CIVIL AERONAUTICS AUTHORITY

Private Flying and Planning Division

Confidential Note No. 12

MEMORANDUM CONCERNING RADIO COMMUNICATIONS

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MEMORANDUM CONCERNING RADIO COMMUNICATIONS

SUMMARY

This confidential note will discuss, briefly, operation of communications, airway traffic control, and radio aids encountered on a typical 2100-mile cross-country trip by airplane from Washington, D. C., to Kansas City, via Pittsburgh, Columbus, Indianapolis, and St. Louis; also the return trip to Washington via Chicago, Cleveland, Akron, and Pittsburgh. It will also cover difficulties experienced by the writer on various other trips and by the Air Traffic Specialist of this Section on a recent airplane trip from Washington, D. C., to Seattle, Washington, via Los Angeles.

The discussion of the first mentioned trip will include a tabulation of the dates, time of day, number of calls made and the length of time necessary to effect contacts and in some cases, to repeat contacts. It will be noted that some stations were very efficient, that others were difficult to reach, and that some stations did not respond at all.

Certain conclusions are reached and corrective measures are recommended.

INTRODUCTION

One of the most important factors governing safety in aviation today is radio communication. Upon satisfactory radio contacts depend the latest weather reports (upon request), urgent messages, information concerning altitudes of flight, and proper control of air traffic.

Traffic control is directed from two sources: Airways Traffic Control and Airport Traffic Control. Both are operated independently, but the relationship between the two is so close that they assume responsibilities of equal proportions. Inasmuch as all traffic control is largely dependent upon radio contacts, the failure of this method of communication means almost certain breakdown of the whole system.

Much has been said relative to the difficulties experienced in the use of aircraft radio transmitters operating on 3105 kc. Therefore, it was deemed advisable, in the interest of safety, to determine the exact degree of efficiency in radio communication not only for military and miscellaneous aircraft, which transmit on 3105 kc, but for all aircraft while in the air. In order that suitable recommendations might be made for correction of conditions found to be unsatisfactory, it was necessary to determine just what was wrong - whether it was equipment, personnel or procedure. The plan also included careful checks on all other radio aids to avigation encountered on the trip.

For obvious reasons, it was believed that the survey should be conducted by the use of an airplane other than one belonging to the Authority. The most important consideration was that normal routine procedure should be found, and that so-called "grape-vine" channels should not carry the "alert" signal from station to station. A request for extended cross-country use of an Army BT-9C airplane was approved by the Chief of the Air Corps. The airplane call letters

were "Army 8238", and the radio transmitter operated on a frequency of 3105 kc.

The trip began from Bolling Field at 9:10 a.m., Sunday, October 2, 1938, with the writer acting as pilot and radio operator, and Private J. M. Evans, U. S. Army Air Corps, in the rear seat acting as clerk.

DISCUSSION

Since it is the purpose of this note to suggest ways and means, if possible, to improve the service, it is first necessary to point out what is wrong.

The tabulation which follows provides a brief record of contacts and attempted contacts, with the results under "Comments" listed as "Satisfactory", "Fairly Satisfactory", "Unsatisfactory", or "Inoperative", regardless of causes.

The reason for making second contacts several minutes after the first was to determine how many operators turn the receiving volume down after the first conversation, or leave the receiver. It must be remembered that the teletype circuits carry the news of the airplane's approach by FX, and that the majority of operators may be expecting a call. After this call, however, and because they are not expecting a second or a third, some operators may turn the volume low to prevent distracting static noises.

