of the stands that was about the same size. So all the equipment could only enter and leave the field from one side where a temporary bridge had been built across the inner moat. The musicians and Mr. Sinatra got to the stage through a tunnel which opened onto the field from underneath the stadium. There was one more special bridge built for the people who sat on the infield next to the stage. These people had paid about \$100.00 a ticket so that they could actually see as well as hear Sinatra, and they weren't considered likely to riot.

The stage itself was built in the shape of a six-pointed star which resembled a huge multi-colored Aztec sun laid out on the field. The orchestra was arranged around the

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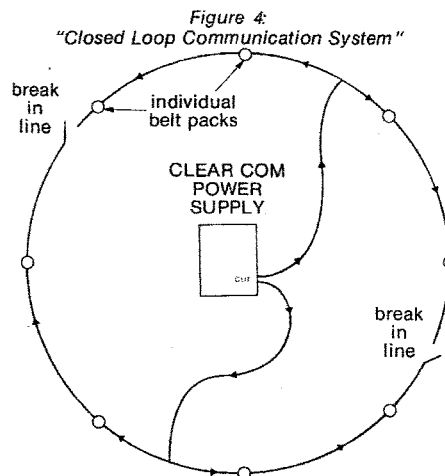
center of the sun and the six rays, extending outward from the center, served as ramps that Mr. Sinatra could walk out onto during the show. In designing the set Bob Kiernan had arranged for the inner PA system to be incorporated into the stage itself so that the loudspeakers would be evenly distributed around the perimeter of the set. This inner system consisted of twelve bi-amplified monitor type loudspeakers that were three-way systems containing a 15-inch JBL or Gauss woofer, a JBL 2441 mid-range driver and a JBL 2402 tweeter. In addition there were eighteen small two-way speakers that had 5-inch cones and a small tweeter. These were actually mounted right in the facing of the stage and were for those people who were seated immediately next to the stage. The twelve bi-amp speakers were located back at the inner points of the star. There were no speakers over the stage because they didn't want to interfere with any sight lines or television camera angles. The stage was about five feet off the ground. The inner system was designed to reproduce medium power levels since its intended audience was in fairly close proximity to the stage. The idea was to deliberately not overpower these close-in people in an attempt to have the inner system affect the audience seated 300 feet away in the stands.

The Outer System

The audience in the stands was covered by a much higher power sound system which was located around the perimeter of the playing field and was fed through the two digital delay units. This perimeter system was made up of twelve VIP (Vertically Integrated

Power) speaker stacks, so-called because of the manner in which they are assembled. These speakers were set up on the playing field side of the inner moat so that the sound had a chance to disperse across the distance between the two moats before it reached the people in the stands. Each individual VIP stack could therefore be run quite loud and could cover a fairly wide area without blowing anyone out of their seats, since the closest anyone could get to a speaker was at least 50 feet. Individual VIP systems were then located about 90 feet apart all the way around the perimeter of the field. Given the 90° pattern of the horn and the distance to the seats, this spacing gave them about a 50% overlap in coverage from one seating area to the next. If any single speaker stack malfunctioned, that area would still be adequately covered by the two adjacent VIP systems. Of course, the level would be lower in this area, but at least the sound would still be clear and intelligible. This is an example of the importance A-1 Audio places on reliability. Everyone in the stands was listening to at least two speaker sections at all times. Each coverage section contained about 10,000 people!

The location and layout of the speakers was all done from drawings and photographs of the coliseum before the staff ever left the States. Distances between the speakers, the stage, and the console areas were determined from scale drawings and the proper cable lengths were prepared. Everything was pre-labeled as to its specific use so that time would not be wasted on location. It took quite a long time just to lay the cable out, mainly due to the fact that

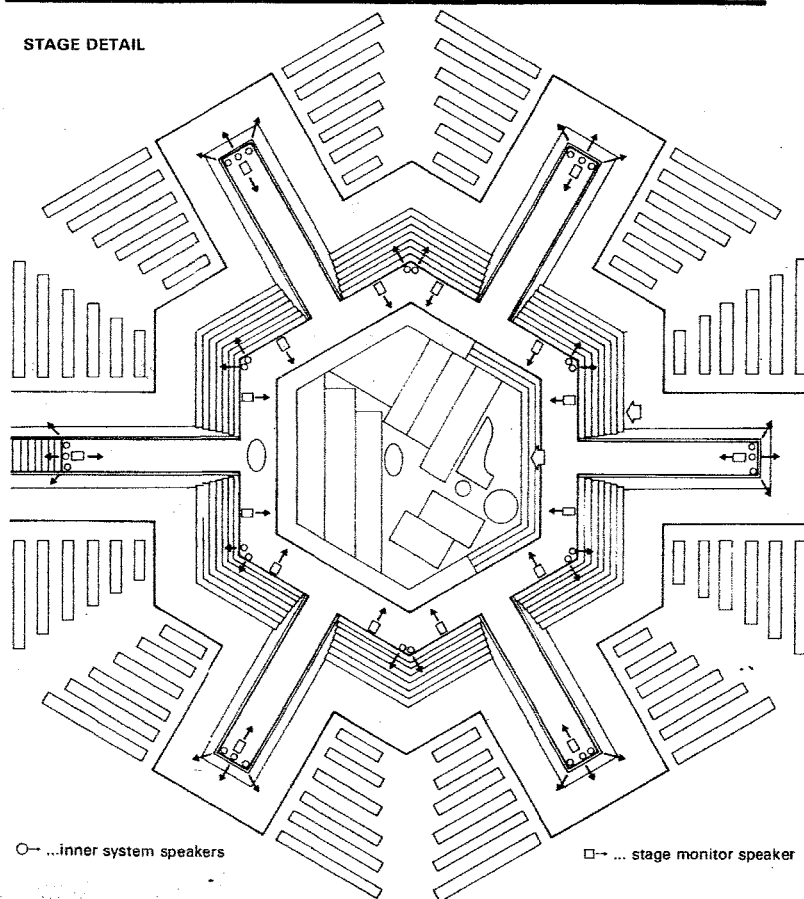


○ ... 51 belt pack stations for sound and lighting, around three quarters of a mile of wire.

