

## USE OF TAPE RECORDERS IN AVIATION COMMUNICATIONS

### New Multi-Channel Recorders Provide Accurate and Continuous Record of Air-Ground Radio Communications

It takes a lot of talk to fly a plane. And mighty important talk it is, too. From the time the modern airliner leaves the ground until it reaches its destination, the pilot is in constant radio contact with ground stations along the route. From them he receives weather reports, flight instructions, and possible re-routing to avoid local storms. He is kept informed of the movement and altitudes of other planes flying the same "lane". Also, he is required to keep ground stations informed of his position at regular intervals and to report expected time of arrival at the next scheduled terminal. In instrument weather the pilot may depend largely on verbal instructions from the control tower to "talk" the plane down for a safe "blind" landing.

The very nature of these vital communications indicates the desirability of keeping some kind of accurate record for possible future reference. Although this is not required by the FCC, many progressive Airlines have made the recording of all plane-to-ground and ground-to-plane communications a part of their standard procedure. In this application, magnetic tape has been found far superior to any other recording methods heretofore used.

To give a better understanding of this relatively new application, and the highly specialized equipment used, we will consider briefly one of the outstanding installations -- as made by United Airlines at their major air terminals throughout the country. The installation at LaGuardia Airport in New York is a typical example.

The Stancil-Hoffman multi-channel communications recorder shown in the accompanying illustrations is used continuously, 24 hours a day, making an accurate and unquestionable record of all plane-to-ground and ground-to-plane messages car-

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Stancil-Hoffman multi-channel tape recorder and associated radio equipment, in operation at United Airlines Building, LaGuardia Airport, New York City. Mr. L. M. Zell, chief communications engineer, monitors from tape while operator (in foreground) contacts a plane en route to New York from Chicago.

Rear view of tape recorder cabinet with access door open showing compact interior arrangement of components.



## AMERICA'S YOUNGEST RADIO WORKSHOP

Third and Fourth Graders Plan, Prepare, Write and Produce Daily In-School "Radio Programs" . . . at Enterprise School, Decatur, Ill.

Although this sounds like an ambitious enterprise, even for students of high school age, it has already proved to be a practical and stimulating part of the daily routine for third and fourth grade pupils at Enterprise School. In fact, the first and second graders come in for their share of recording activities, too.

This radical departure from traditional teaching methods has been made possible by the modern technique of tape record-

ing — for the tape recorder serves as both the "recording studio" and "broadcasting station". In instituting this program of student "radio shows", the Enterprise School is not attempting to make script writers or sound technicians out of all of their pupils. The real objective is much more fundamental in nature — and the recording work is simply a means to that end. The key words in this new type of primary education are *self-evaluation* and *self-criticism* — as well as *self-expression* and *self-reliance*.

Armin H. Beck, of the Enterprise School gives the following account of the work-

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# audio record

Published monthly by Audio Devices, Inc., 444 Madison Avenue, New York City, in the interests of better sound recording. Mailed without cost to radio stations, recording studios, motion picture studios, colleges, vocational schools and recording enthusiasts throughout the United States and Canada.

VOL. 6, NO. 9

DECEMBER, 1950

## Aviation Recordings

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ried on three separate radio channels, as follows:

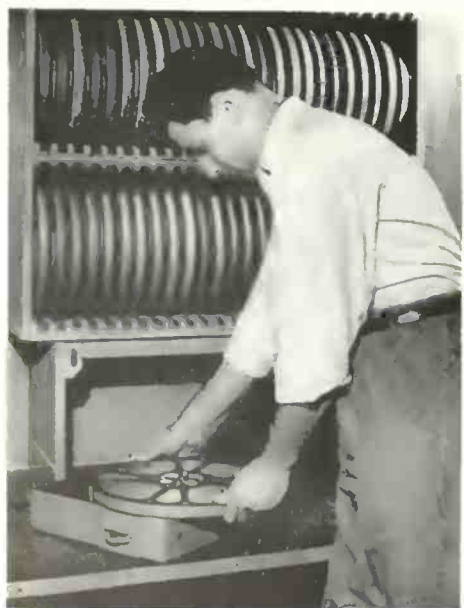
- (1) 5572.5 Kc (day) or  
3162.5 Kc (night)
- (2) 8240 Kc
- (3) VHF

The No. 1 channel covers the majority of all routine communications with flights between Chicago and New York.