STATION	CALL LETTERS	VOICE FREQUENCY KC	DATE	TIME OF 1st CALL	NO. OF CALLS	TIME OF CONTACT	NO. OF CALLS SECOND CONTACT	TIME REQUIRED	RADIO RECEPTION CONDITIONS	COMMENTS
				EST		EST				
WASHINGTON (CT)*	WAHN	278	Oct.2	9:15 A	2	9:15½ A	None	–	Good	Satisfactory
MCCONNELLSBURG	WMHR	209	"	9:47 A	1	9:47½ A	1	3'	"	"
BUCKSTOWN	WATR	359	"	10:11 A	1	10:11 A	6	NA**	"	Unsatisfactory
PITTSBURGH	WMAP	254	"	10:22 A	6	NA	2	2'	"	"
PITTSBURGH (CT)	WMET	278	"	10:37 A	7	10:42 A	None	–	"	"
CAMBRIDGE	WMJV	278	"	12:35 P	2	12:36 P	5	NA	"	"
COLUMBUS (CT)	WPCO	278	"	1:01 P	5	1:05 P	1	1'	"	Fairly Satis.
DAYTON (ARMY)	WYD	379	"	1:35 P	5	1:38 P	None	–	"	" "
				CST		CST				
INDIANAPOLIS (CT)	WIIA	278	"	1:05 P	2	1:06 P	"	–	"	Satisfactory
TERRE HAUTE	WMJO	248	Oct.3	10:50 A	5	10:55 A	1	1(	"	Unsatisfactory
EFFINGHAM	WMHZ	278	"	11:16 A	8	11:23 A	1	½'	"	"
ST. LOUIS	KCQ	209	"	11:46 A	10	12:01 P	1	½'	"	"
ST. LOUIS (CT)	KGSA	278	"	12:05 P	1	12:05 P	None	–	"	Satisfactory
NEW FLORENCE	KCEX	278	"	12:26 P	1	12:26 P	1	½'	"	"
COLUMBIA	KCEB	278	"	12:44 P	10	12:56 P	None	–	"	Unsatisfactory
KNOXVILLE	WWIZ	278	"	1:30 P	2	1:32 P	None	–	"	Satisfactory
KANSAS CITY	KRC	359 236	"	–	–	–	–	–	–	Inoperative Fairly

STATION	CALL LETTERS	VOICE FREQUENCY KC	DATE	TIME OF 1st CALL CST	NO. OF CALLS	TIME OF CONTACT CST	NO. OF CALLS SECOND CONTACT	TIME REQUIRED	RADIO RECEPTION CONDITIONS	COMMENTS
FT. LEAVENWORTH (ARMY) (CT)	WYS	396	Oct.5	12:01 P	6	12:10 P	1	½'	Good	Satisfactory
KNOXVILLE	WWIZ	278	"	1:01 P	1	1:01 P	None	–	"	"
KIRKSVILLE	WMIY	278	"	1:17 P	2	1:18 P	1	½'	"	"
BURLINGTON	KCEJ	326	"	–	–	–	–	–	–	Inoperative
MORSE	WAJG	278	"	2:27 P	4	2:30 P	2	3'	"	Unsatisfactory
CHICAGO	KDA	236	"	3:12 P	3	NA	None	–	"	"
CHICAGO (CT)	WGEH	278	"	3:14 P	16	3:30 P	"	–	"	"
McCOOL	WWJB	278	Oct.6	11:00 A	1	11:00 A	"	–	"	"
GOSHEN	WNIE	320	"	11:28 A	1	11:28 A	1	½'	"	Satisfactory
HELMAR	WWIX	278	"	11:50 A	4	NA	None	–	"	Unsatisfactory
ARCHBOLD	WNIT	329	"	12:01 P EST	3	12:03 P EST	"	–	"	Satisfactory
TOLEDO	WMIT	239	"	1:20 P	8	NA	"	–	"	Unsatisfactory
TOLEDO (CT)	WAEU	278	"	1:27 P	3	1:30 P	"	–	"	Satisfactory
VICKERY	WWJR	278	"	1:45 P	5	1:47 P	"	–	"	Fairly Satis.
CLEVELAND	WWO	236	"	1:55 P	5	NA	"	–	"	Unsatisfactory
CLEVELAND (CT)	WRDT	278	"	2:05 P	8	2:12 P	"	–	"	"
AKRON (CT)	WMAK	278	"	3:43 P	6	NA	"	–	"	"
PITTSBURGH (CT)	WJET	278	"	4:03 P	7	4:23 P	"	–	"	"