distributing the speaker system around the perimeter of a soccer field uses up a heck of a lot more cable and installation time than if the show were being done from one end of the field, as is normally the case. A-1 Audio was also responsible for installing the 45-position intercom system which included running cable along the top outside rim of the stadium to the follow-spot lighting positions. The ellipse of the Maracana Stadium was about 1,000 feet across at its widest point, and the perimeter around the top where the follow-spots were located was about 3,000 feet in length. The top of the grandstand is about 100 feet, or about 10 stories high. You can now get an idea of how much intercom cable they had to use. Since it took about 3,000 feet to get around the perimeter and another thousand feet to get down on either side, it ended up being about a mile run altogether. The intercom system used by A-1 is made by Clear-Com and was hooked up in a novel manner which again underscores A-1's concern with system reliability.

They ran what A1 refers to as a "closed loop communication system." First, they ran the Clear-Com cable in a completely closed loop to all the spotlight stations. Then they picked the two furthest extremes of the loop and ran two separate lines down to the Clear-Com main station which was located at the console. A break could occur in two places along the loop and complete communication would still be maintained (see Figure 4). There are a lot of connections in a mile's worth of 50-foot cables, so they figured it would be reasonable to assume that there might be a possibility of failure at an inopportune moment and therefore designed the system so that there could be two failures in the line and the show would go on as planned. There was so much space to cover and so much wire to trace that it was quite possible a fault couldn't be corrected during the time span of the show — hence, the closed loop. The Clear-Com is so wired that you can come out of an output at the main station, loop through a series of belt packs, and come back into another output on the main station using a three-pin reversing connector. You could actually come out of the main station with a third cable to the same multiple belt pack loop for an additional back-up line if the situation warranted it.

STAGE DETAIL



○ → ... inner system speakers

□ → ... stage monitor speaker

— continued overleaf

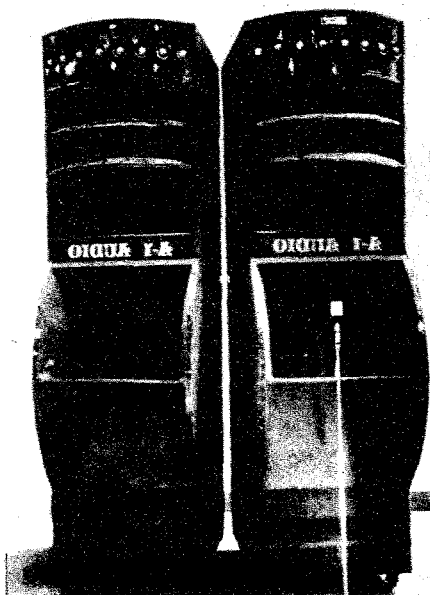
Frank Sinatra . . . 'Singin' in the Rain'

The VIP System

The VIP is a three-way tri-amplified system in which the bass units reproduce the low end response from about 25 Hertz to 500 Hertz. The mid-range section consists of two precisely coupled horns which operate from 500 Hertz to 5,000 Hertz — at which point the tweeters take over. There are eight tweeters in each cabinet which are set in a 90° convex curve that focuses back to the same vertical axis that the mid-range drivers pass through. This point is a little further back from the center of the woofers' voice coils. According to Siniscal this physical alignment of driver elements was developed using the Hewlett-Packard 3580A Spectrum Analyzer and achieves approximately the same result as that obtained from the latest electronic delay techniques. The bass cabinet (Figure 5A) contains two 15-inch Gauss 4583 woofers rated at 400 watts RMS apiece in a bass enclosure which measures 7 feet tall by about 3 feet wide by 4 feet deep. Each 8 ohm woofer is driven by one-half of a BGW 750B stereo amplifier which is mounted in the bottom of the cabinet itself. This assures a very high damping factor and excellent direct coupling to the transducers.

There are two AC connection points to the amplifier mounted on each cabinet . . . either one of which will power the amp (see Figure 5B). Whichever one is not being used is automatically shut off by a relay which is in turn powered by the AC from the connector that is being used. The AC sockets are located at the top and bottom of the cabinet to simplify hook-up — depending on whether they are being wired from above as is normal in a hanging situation, or from below. This makes for a cleaner cabling set-up. After all these bass cabinets are seven feet tall!

Figure 5A: Two VIP Series stacks with mid/high cabinets mounted on top.



According to Al, "the bass amplifier has a tremendous amount of reserve capability and since it is running at 8 ohms and not at 4 ohms, the amp runs much cooler. Also, the reserve power that is available enables it to cleanly reproduce a signal that contains a lot of repetitive low frequency sounds. The amp is rated at about 250 watts into 8 ohms, so the speaker can withstand about twice as much level as the amplifier is capable of putting out without clipping."

The mid-range/high frequency cabinet (Figure 6) houses two JBL 2482 Compression Drivers attached to two JBL 2350 horns. They are very carefully aligned in the vertical plane at 4,000 Hertz in order to get them to couple efficiently. Al states that, "The advantage of doing this derives from the fact that two drivers coupled are theoretically equivalent to the output of four drivers. In reality, however, it ends up being equal to about 3½ drivers because things don't couple quite that perfectly even though we align them as best we can. By permanently aligning the two horns, we have more of a unified mouth area than you can get by simply stacking two separate horn cabinets on top of each other. We also achieve a lower cut-off frequency than is possible with a single horn, due to the fact that the larger area provides for a smoother transition to the low frequency." All the internal surfaces of the horn enclosure are packed and sealed with a high density pressurized foam which is poured into the cabinet once the horns are aligned in place. This foam is originally a liquid which expands and hardens in about fifteen minutes to permanently lock the two horns in place. This foam also effectively damps out any resonances inherent in the horns themselves and prevents the ringing that is largely responsible for the typically nasal sounds of many horn loaded mid-range cabinets. The result, says Al, is a much more natural sound which is especially noticeable on vocals.