The No. 2 channel is for standby service, and is used whenever the No. 1 channel is not available for a given message.

The No. 3 channel (VHF) is used within line-of-sight distances from the control center, to provide clearer reception under unfavorable static conditions.

Although the equipment used is capable of recording up to 15 channels simultaneously on Audiotape 0.7" wide, this particular United Airlines' installation uses only three channels at the present time. Additional channels, however, will probably be utilized later. After recording a full 5000-foot reel (4 hours continuous), utilizing the three channels nearest one edge of



Marvin Boland, of United Airlines communications department, "defrosts" a 5000 foot reel of 0.7" Audiotape. Tape storage racks shown in background.

the tape, the reel is turned around and recorded again, so that the same three-channels record at the opposite edge of the tape. This enables United to store a full 8 hours of recording time on a single reel of tape.

The following simple but foolproof method has been devised for determining whether a reel has been fully recorded (run through twice) or only half recorded (run through once). The two empty reels supplied with the machine are bright aluminum, while the reels supplied with the tape have a brown finish. The aluminum reels are used on the machine at all times—never stored. When a full reel of tape (brown reel) is put on the machine, the aluminum reel is used for the take-up at the initial recording, after which it is turned around and moved to the supply-reel position, and a brown reel is used for the take-up during the second recording. A full aluminum reel therefore always contains tape that has been recorded only once, and no confusion can result.

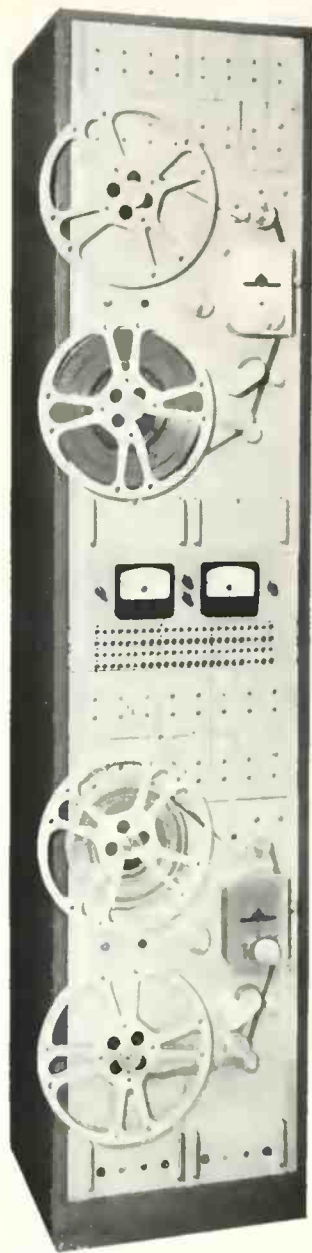
Fully recorded reels are kept on file for 15 days. If, during that time, any question should arise as to who said what to whom—the tape provides an infallible and indisputable record. After the 15-day storage period, the reels are individually erased in bulk (or "defrosted" as the airline people call it) and used over again. The "defrosting" unit supplied with the machine permits a fully recorded 5000-foot reel to be completely erased in a few seconds, simply by rotating the reel a few times in a strong alternating magnetic field.

The Stancil-Hoffman Type CRM-15 multiple-channel communications recorder includes two separate record-playback units—timed and synchronized to operate automatically in sequence as follows.