STATION	CALL LETTERS	VOICE FREQUENCY KC	DATE	TIME OF 1st CALL EST	NO. OF CALLS	TIME OF CONTACT EST	NO. OF CALLS SECOND CONTACT	TIME REQUIRED	RADIO RECEPTION CONDITIONS	COMMENTS
BUCKSTOWN	[illegible]AIR	359	Oct.7	8:45 A	4	8:52 A	2	1'	Good	Fairly Satis.
McCONNELLSBURG	[illegible]AHR	209	"	9:18 A	1	9:18 A	1	½'	"	Satisfactory
WASHINGTON (CT)	[illegible]AHR	278	"	9:43 A	2	NA	None	–	"	Unsatisfactory
BOLLING FIELD (Army)	[illegible]YB	219	"	9:44 A	4	9:47 A	"	–	"	Satisfactory

* Control Tower
** No Answer

A further discussion with amplification and additional details concerning each station follows herewith:

Washington - The airport control tower was reached on the second call and, although we were close to the airport the contact and procedure were entirely satisfactory.

McConnellsburg - The range station was contacted, and again reached on a return call with but one attempt each time, which may be considered par.

Buckstown - The range station was reached with but one call on the first attempt. After passing the station, we made six attempts without success, although Harrisburg, 115 miles distant, answered promptly. It appears that the operator, not expecting another call, either turned his volume down or left the station. There was no static.

Pittsburgh - The range station was called six times without success. Upon arrival, we made a visit to the station and found that the volume was turned low, the operator stating that he was experiencing considerable local interference. He was requested to guard the 3105 kc channel carefully upon our departure, and satisfactory contacts were continued for 20 minutes. Static was negligible.

Pittsburgh - The airport control tower was reached after ten minutes on the seventh call as the airplane was approaching the field. With no static present, the only deduction that can be drawn is that the 3105 kc receiver was turned to low volume in order that the operator might listen more attentively to airline frequencies.

Cambridge - The MT marker station replied after two calls which took one minute, but failed to come in a few minutes later in response to five calls. The deduction is that the volume was reduced or that the operator left the station. Static was negligible.

Columbus - The airport control tower replied to the fifth call, probably because of low volume receiver setting, but replied promptly to a return call a few minutes later. Static was negligible.

Dayton - The Wright and Patterson Field control tower (Army) replied after three minutes and five calls, but was obviously encountering transmitter difficulties. Static was negligible.

Indianapolis - The airport control tower replied in one minute following two calls with good range and satisfactory procedure.

Terre Haute - The range station was reached after five calls taking five minutes. A second call was answered immediately with good procedure, but a third call shortly thereafter went unanswered, indicating that the operator either turned the volume down or left the station. Static was negligible.

Effingham - The range station replied after eight calls had been made consuming seven minutes, indicating low volume setting or absence from station. A repeat call several minutes after we had passed the station was replied to promptly. Static was negligible.

St. Louis - The range station replied as we neared the field after ten calls taking 15 minutes, indicating low volume setting. A return call some minutes after passing over the field was replied to promptly. Static was negligible.

St. Louis - The airport control tower answered the first call with satisfactory procedure.

New Florence - The MT marker station replied to both calls promptly and with good procedure.

Columbia - The range station replied only after we had made ten calls consuming 12 minutes, and had, as a last resort, power-dived the field. It appears that either the volume was turned low or the operator was not in the station. No return contacts were attempted. Static was negligible.

Knoxville - The MT marker station gave prompt reply and used correct procedure. (Westbound contact).

Kansas City - The range station was inoperative because of modernization work in progress, and no radio communication was possible except airline frequencies with the operating companies.

Fort Leavenworth - The Sherman Field control tower (Army) took six calls and ten minutes to respond, but when this was mentioned to the Commanding Officer of the field, excellent contacts were maintained for 30 minutes after departure, indicating low volume setting originally. Static was negligible.