The power connectors to the high frequency cabinet are of the twist-lock type

Figure 5B: Rear view of two complete VIP stacks.

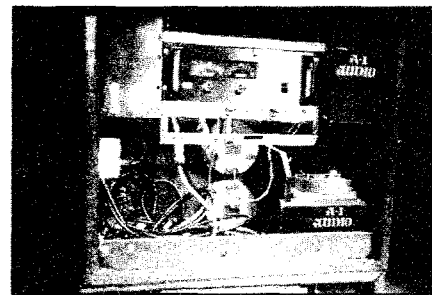
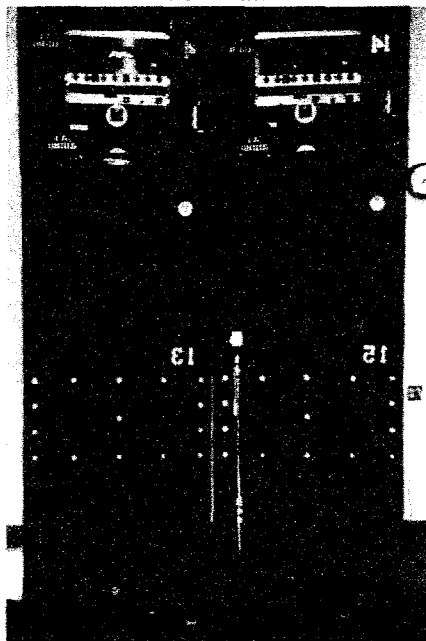


Figure 6: Rear view of VIP mid/high cabinet.

to ensure that power cables don't vibrate or otherwise pull loose during a show. Again, they use a single BGW 750B amplifier in each cabinet to power the mid-range and the high end. The two 16-ohm JBL 2482 mid-range drivers are connected in parallel — thus placing an 8-ohm load on only one channel of the amp. This configuration results in at least 250 watts being available to power both of the drivers which effectively prevents the amps from going into clipping. A-1's design philosophy is to eliminate limiting at the amp in order to preserve as much dynamic range in the system as possible. Instead they prefer to utilize speakers that can withstand more signal level than the amps are capable of producing before the onset of clipping. The other half of the 750B amplifier powers the eight JBL 2402 tweeters which are wired in a series-parallel configuration. "The reserve power capability for this combination of components is absolutely fantastic," Al states. "The amplifier is just coasting all the time." As with the bass cabinet, the 750B amp is integrated into the back of the high range cabinet.

The line level audio signals are brought out to the power amps from the console area via an 11-pair snake cable. They can also be transmitted via three independent cables utilizing standard three-pin XLR connectors to carry the separate low, mid, and high signals — although the snake is generally preferred. This 11-pair cable uses a military type jam-nut connector which provides a very quick positive connection and eliminates the possibility of stripped threads. The 11-pair cable provides the flexibility of sending three separate three-way signals down the line, i.e., left low, mid, high; center low, mid, high; and right low, mid, high — as well as a single full range signal. A three-position switch on the back of each VIP system then selects which one of the three three-way signals it will amplify. The concept behind this came from Grey Ingram who needed a system for The Doobie Brothers that would allow him to run a common cable to all the cabinets and still maintain flexibility in the hook-up. Each cabinet could then be switched over to left, center, or right depending on its position in the system. Even though the system was run in mono in Brazil, these three channels proved to be very useful indeed. This feature allowed both delayed signals to be available at each VIP stack at all times without having to switch between feeds at the console. Initially, it was difficult to determine which delay would be most appropriate for each speaker stack since they were all located on an ellipse relative to center stage. Having the ability to switch

Frank Sinatra . . . 'Singin' in the Rain'

from one delay to the other at each individual speaker made this particular task quite easy and saved a considerable amount of time and cabling. "We simply had a guy with a walkie-talkie go around to each VIP speaker and switch from one delay to the other while another member of the crew listened in the stands and communicated back which delay sounded best," Al recollected. "This had a lot to do with getting a good quality sound in the arena."

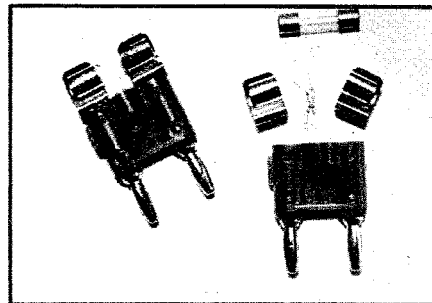
And now we come to another clever idea that scored a 7, a 7, an 8, and a 9 from our hard-nosed judges in the *American Ingenuity Finals*. Located on the back of each speaker cabinet and connected between the output of the amplifier and the input to the speakers is a clever banana plug connector which has several uses. First of all, the bass cabinet is quite rigidly built and solid and it would be extremely difficult to get at the terminals of the loudspeakers for testing. Then, too, being able to quickly and easily open bass cabinets tends to undermine their rigidity in the first place. So, instead, A-1 Audio brings out to a test point both the output of the power amplifier and the input to the speaker on a standard banana plug socket. Dual banana plugs are then used as jumpers between both the plus side and the minus line to each speaker — with the minus jumper being normally hard wired across the two

prongs. As an added safety factor, however, the plus jumper is not simply hard wired. Instead A-1 Audio has installed a standard fuse holder to the plug through the little holes where the set screws normally go. A fast acting, low resistance fuse was then selected to prevent damaging signals from reaching the speakers. Then, wired in parallel with this fuse, there is a tiny, 48-volt incandescent light bulb that fits right into the round wire opening on the side of the standard MDP banana plug. So in the event a fuse ever blows, the resultant open circuit forces the signal to flow through the light bulb, causing the bulb to light and thus indicating which cabinet has malfunctioned. Since the light bulb has a resistance of its own, the amount of signal reaching the speaker is lessened considerably and damage prevented.