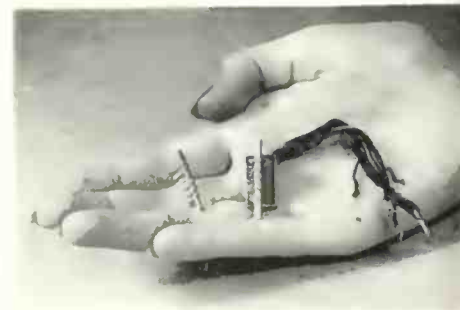
At the beginning of a recording period, the first unit, containing a fresh reel of tape, is automatically started by its timing mechanism, which actuates both the tape motion and the recording circuits. This unit then records continuously for four hours, using a reel containing approximately 5000 feet of 0.7 inch wide, paper-base magnetic tape. At the end of the four-hour period, the time clock on the second unit automatically starts this machine operating.

Meanwhile the first unit continues to run until its tape is exhausted, allowing an overlap of the two recordings of about 25 minutes. When the tape is completely run off the first machine, it automatically stops. At any time during the next four-hour period, the operator may rethread the first unit with a fresh reel of tape, making it ready to take over for the following 4 hour period.

At any time an operator may check the recordings as they are being made on the tape by monitoring directly from the



Stancil-Hoffman, Type CRM-15 communications recorder, designed for continuous operation with up to 15 simultaneous recording channels.



Close-up view of 5 unit recording head assembly for CRM-15 multiple-channel recorder. Three of these units are used to give full 15-channel capacity.

recorded tracks. The playback head is switched from track to track by means of a rotating knob, which also actuates a numerical indication of the track being played back. It is thus possible to make sure that each track is recording properly while the machine is in operation.

If it is desired to play back a recorded tape from the files, the reel is threaded on the stand-by unit in the normal manner, and run to the desired position by fast forward or rewind. When the section of interest is located, it is played at normal speed and monitored either from the output of the playback amplifier through a power amplifier and speaker, or by means of earphones plugged into the machine at the front panel. During fast forward and rewind, the tape is lifted away from the heads to reduce wear.

The basic recorder includes a 5-unit head assembly which provides for simultaneous recording on 5 different channels. Additional channels up to a total of 15 may be added at any time simply by adding plug-in head assemblies and associated plug-in recording amplifiers.

Performance specifications are as follows:

Frequency response: 200-3500 cycles ( $\pm 3$  db) at  $3\frac{3}{4}$  in/sec. 200-7500 cycles ( $\pm 3$  db) at  $7\frac{1}{2}$  in/sec.

Signal-to-noise ratio: at least 40 db.

Distortion: not more than 5% total harmonic at "0" input recording level

Tape Speed:  $3\frac{3}{4}$  or  $7\frac{1}{2}$  inches per second.

Input Impedance: 600 ohms balanced

Input Level: 0 db (6 milliwatts)

Additional detailed information on this multi-channel recorder can be obtained by writing to The Stancil-Hoffman Corporation, 1016 N. Highland Avenue, Hollywood 38, California.

## What — No Santa Claus?

During 1950, Audio Devices has sent out many thousands of free sample reels of Audiotape — to interested recordists all over the country, and in all fields of recording work.

Recently, however, we received a total of fourteen requests for Audiotape samples — all from one high school student.

He got a generous 300-foot free sample, of course. We are sure that it convinced him of the superior qualities of Audiotape — even though it might have been disillusioning with respect to the existence of a real Santa Claus.



## CLIPPING

by C. J. LeBel, Vice President,  
Audio Devices, Inc.

One of the gravest deficiencies of the English language is the fact that a given word has so many different meanings to different people. Compare, for example, the pleasant meaning of "clipping" to the barber, the pugilist, the owner of bonds, the manicurist, and the television designer, with its bad connotation to the audio engineer. For lack of space we will have to limit our discussion to one aspect of its impact on the tape recordist.



C. J. LeBel

### The Effect

For some time the writer has noticed a fault common to many phonograph records made from tape originals. They lack expression and punch. Crescendos do not seem to have any force — they are like trying to hammer a feather — they lack solid impact. In a subtle way, the result is very tasteless. The effect seems worst with tape originals done on portable recorders by those new to the field, but it exists also on work of some of the old timers. We may lay much of the blame to the fact that a portable tape recorder looks so easy to run, for even record critics try to operate one! Portable equipment should be viewed with the caution and respect accorded the old portable wax recorder.