Knoxville - The MT marker station again functioned promptly and properly. (Eastbound contact).

Kirksville - The range station replied to both first and second calls promptly and efficiently.

Burlington - The range station was inoperative because of modernization work in progress.

Morse - The range station was obviously having transmitter trouble, as the operator's voice was barely audible with full airplane receiver volume turned on. However, he functioned efficiently and was advised of the difficulty.

Chicago - The radio range station did not reply after three calls, but this failure may have been due to the modernization program then in progress, although the range operated perfectly. Static was negligible.

Chicago - The airport control tower replied following 16 calls over a period of 16 minutes. The ceiling was a scant 1000 feet with about two miles visibility and as the operator replied, our airplane was over the field boundary. We were immediately warned to pull up to avoid collision with an American Airlines Douglas, and then were directed to a landing. The conclusion is drawn that the volume on the 3105 kc receiver was turned down to minimum and the operator's attention was concentrated on airline frequencies. Static was negligible.

McCool - The MT marker station replied promptly and with correct procedure to the first call, but excessive interference was experienced from the Chicago Control Tower which operates on the same frequency (278 kc) 35 miles distant. No return call was made because of this interference.

Goshen - The range station replied to all calls promptly and efficiently.

Helmar - The MT marker station did not respond to four calls despite the fact that we flew close to the field. The marker functioned satisfactorily, however, indicating personnel absence from the station. Static was negligible.

Archbold - The range station replied to the third call, in two minutes with good procedure. No repeat contacts were attempted.

Toledo - The range station did not reply to eight calls consuming six minutes. A remote receiver is now on hand for installation at this station. Range was in operation. Static was negligible.

Toledo - The airport control tower replied in three minutes to the third call with proper procedure.

Vickery - The MT marker station replied to the fifth call, taking slightly more than two minutes to do so, but using correct procedure.

Cleveland - The radio range station failed to respond (236 kc-voice) to five calls, probably because of low volume setting of receiver. Static was negligible.

Cleveland - The airport control tower responded to the eighth call, taking seven minutes to do so, just as we approached the field. The most reasonable assumption is that the 3105 kc receiver was turned low in favor of airline frequencies. Static was negligible.

Akron - The airport control tower failed to answer six calls over a period of four minutes, the last of which was over the field. The reason for this failure is not known. Static was negligible.

Pittsburgh - The airport control tower finally responded to the seventh call taking 20 minutes from the time of first call and when we were 5 miles west of the field. After landing, we visited the tower and found that the volume was turned low in favor of airline frequencies. Static was negligible.

Buckstown - The radio station responded to the fourth call, taking seven minutes. Repeat contact was made on second call taking one minute, indicating that volume was turned low during the time of the first calls. Static was negligible.

McConnellsburg - The radio range station replied to the first call and repeat call promptly and with correct procedure.

Washington - The airport control tower failed to answer two calls within ten miles of the field ostensibly because of low volume setting of 3105 kc receiver, or other duties. Static was negligible.

Bolling Field - The control tower (Army) replied to the fourth call which took three minutes, but the operator was busy with other traffic.

RECAPITULATION

Civil Aeronautics Authority stations 21
(not including K. C. and Burlington)

Civil Airport Control Towers 9

Army Field Control Towers 3

Number of stations called (including all stations both ways) 37

Number of stations responding at any time (including same as above) 31

Calls made from airplane to ground stations (1st contact attempts) 162

Average number of calls to stations responding (1st contacts only) ..... 5.

Average number of minutes necessary for first contacts (including only those reached) 4-1/3

Range stations inoperative 2

Number of stations entirely satisfactory 13

Number of stations fairly satisfactory 5

Number of stations unsatisfactory 19

Number of stations failing to respond (1st or 2nd calls) 9

Trouble directly traceable to ground transmitter (Morse) 1

Number of stations appearing to have low volume receiver setting (on 1st call) 20

Efficiency of C.A.A. stations (not including K. C. & Burlington but considering McCool satisfactory, as operator had no control over interference) ..... 43.