Now, obviously, a normal off-the-shelf fuse is not the most precise device to begin with and can blow at anywhere from 200 to 400 per cent of its value. For this reason A-1 uses only precision made 4-amp fuses that blow a lot closer to their rated value. The company puts a great deal of emphasis on operating the system correctly in the first place so that the fuses are never called to duty. In the unfortunate event that something rude does happen, it's a lot simpler, faster, and considerably cheaper to replace fuses than loudspeakers. Especially if the fuses are already attached to banana plugs that can be quickly inserted. These handy little plugs are available directly from A-1 Audio, pre-wired and fused, for \$19.95 each.

As was pointed out earlier, the VIP system

... winner in the
'American Ingenuity Finals' —



is designed with the power amplifier mounted in the speaker enclosures themselves. Al describes his reasoning behind this approach: "The purpose of this is first to improve the damping factor of the system by essentially eliminating the speaker cable. Trying to transmit high speaker level signals long distances and dealing with the problems of large resistances through the wires didn't make as much sense to us as did using normal mike cable to carry line level signals. This, of course, was a big help in Brazil where individual cable runs to the VIP systems on the perimeter of the field would have been incredibly long. Also, the possibility of phase reversals is eliminated since the cabinet is correctly wired when it is first assembled and then it is left alone." But what about a normal concert situation wherein they have a stack of speakers on each side of the stage and an amp goes out in a bass cabinet, for example? A short 3-foot cable with banana plugs at both ends is all that is needed to parallel patch into a neighboring amplifier. Of course, this amp is now looking at 4 ohms instead of 8 — which actually is not a problem at all since the BGW 750B is rated at this load to begin with.

This author's main concern with this approach had to do with the system's recoverability from a malfunctioning amplifier in a concert situation in which the system is hanging at least twenty feet in the air — a bit out of reach for most of us. "If a problem develops during the day, at sound check for instance, we will change out the amplifier entirely," Al explained. "But if it happens during the show, we probably won't do anything unless it is in a critical location — at the end of the cluster, for instance — where its failure would be very noticeable since that area isn't overlapped by another system. We usually have so many speaker systems up in the air that it's not a serious problem if one goes out. If it's critical enough, however, a rigger will go up and make the necessary patch. Generally speaking, once it is operating and in the air, it is extremely rare that anything goes wrong. If a problem occurs at all, it is usually due to the handling the unit gets when it is loaded, driven 500 miles, and unloaded again night-after-night. Also, the systems are hooked up and tested while they are still on the ground. We feel that the advantages of having the amps located in the speaker enclosures — even though they are hung twenty feet above the stage — far outweigh any disadvantages that might be encountered. The chance of it failing in the air — well, it just doesn't happen. One of the secrets, of course, is to use reliable amplifiers."

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In addition to the BGW 750B, A-1 Audio uses quite a number of Yamaha P2200 amplifiers as well. All the systems that were taken to Brazil, however, utilized the BGWs due to their quick-change heat-sink assembly which contains the 10 output devices and all the input circuitry. Once you remove the top of the amplifier, you can unplug the whole channel from an octal socket and plug in a new one in a matter of moments. They took several spare heat-sinks to Brazil, but were fortunate in that none of them had to be used.

The Monitor System

The monitor speakers were composed of a 15-inch JBL K130 or Gauss 5840 woofer; either a JBL 2441 or 2440 compression driver for the mid-range; and a JBL 2402 tweeter. Each of these three-way monitors was bi-amplified by a single BGW 750B amp with one side of the amp powering the woofer and the other side driving a passive crossover that fed the mid-range and tweeter elements. Eighteen monitor speakers were used in Brazil for Mr. Sinatra, and were actually inset into the floor of the stage itself. One was located at the end of each of the six sun rays and there were two in between each ray around the center part of the stage which accounted for the remaining twelve. These monitors were all fed from a central point individually so that any one line could malfunction and the rest of the monitors would not be affected. Al said he went to this extreme because, "After all, Sinatra had to hear in order to do the show. There is no 'Take Two!' I think it is extremely important in sound reinforcement to realize that there is no 'Take Two.' There is only 'Take One' and it's not 'Take One an hour from now,' it's 'Take One right now!' This is one area that I spend probably my whole life working on and my company is geared toward maintaining this attitude."

Crossovers

The crossovers for the VIP system were Yamaha F1030s that were located at the console position. These are three-way crossovers with separate controls for the low, mid, and high frequency turnover points, and which contained a visual clipping indicator. The frequencies are front panel selectable and can be rolled off at either 12 or 18 dB per octave, on either side of the crossover points. This flexibility allows you to play some games with the normal response of your system. For instance: say you were in an environment where you wanted a little more build-up between 500 Hertz and 800 Hertz. You could therefore set up the woofer to go out to 800 Hertz with a 12 dB per octave roll-off and then extend the horn down to 500 Hertz with an 18 dB per octave cut-off. Now, I'm not saying that this is the best way to achieve this result, but only that it is a possibility with this crossover. All the various settings on this Yamaha crossover are absolutely repeatable because all the controls are detented. "I worked with other manufacturer's crossovers where they talked about how nice it was to be completely variable," says Al. "To me that is just absolutely impossible to work with. It is unrealistic to believe that when the unit

bounces in a truck for 500 miles, it isn't going to shift a little — or you accidentally brush against it and it changes. Well, I just can't tolerate that much shift. Another nice thing about the Yamaha F1030 is that there is a phase reversal switch right on the back of the unit. You can throw the mid-range in or out of phase with relationship to the high end just by throwing a switch. It's a fine crossover and works very well for us."

A somewhat modified JBL 5234 stereo crossover with changeable frequency cards was used for the monitor speakers. The first modification involved installing Jensen input transformers in place of the unit's differential input to guard against damage from stray AC on the line and other dangers peculiar to road work. A custom designed 18 dB per octave,

20 Hertz, low-cut filter was installed in the crossover to limit the low frequency response. According to Al, there isn't anything coming out below 20 Hertz that's useable anyway — just a lot of rumble, stage noise, and the impact from the occasional dropped microphone.