### The Cause

Beyond a certain point, tape recorder gain drops rapidly and distortion increases without limit, as shown in figure 1. This limiting output occurs at a level producing about 2 or 3% harmonic distortion. Many portable tape recorders have volume indicator sensitivity so adjusted that 0 VU occurs at a level corresponding to 2% distortion.

Unpleasantly, typical program material peak levels will exceed the meter-indicated level by 10 to 15 db, so when a volume

indicator indicates 0 VU, peaks of much higher level are trying to pass through. If 0 VU corresponds to the 2% distortion point, these peaks cannot be recorded, for the tape saturates with a result like recording through a wrongly set volume limiter. Machine salesmen have boasted about the limiting effect of overloaded tape without realizing the actual effect on the ear.

The same effect does not occur in transcription disc recording, for the widely used 5 to 7 cm/second nominal recording level provides a 10 db allowance for program peaks if proper preemphasis is used.

### The Remedy

The cure for all this is very simple — just use a lower recording level. The most conscientious organizations will use a nominal level of 10 db below the 2% point. Those more concerned with signal to noise ratio than with distortion may drop only 5 or 6 db below. Using a lower recording level means that, in effect, we are trading loss of signal-to-noise ratio for reduction of distortion, a good trade only if we have signal-to-noise ratio to spare. The home type machine with a catalogued 40 db ratio drops in actuality to 30 db — too low. Only with a nominal ratio of over 55 db does this level decrease become fully practical.

Good modern unfilled-vinyl pressings seem to achieve a signal-to-noise ratio of at least 50 db, so a tape original which is to add no noise to the disc must be rather better than 50 db; this would become well over 60 db at the 2% point. Evidently, a tape recorder for phonograph mastering must be of exceptional quality.

### Conclusion

While all that has been discussed is known to leading recording organizations, there is need to apply it on a much wider scale, judging from a brief listen to current record production.

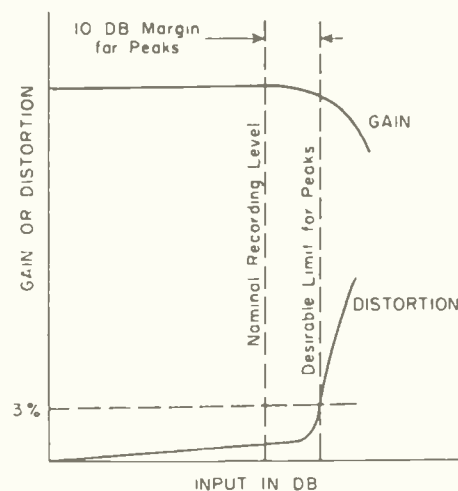


Fig. 1. Gain and distortion characteristics of a magnetic tape recorder.

## Radio Workshop

(Continued from Page 1, Col. 3)

ing of this interesting and highly instructive program.

"Enterprise School is a two-room school, part of the Decatur School System, with Grades 1 to 4. Third and fourth graders plan, prepare, write and produce daily in-school radio programs. These programs are on a variety of subjects which have been developed by the children themselves, and they maintain a rather high level of interest among the children, particularly because each child is on a show at least once a week, and usually more. Those on the daily shows record the programs on the tape, away from the remainder of the class (usually during recess), and then the recording is played back on the part of our daily schedule known as 'Our Listening Post.' The class then breaks down into small groups for short buzz sessions, with the leader of each small group joining the other leaders to form a panel discussion. This panel discusses the program from two points of view: what was done well, and what could have been done better. These discussions are also tape recorded for instantaneous playback, with the children themselves engineering the actual recording."

"Last year the children developed into such expressive readers that they were invited by one of the local radio stations,



Third and fourth graders at Enterprise School, rehearsing one of their daily, in-school radio programs.



Another group of third and fourth grade students recording on tape. Mike stand was made by a fourth grader.