Efficiency of airport control towers ..... 56.

Static

It is significant that only a negligible amount of static was present at any time. Reception could be heard clearly for distances from 50 to 100 miles during the entire trip with the three following exceptions:

Morse MRL-DT station which was having transmitter trouble,
McCool MT station which had serious interference from WGEK Chicago,
Dayton (Army range station) which was apparently experiencing transmitter difficulties.

Conditions during this flight could be considered well above average.

Airplane Radio Equipment

The radio equipment in the airplane functioned normally at all times with good output and excellent reception. One ground station advised by radio that we were off frequency, a bit low, but subsequent stations when questioned on this point, advised that our frequency was 3105 kc. Since all flying was done during daylight hours, the 6210 kc frequency was not employed.

Ground Equipment

As has been stated above, the Morse station was barely understandable with full aircraft receiver volume turned up, and the operator was so advised. The range functioned normally, and the operator employed correct procedure.

The Dayton Army range station was doubtless experiencing transmitter trouble, as the messages were hardly discernible and it was

found necessary to request a "count" for a close setting.

The McCook station functioned properly throughout, but is seriously handicapped by interference from the Chicago control tower which uses the same frequency and is but 35 miles distant. This station was placed in the "unsatisfactory" column in this report because of the interference only.

Procedure

The procedure used by all communication stations when contacted was correct and capably conducted.

Radio Ranges

Radio range facilities functioned well throughout and appeared to be in correct alignment.

The Airways Engineering Division has issued instructions that during the modernization program, not more than one station is to become inoperative over any one principal leg of an airway. In spite of this, both the Kansas City and Burlington ranges were silent at the same time for modernization work, leaving only the low powered Kirksville range, and the Chicago range in operation on this important airway of 410 miles. The Morse range is not in alignment with this airway.

Simultaneous ranges have very definite advantages, but the airplane having a radio without a filter has difficulty understanding voice at several of these stations, although some are easily read. If possible, the former should be adjusted to function equally as well as the best.

One danger that must be removed is the inability of these stations to call an airplane which has eliminated voice in favor of continuous range by use of a filter. This is a problem of some magnitude, as airways traffic control frequently has sufficient reason, in the interest of safety, to contact aircraft, particularly during periods of bad weather and heavy traffic.

Airways Traffic Control

This unit of airways operations appeared to function satisfactorily with two or three exceptions.

There was some discussion at Chicago about clearing for Pittsburgh, but the airplane finally cleared for Cleveland because of uncertain weather beyond.

It is not known whether Air Corps operations or traffic control at Chicago was at fault; however, nearly every station contacted between Chicago and Cleveland advised that we were cleared to a point 25 miles southeast of Akron. Each time, the writer advised the operator that we were en route to Cleveland, but upon landing there we found that we were unexpected.

We left Cleveland for Washington via Pittsburgh, deciding to land at the latter city only if weather conditions prohibited completion of the trip. Deciding to land at Pittsburgh for the night on account of unfavorable weather, we were advised that no message had been received concerning our landing at Cleveland where we had remained for one hour and 15 minutes. Pittsburgh, having received our PX from

Chicago, and not knowing of our landing at Cleveland, had about given us up.

Pittsburgh traffic control was then advised of our intention to remain over night and ostensibly sent the message to Washington traffic control. Bolling Field, however, was not notified and had no record of our location until the P.I. message of the following morning upon our departure from Pittsburgh for Washington.

These appear to be personnel problems which can be easily corrected, but unless they are they will continue to cause concern and even alarm to those on the ground.

Airport Traffic Control

From the experience mentioned in this report, particularly at Chicago, Cleveland, and Pittsburgh, it appears that there is considerable room for improvement in the field of airport traffic control. The difficulties encountered at these three points could be easily corrected by the maintenance of a better watch on 3105 kc receivers at all times.