Sinatra's monitors were run off the house console which was a Yamaha PM2000, 32-in by 8 outboard. There was no separate stage monitor mix as they felt it was unnecessary with only one vocalist and they really didn't need another level of complication added to the show. Keeping everything as simple as possible, yet flexible enough to do the job, is a key point in maintaining system reliability. A-1's dedication to reliability is evident in all phases of their operation including the



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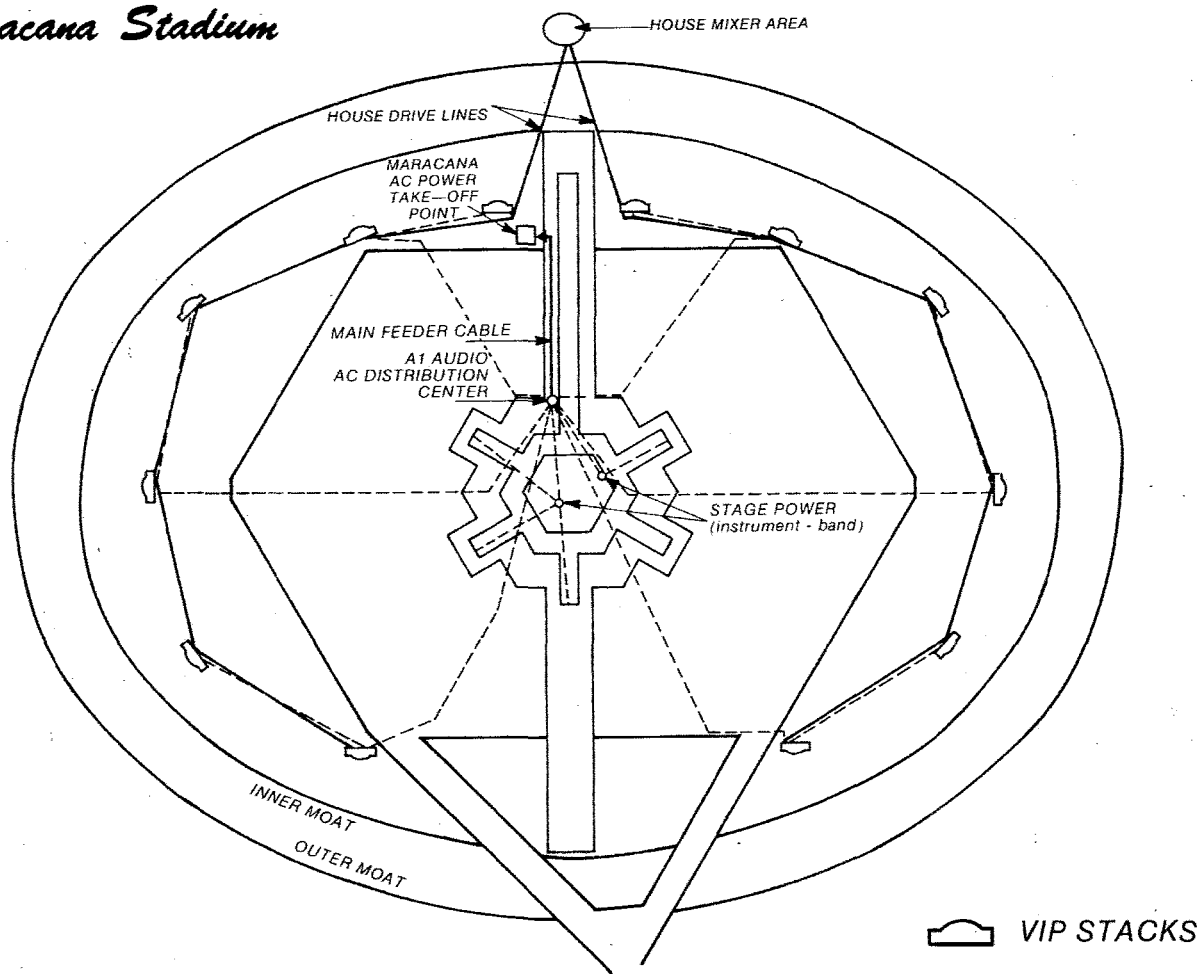
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Maracana Stadium



construction of the road cases. All their equipment racks are of the "case within a case" design. They first build a very rigid inner frame out of 13-ply Baltic Birch Plywood on which they mount front and back rack rails. This enclosure is then placed inside a foam-walled shipping case which is made with removable front and back lids. Any shock given to this case is absorbed by the foam and the force to the rack is evenly distributed and significantly reduced. They preferred a front and back lid approach as opposed to the lift-off top concept which can result in a lot of large empty boxes stacked on stage and in the way.

Cable reels are used for storing and transporting the microphone cables. All mike cable are labeled with different colored strips of heat-shrink tubing according to their length and there is a sample piece of color coded cable on top of each reel. Stagehands are then told to simply connect all similar color coded cables together and wind them onto the reel with the matching sample strip. This also provides for a fairly good way of checking the cables out ahead of time since the end cable comes out of the hub of the reel and a cable checker can be used between the first and last connector to make sure that all the cables on the reel are okay. The main advantage to this system, however, is the fact that the cables are not all knotted up. Extensive use of sub-snakes also cuts down on the length and number of individual mike cables needed.

Microphones

AKG C451 condenser microphones were used extensively on this show, especially on the large twenty-piece string section. Contact pick-ups were avoided in order to get a more natural ensemble-type string sound. Sennheiser 421s, Shure SM-57s, and SM-58s rounded out the microphone complement. A Helpinstill piano pick-up was used in conjunction with some live overhead mikes to pick up the piano. Direct boxes equipped with Jensen transformers were used and are manufactured and distributed by A-1 Audio themselves. AKG mike stands were used on this show and are favored by A-1 due to their robust nature and collapsible bases which simplified shipping considerably. Atlas type stands with screw-on bases are also available if requested by vocalists.