WDZ, to put on a series of weekly plays, which were produced by the children under the name of 'Adventures in Education'. The story was usually adapted from some children's literary classic, such as Aesop's Fables, or Tom Sawyer. The programs were successful, as attested to by local school personnel, fan mail, and WDZ broadcasters."

"Briefly, the improvements noted in the children can be categorized in two ways: social learnings, and academic learnings. By utilizing the motivations inherent in such a learning situation, the children were able to develop respect for constructive criticism and divergent points of view, cooperation, regard for properly constituted authority (they must obey the producer once the show is ready for recording), interest in the welfare and abilities of others, the feeling of belonging and contributing something important, and a willing acceptance of greater responsibility."

"The list of subject-matter improvement, or academic learnings, broken down, is also impressive: reading for content and expression, spelling (in writing their own scripts), oral and written language, science, social studies, handwriting (legible enough so that it can be read easily by others to prevent the possibility of 'dead air'), and an appreciation of music as an integral part of everyday living. These latter are, of course, also the mechanical skills of the traditional school."

This educational recording program, as worked out by the Enterprise School, proves that it is not necessary to have a basic knowledge of radio in order to organize a daily classroom "radio program". Because of the simplicity of modern tape machines, the children can and do make their own recordings, with little or no supervision from the teacher.

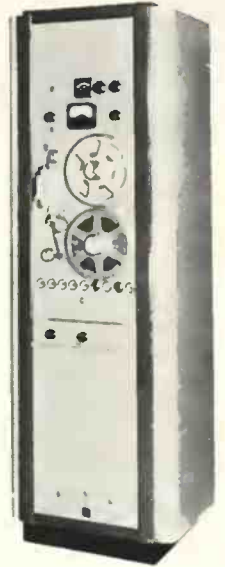
At the request of local school officials, Armin H. Beck has prepared a very comprehensive article on the subject, entitled "Radio Expression in Elementary Schools". Interested teachers may obtain a copy by writing to the Enterprise School, RRS, Decatur, Ill.



Second, third and fourth graders of Enterprise School broadcasting "The Musicians of Bremen", on Station WDZ, Decatur.

## New RCA Recorder

RCA Type RT-11A tape recorder, mounted in cabinet rack and equipped with VU meter panel, tube metering panel and switch and fuse panel.



The RCA Broadcast Equipment Section has recently announced the development of a new, single-track, dual-speed professional tape recorder, designed to meet rigid specifications for broadcast station application.

Features of this Type RT-11A machine include push-button control, timing accuracy of  $\pm 2\frac{1}{2}$  seconds in a 30-minute run, and instant starting and stopping (within 0.1 second). All controls are recessed to avoid interference with tape during threading. The tape is automatically lifted away from the heads during fast forward and rewind, saving wear on heads and tape. Microswitch control automatically stops the machine and applies reel brakes in case of tape breakage. Interlocked solenoid control prevents accidental erasing and makes it impossible to snarl or spill tape during operation.

Although designed for cabinet rack mounting, the RT-11A can be installed in a console type cabinet if desired. Standard equipment includes the tape drive unit, power supply, recording amplifier, reproducing amplifier, panel and shelf assembly, interconnecting cable, and two NAB reels. Accessory equipment includes remote control unit, VU meter panel, tube metering panel, cabinet rack, and switch and fuse panel.

### SPECIFICATIONS

Frequency Response: 50-15,000 cycles ( $\pm 2$  db) at 15"/Sec. 50-5,000 cycles ( $\pm 2$  db) at 7 $\frac{1}{2}$ "/Sec.

Distortion: Less than 1% at 10 db below maximum recording level

Signal-to-Noise: 60 db below maximum recording level

Vow and Flutter (combined):

0.1% RMS at 15"/Sec.

0.2% RMS at 7 $\frac{1}{2}$ "/Sec.

Rewind Time: 60 seconds for 2400-ft reel

Recording Heads: separate erase, record and reproduce

The standard RT-11A recorder is priced at \$1850.00 (less tubes).

For further information write to Broadcast Equipment Section, Radio Corporation of America, Camden, New Jersey.