In connection with the important subject of airport traffic control, two recent trips to Newark and return might be mentioned to illustrate improper procedure. On July 19, the writer, using an army airplane, desired to leave Newark without delay because of anticipated bad weather near Washington. At 6:15 p.m., we were ready to taxi out for take-off. Four calls were made to the tower on the 3105 kc frequency, spaced at minute intervals and only at times when no voice

was heard on the 278 kc frequency. No aircraft were in the vicinity. The WREE operator then replied, requesting that we stand by and discontinue calling. After four minutes, WREE was again called and advised that we were ready to taxi out for take-off. The reply was not very courteous, but permission was given to taxi out, with instructions for a standard instrument take-off procedure and other information. The take-off was made at 8:30 p.m. fifteen minutes had been lost and no aircraft could be observed in the vicinity. When we had been in the air a few minutes, WREE called and said that airways traffic control desired to know if the pilot had an instrument rating. He was advised in the affirmative and the flight continued, but severe N weather was encountered between Baltimore and Washington, taking place only during the last 15 minutes of the trip, which could have been avoided had we been promptly released at Newark.

On September 24, the author was flying an Army BT-9 airplane from Washington to Newark and began calling WREE when over Princeton, N. J. A reply finally was received when we were over the southeast corner of the field at 1500 feet altitude. The impatient reply was that our last call had broken up a conversation, but to "go ahead now anyway". After landing, the writer proceeded to the control tower and found that the 3105 kc receiver volume was turned low and airline receivers turned up. When this was mentioned, the operator stated that "everybody" was talking on 3105 kc but no sound could be heard, and then, when the volume was turned up a voice was heard calling WREE. He was informed that the breaking up of a conversation

which he did not know was being conducted, was of no concern whatsoever to a pilot over the field desiring landing instructions.

The Camden MRE-DT station employs proper procedure, but after first contacts, repeat calls frequently go unanswered. This is ostensibly due to turning the 3105 Kc receiver low to avoid the well known "frying noise" in favor of airline frequencies.

Late in the afternoon of March 17, the writer was practicing instrument flying under the hood in the vicinity of Washington and had for a safety man, Corporal Frank Huffer, U. S. Army Air Corps. When we arrived over the Washington range station at 3000 feet, the hood was released and it was learned that we were over a solid overcast. WAHN was called for traffic and ceiling. We were advised that the ceiling was 1800 feet, but to hold our altitude because of the approach of an American Airlines Transport on instruments. A position was taken about 12 miles from the station on the north leg of the range. The writer heard WAHN given landing instructions to the transport, followed later by take-off instructions to one of Eastern Airlines, but we were not called and it was growing dark. The control tower was again contacted and requested for permission to let down through the overcast. Permission was granted but the station did not advise that the ceiling had dropped from 1600 feet to 700 feet during our wait of approximately 20 minutes. Unquestionably the tower operator had forgotten about us.

CONCLUSIONS

From the experiences mentioned above it must be concluded that the efficiency of present radio communications for miscellaneous and military aircraft leaves much to be desired, not only from the standpoint of convenience, but far more important, from the standpoint of safety in the air. It has been said that the smallest aircraft that flies can cause disaster to the largest transport, if a collision should occur. It is of utmost importance, therefore, for the safety of all aircraft, that communication efficiency be improved with the least practicable delay.

An airplane trip taken in May, 1938, by the Air Traffic Specialist of this section may further serve to emphasize the seriousness of the situation, as it covered numerous additional communications stations to Los Angeles, and thence to Seattle, using Airways #3 and #1. He experienced considerable difficulty and on numerous occasions made several calls before completing contacts with a number of stations despite the fact that he had unusually efficient radio equipment. In some instances he found it necessary to call distant stations for aid in raising the station desired.

The most logical conclusion to be reached in the majority of all cases mentioned in this note appears to be that numerous operators standing watch on the 3105 kc frequency keep their receivers turned down to avoid noise and/or interference with other receivers. In consequence, signals on this frequency are not heard until the airplane is

over the station and frequently not even then.