Microphone Splitter System

The splitter system was transformer-isolated with direct lines feeding A-1's equipment and an isolated split going out to the television truck. The snake connectors are circular military multi-pin connectors that are ordered from a military supplier and come with locking jam-nuts to again avoid the crimping and stripping problems common to screw-on connectors. The mating pins are all gold-flashed and are quite durable. A-1 uses the AMP connectors as well, but chose this military approved system for Brazil since it has a very tight seal that is

superior in keeping out moisture — one of the major factors they had to contend with. In this particular case the transformers in the splitter boxes were Triad A66J, which are actually console input transformers. Jensen transformers, however, are used in all the splitters currently being built at A-1 Audio. This splitter provided for 36-input and 10 return lines, while two additional 6-pair snakes carried signals to various speaker systems. So there were about 60 lines in all carrying audio information between the console and the stage. The isolated split that was made available to the television company terminated in three-pin XLR male connectors which they then plugged into their own input snake box. The audio connectors and wiring configuration of their snake was the same as A-1's, so there was no problem at this point. But, as you may have guessed, a problem did crop up. Personally I don't trust frequencies that I can't hear and I always approach television tie-ins with one eyebrow raised. A hum problem arose due to the fact that the television truck was parked quite a distance away and was tied into a different AC power source than the one used by A-1. A potential difference was created that was aggravated by the long feed-line and wasn't eliminated until the television crew grasped the fact that they had to be tied to A-1's AC system. For some reason they didn't feel it was at all necessary and this turned out to be one of the biggest problems A1 and his crew encountered. This is, no doubt, where

Pat Weber's technical interpreting expertise earned him his T-shirt.

AC Power

The power that was available from the Maracana Stadium was three-phase at 100 amps per leg, with a neutral and no ground. A-1 used two of the phases and the neutral and drove a copper stake about four feet into the ground at their power distribution point to provide a solid ground just as a safety measure. They could have used a floating system, but felt it was better to provide their own ground especially since there was so much rain at the time and the grass was always soaking wet. By the way, this is the first time that a concert had ever been held in this coliseum, so they had to be extra careful that it was safe and accident-free. They brought their own power distribution system and feeder lines and tied right on to the main power source located under the grandstands. The power distribution alone was quite some project as thousands of feet of AC cable were required just to power the outer VIP systems.

"We always trace the power back to its source," Al maintains. "I feel it is important that we walk the line back and see where it's coming from. We made certain in Brazil that we were isolated from the lighting system, for instance. We also brought our own electronic instantaneous voltage regulator to provide a stable source of AC for the audio consoles and all the low level, signal processing electronics, reverb chambers, etc. In foreign countries you can never be

sure how stable or reliable the power is going to be. There may be some instantaneous shifts or power spikes that come down the line. The voltage regulator that we used to protect us from these fluctuations is capable of handling about 30 amps and puts out exactly 117 volts AC if it receives anything from about 95 to 135 volts. It can be set to produce 120 volts AC or 115 volts AC or whatever else you want. Anytime the incoming power drops below 95 volts or rises about 135 volts it changes the output on an approximately linear scale. In other words, if you have 140 volts AC across the input to the regulator, it's going to put out 117 volts plus 5 volts for a total of 122 volts — at which point the internal regulators of the power supplies in the console start working. We have found that this is a mandatory system to use when traveling in foreign countries — especially in a country that is not highly industrialized." There was no regulation on the AC lines that fed the power amplifiers, but since they were not drawing a tremendous amount of current, there was plenty of leeway in their operation. In Brazil, because of the tremendous size of the event, extra power was brought in which helped to keep the power stable. The changes in the line voltage were fairly small with the input to the regulator ranging from 126 volts to about 118 volts AC. "But we have noticed great changes in Mexico," Al stated. "We had a situation once in Mexico City where the power amplifier in a small speaker/amp was not plugged into a regulator — it caught fire and the speaker burst into flames on the

stage."

An RCA Line Voltage Meter was connected across the output of the voltage regulator to make sure that it was operating correctly and producing a steady 117 volts. A-1's power distribution system has a digital voltmeter and a digital ammeter connected between each phase and neutral on the primary side of the panel between the master fuse and the bull switch. This enables them to make certain that the power is correct before throwing the switch that feeds their equipment at 117 volts. A 220 amp breaker powers several sub-breakers and it is to one of these sub-breakers to which the instantaneous electronic voltage regulator is connected.

Protection From Rain

Unstable power was not, as it turned out, a problem in Brazil. The real problem was rain — and lots of it. The consoles, microphones, cables, power distribution, speakers — in short, everything — were subjected to a downpour every single day. In order to ensure that it would all still work when the downbeat came, Al and his staff took several precautions that are generally unnecessary in a normal concert situation. They used Switchcraft Gold-flashed XLR Connectors on all mike cables and suspended the cables in the air whenever possible. They used only high-quality Beldon 8412 and 8413 mike cable (which was made especially for them with their name imprinted every foot or so right on the cable). All the connections along an audio cable run were put up on pieces of wood. If

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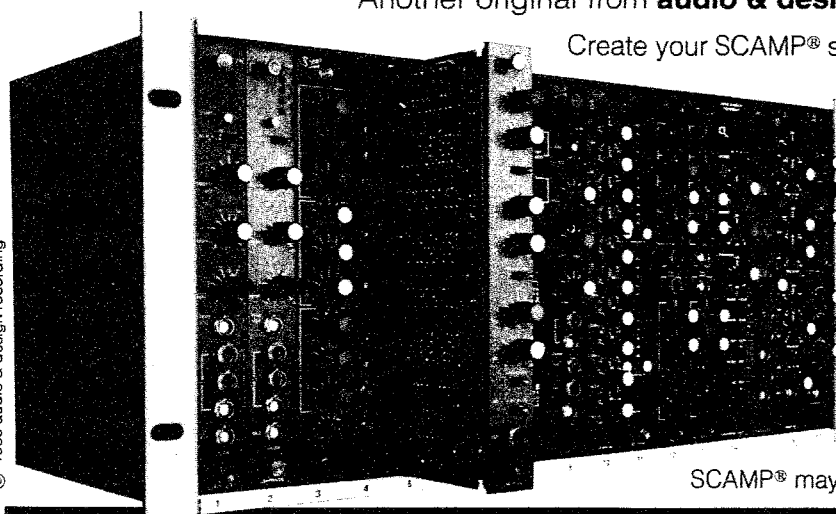
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Frank Sinatra... 'Singin' in the Rain'

they were in a highly wet situation, tape was wound around the connection. "The signal shield in a microphone cable is not tied to the case of the connector," stated Al. "That mode of wiring could have caused terrible problems in the watery situation we had down there." Critical connections were covered up with plastic and the ends taped to make them waterproof. Several rolls of heavy-duty plastic were used to cover everything on stage as well as the power distribution, the audio consoles, the processing rack, and everything else exposed to the open air (see Figure 7). Now, since it was actually raining during rehearsals, a way to protect their expensive microphones without physically removing them and stopping the rehearsal had to be devised. How do you set up a \$350.00 microphone in the rain anyway? Most people don't even want to get a speck of dust on them — much less have the diaphragm and electronic components subject to that much moisture. The solution? "Baggies" from a Brazilian supermarket. The same kind you would pack your cheese, avocado, and sprout sandwich in for lunch. Acquiring the thinnest Baggies they could find, they were put over the microphones and secured with rubber bands. Sound checks were done with the Baggies on all the time. Very thin polyethelene, they found, did not significantly reduce the transmission of sound. The Baggie wasn't stretched tight over the mike at all — in fact it was quite loose. Having realized it was going to rain, the crew had brought down a much thicker plastic with which they had originally intended to cover the mikes. But this turned out to be too thick to keep on the mikes all the time. The particular gauge of plastic that works the best is the kind from the supermarket used to bag your own vegetables — if you can ever get them open.

Strong, hefty, expensive Baggies don't work as well as the thinnest, cheapest ones.

I must admit to a bit of skepticism of this whole affair — especially regarding the fact that something cheaper might actually be better — so I experimented with four or five different gauges of bags and Baggies myself and found that the vegetable bag is indeed the best. It's also rather humorous to see someone singing into a brightly stencilled carrot! On the basis of one grape per bag you can get a whole orchestra worth of protection for under fifty cents and have a healthy snack at the same time. Of course, there is a slight quality difference in the sound from the microphones but it really isn't very much! There is no need to punch little holes in the end of the bag either — acoustically the Baggie just doesn't seem to be there. "Subjectively it was outstanding," Al told me. "It really had a very minimal effect on the sound."

"I was recently talking with Ron Means, the professional division manager at JBL, about how to best protect the mid-range drivers in a highly wet environment. Even though the driver comes with a protective screen further back in the throat, he suggested putting a piece of polyethelene — normal Baggie material — between the horn and the opening of the throat at the end of the driver. In all the drivers that went to Brazil that January, however, we installed an additional protective screen of fine metal wire mesh right where the horn bolts onto the surface of the compression driver. We called both Gauss and JBL and got the same info from both of them regarding the appropriate size of screen to use. I also talked with Algis Renkus, formerly with Emilar and now with Renkus/Heinz, Incorporated, and discussed the problem of putting an additional layer there. This was done before anything was shipped down to Brazil because we wanted to have a second layer of defense keeping the moisture, the condensation, and the dirt out of the drivers. When showtime comes we can't have water in the phasing plugs!"

Another step that was taken to guard against the rain was to cut up pieces of cloth which were then kept in the throats of the speakers at all times except when actually doing a sound check. The entire speaker stack was then covered with heavy plastic which was tied down with rope to prevent the wind from blowing it off during the night. These precautions can apply anywhere where there are outside shows — i.e., in the outdoor summer theaters in the Midwest and on the East Coast where summer storms are not at all uncommon. The additional protective screens were not taken out of the drivers when the equipment returned from Brazil. In fact, Al liked the idea so much that he is incorporating it into everything he has. Some of these drivers were disassembled to see if there was any damage or corrosion and they proved to be just fine. Some of the screens were dirty, of course; but were easily cleaned since they were located right at the throat of the driver. This eliminated the risk of possible damage to the driver from an air hose or contamination from normal handling.

The Show

All these protective measures and weeks of careful pre-planning were finally put to the test the day of the show. As Al remembers, "It rained the afternoon of the show but that didn't stop the people from pouring into the stadium as fast as the rain did. They parked their cars in the middle of the streets around the stadium and the whole area was soon blocked to traffic. It was a big event in Brazil, and since it was being televised live all over South America, the show had to start by 9 p.m. at the latest. The show was scheduled to start at 8 o'clock, but they would keep the stations on the air until 9 o'clock if there was a delay due to rain. If the show didn't start by 9 o'clock, they would shut everything down, and in typical South American fashion, they would come back do the show the next night. It is almost impossible for us to believe that they were going to tell 140,000 people to go home and come back tomorrow, but nevertheless that was really the plan. So at 7 o'clock the night of the show it was raining. Nevertheless there were 140,000 people in those stands and everyone was cheering — the people on the field in the expensive seats were getting very wet and nobody seemed to mind. There was no pre-show entertainment; no lead-on acts at all. There was just the anticipation of Sinatra. It wasn't really cold since it was summertime, but it was definitely wet!

"You can just imagine the possibilities for failure. It's raining. It's just prior to showtime and we've still got all of our speakers covered up. We've got cloth in all the throats. We've got plastic Baggies over all the mikes. We've got all the power distribution covered up and we've got the consoles covered up. Imagine trying to do a sound check under those conditions.