Much may be said from the station operator's viewpoint and some of his problems and duties might be listed as follows:

1. Excessive noise when the volume is turned up.
2. Aircraft radio transmitters may be off frequency.
3. Weather observation duties.
4. Teletype operation duties.
5. Equipment maintenance.
6. Weather broadcasts (32% of C.A.R. stations)
7. Voice communication with aircraft.
8. Answering the telephone.
9. Preparation of reports and correspondence.

It must be admitted that some of these problems and duties are complex. They require time and close attention to accuracy. Frequently, an operator must stop the thing he is doing to do something else of equal or greater importance.

A number of stations appear to be under-manned and do not have sufficient personnel to conduct all functions of the work as efficiently as they could be administered. Moreover, it is said that the rate of compensation in some cases is inadequate.

It can well be appreciated, too, that noisy static from a receiver perhaps infrequently used, is a distraction and irritation. It is eliminated by merely turning the volume control down, and that is exactly what appears to happen in the majority of all stations.

Equipment is not infallible, but in the light of experience it must be concluded that despite certain mechanical and electrical trouble the basic fault lies with personnel. In support of this conclusion, the findings as a result of this survey trip may again be mentioned briefly, with emphasis on the fact that static was not a

primary cause.

1. C.A.A. radio stations were but 43% efficient despite the fact that only two of these stations were inefficient because of interference (McCool), and transmitter difficulties (Morse), so far as we know.

2. Civil Airport Control towers were 56% efficient, two failing to answer and the remaining seven requiring an average of 6½ calls consuming 7½ minutes before responding.

3. Despite instructions, two principal range stations on an important leg of an airway were inoperative at the same time for modernization work.

4. Twenty stations, or 65%, in all appeared to have low volume receiver settings at the time of first calls while three, or 10%, were unsatisfactory for other reasons.

5. Of the seven airport control towers contacted, four, or 57%, did not reply until we approached the fields creating a serious traffic hazard.

It is reasonable to believe that these percentages may be considered very close to the national average of efficiency and the entire system of radio communication is no better than the competency of operating personnel.

In a few months the Army Air Corps will discontinue the use of 3105 kc and will transmit on 4495 kc thereby relieving congestion to a considerable extent.

Ultra-high frequencies will probably be in general use within the next two years which will relieve the radio spectrum and make possible better communication with the elimination of static noises. However, until this can be accomplished, something must be done to improve the present situation for the safety of all aircraft.

Corrective measures should be undertaken immediately, and it is believed that a better spirit of cooperation among personnel with a full realization of the grave consequences that might follow because of their failure to be alert can be quickly and easily accomplished.

RECOMMENDATIONS

1. A thorough check for good receiving conditions after installations are completed. If found unsatisfactory, the radio technicians remain at location until the problems are cleared up.

2. An investigation to determine:

   (a) If an operator has time to maintain a good watch.

   (b) If the equipment at each station is capable of getting distance without noise.

   (c) If the rate of compensation for operators is adequate for the type of services performed.

   (d) If the attitude of personnel is all that it should be.

   (e) If personnel are sufficiently competent.

   (f) Minimum floor space necessary for adequate communication operations.
      (1) Airport traffic control tower.
      (2) Airways traffic control.
      (3) C.A.A. communications stations.

(g) The advisability of establishing communications zones wherein only one, or not more than two transmitting frequencies are employed by aircraft, thereby making it possible for ground operators to maintain proper watches.

3. Conduct a thorough study covering all C.A.A. stations and airport control towers with the use of an airplane to determine the exact status of each and to remain until the situation is corrected if found deficient.

4. Careful checks and adjustments of all simultaneous radio range stations to make it possible for pilots using aircraft receivers without filters to understand voice communication.

5. A study to find ways and means of correcting, if possible, the situation mentioned in the second paragraph on page 17 of this note.

6. Steps be taken immediately for the installation of ultra-high frequency voice communication facilities to replace the low frequency equipment now employed.

7. Forcefully impress every operator with the importance of maintaining a close watch on the 3105 Kc frequency with a sufficient receiver volume setting to hear all calls within a distance of 50 miles.