"At 8 o'clock when the show is scheduled to start there is still a heavy rain falling. The spotlights are starting to fire up and you can see the lights shining down into the arena. Thirty spotlights cutting through the falling rain is a very dramatic sight! That, together with the roar of 140,000 people is just

— rain... the afternoon before the show... baggies... more rain...



phenomenal. But even though it's 8 o'clock you can't very well uncover the piano, and the string players — especially Sinatra's string players with their Stradivarius violins — are not about to come out and play in the rain! At least they certainly don't want to. Needless to say, the television people don't want water on their expensive camera lenses either. The show has got to start pretty soon or everyone has to come back tomorrow night — a situation nobody seemed to mind too much, except for me, that is. I was sort of in a panic! To feel that we would not be able to do the show was such a tremendous let-down. The excitement was just tremendous! The musicians finally said that as long as it wasn't pouring down rain, they would go out there and play and would just keep drying off their instruments. Sinatra's people were extremely willing as well. Everybody was extremely willing — but it was just a matter of not being able to do a concert in a downpour.

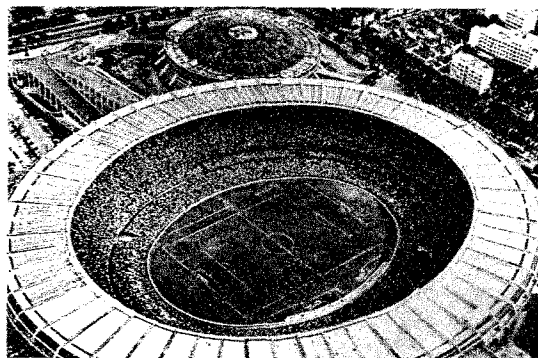
"The local Brazilian people were used to this and took it all for granted. Nobody was concerned among the Brazilian people. If they had to come back tomorrow night, they would all come back tomorrow night. No big deal! Well, it's now about 8:30 p.m. and it's still raining. But it slowed down a little and by 8:45 it was down to a light drizzle.

"Then at 8:53 the rain had essentially stopped and the word was given to start the show. So we had only seven minutes to start the show! We had laborers placed at all the strategic positions on the field whom we had trained during the week to prepare for just this kind of situation. After all, there were

only three of us on this job plus, of course, Bob Kiernan on whose capable shoulders fell the responsibility of giving the technical go-ahead for the show. I must say that Bob did an outstanding job. He was just superb. So as soon as he gave us the word we uncovered everything, took off all the Baggies, got the system completely operational in six minutes and started the show at one minute to nine."

"MY GOD!"

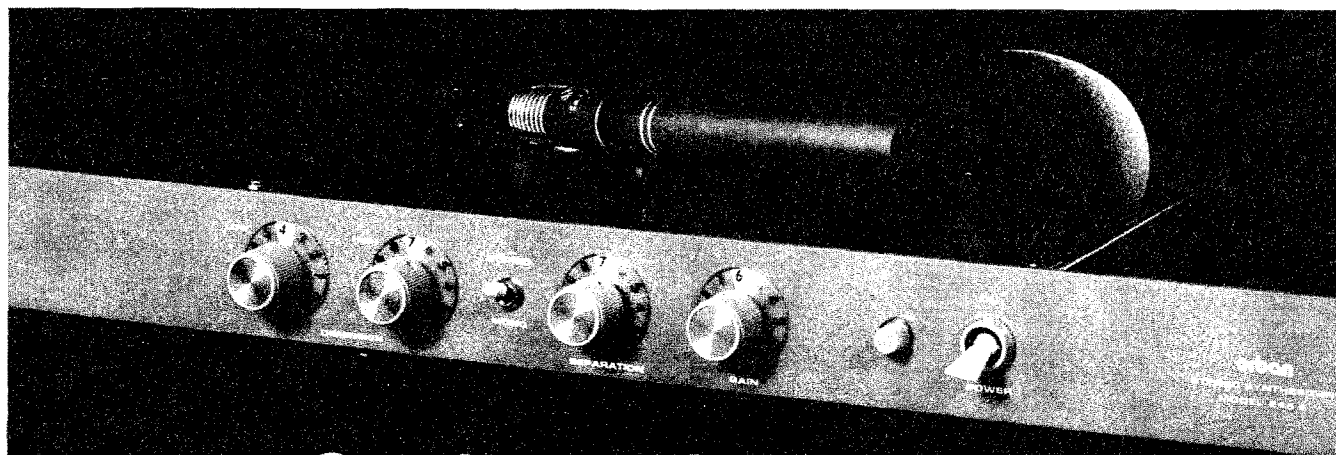
"Mr. Sinatra walked out of the underground tunnel, came out onto the stage, and when he saw 140,000 people surrounding him, said just two words . . . "MY GOD!" He then walked up onto the center stage and did a great show which lasted just one-hour-and-fifteen-minutes, including numerous standing ovations. Now it must be remembered there were no warm-up acts, no comedians, no Mariachis, no closing bands, no anything — it was just Sinatra. The show started at 9 o'clock and it was over at 10:15, and it was just fantastic! The lighting people who were up on the rim of the stadium told us later that the sound was absolutely perfect. We got tremendous reviews on the quality of the sound because it was evidently the first time anyone had ever been able hear anything correctly in that stadium. Smaller events had been attempted before, but either the equipment wasn't set up properly or they didn't allow enough time,



— 150,000 seat Maracana Stadium . . . small arena at top is same size as L.A.'s Forum,

or they didn't have an inner and outer system. The Brazilian press had even been a little apprehensive going into the show. All down the line they were very concerned about whether the people would even be able to hear the concert at all! But, as the lighting people and the engineers from the television stations said later, the sound was absolutely crystal clear. It was free of a lot of reverberation effect; was very intelligible, and the string sound especially was just beautiful."

Then began the long arduous load-out. Because of the slow labor situation down there, it took all of that night and the next two days to get the equipment to the airport. After all, they again had to deal with that marvel of human engineering, the "Brazilian Forklift" — twenty guys and a couple of pieces of wood! □ □ □



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