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NEW YORK CITY PILOTS AUTOMATIC TELEPHONE WEATHER ANSWERING SERVICE (PATWAS) TEST, VOLUME I

Frank Staiano

Ephraim Shochet

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METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	
	acres	0.4	hectares	
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

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15. Supplementary Notes This is a two-volume report. Volume I (FAA-RD-77-80, I) summarizes the work and presents conclusions and recommendations; volume II (FAA-RD-77-80, II) contains detailed technical data. The Executive Summary (FAA-RD-77-80) presents a compendium of the NYC PATWAS Test.

16. Abstract

An improved Pilots Automatic Telephone Weather Answering Service (PATWAS) was subjected to a year-long test in the New York City metropolitan area. The improvements consisted primarily of the following: (1) user access to three route-oriented briefings, (2) an increase in the number of access lines to PATWAS, (3) more frequent updating of information, (4) the addition of special early morning recordings, (5) capability to request meteorological and aeronautical information from the Weather Message Switching Center for incorporation into the PATWAS message, (6) reduction in the time required for updating, (7) addition of more meteorological and aeronautical information to the PATWAS message, (8) new and more efficient magnetic tape equipment, (9) installation of an acoustic enclosure for PATWAS tape recording, and (10) more efficient organization of the message format.

The purpose of the experiment was to test and evaluate the new PATWAS products, schedules, user acceptance, and the effects on the telephone briefing workload at the flight service station (FSS).

In addition, the test permitted the gathering of technical performance data which could serve as the basis for a new, consolidated, national system for the mass dissemination of weather information. It is concluded that the improved PATWAS disseminates more weather information, reduces FAA/NWS telephone briefer workloads, is preferred over the basic PATWAS, and is acceptable to the general aviation public.

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PREFACE

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Mr. Louis Delemarre, ANA-230, who fabricated the data collection system for the telephone line utilization of the trial PATWAS.

Dr. Shiu-Ming Cheung, ANA-553, for the valuable assistance in providing the required programming support.

The Data Preparation Section, ANA-245, for their valuable assistance in coding thousands of PATWAS questionnaires.

The Printing and Distribution Section, ANA-524, for the expeditious printing and mailing of the PATWAS materials.

Acknowledgement is given to Mr. George Barboza, SRDS/ARD-440, for his important contribution to the conceptual design of the experiment and invaluable suggestions which served to improve the results of the test.

Acknowledgement is given to Mr. Edward Gross of the National Weather Service Headquarters for his important contribution and encouragement in the conceptual development of the test and to personnel of the National Weather Service, who not only made the experiment possible, but along with FAA personnel, assisted in conducting the test.

The professional skill of Mr. Edward Morin of the National Weather Service at La Guardia Airport is gratefully acknowledged. Mr. Morin and members of his staff helped to develop the product design and schedule and were responsible for providing the required manpower on a day-to-day basis for accomplishing the operational aspects of the test.

Acknowledgement is given to Mr. John Vandenberg of Lockheed Electronics Corporation who accomplished the test design and the analysis of data.

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EXECUTIVE SUMMARY

PURPOSE.

The purpose of this executive summary is to give a succinct account of the evaluation of a trial Pilots Automatic Telephone Weather Answering Service (PATWAS) in the New York City metropolitan area as documented in volumes I and II of the basic report.

BACKGROUND

The rapid growth in general aviation has made it necessary to improve and expand the present system for disseminating aviation weather information to the flying public. It is apparent that the projected growth of the flying public will give rise to a corresponding increase in the demand for general aviation preflight weather briefings. One of the most effective techniques currently being utilized to disseminate general aviation weather information for preflight planning is the telephone-accessed prerecorded PATWAS.

As part of the Near Term Flight Service Station Improvement Program, the Federal Aviation Administration (FAA), in conjunction with the National Weather Service (NWS), conducted the New York City (NYC) PATWAS test. The purpose of the controlled experiment was to test and evaluate trial PATWAS route-oriented briefings, products, schedules, user acceptance, the effects on the telephone briefing workload at the La Guardia (LGA) Weather Service Office (WSO), and the Teterboro, New Jersey (TEB), and Islip, New York (ISP), Flight Service Stations (FSS's), and to gather technical performance data. It was hypothesized that an improved PATWAS in the NYC metropolitan area would produce a decrease in the number and length of person-to-person pilot briefings and provide a significant improvement in the service rendered to general aviation pilots. The trial PATWAS installed at La Guardia Airport WSO provides telephone access to three tailored independent recordings at three different phone numbers. One phone number provides the local New York area (50 nautical miles (nmi) radius) conditions; the second number provides briefing information for routes northbound; and the third number provides pertinent information for routes south and westbound. The number of access lines was increased to minmize busy signals. Other improvements over the basic PATWAS system included new magnetic tape equipment, widely expanded message content, improved message format, more frequent updating of information, and reduction in the time required for updating. In order to meet the pilot's need for the latest available weather information in the early hours, presumably when he is doing his flight planning, two special early morning recordings were made available in addition to those prepared in the morning, afternoon, and evening. These messages were updated hourly, and if conditions demanded, more frequently. The new system contained the capability to request meteorological and aeronautical information from the Weather Message Switching Center (WMSC) for incorporation in the PATWAS message. Software changes were incorporated in the WMSC computers to facilitate automatic text preparation for updating the recordings.

In contrast, the content of the basic PATWAS message was limited to a generalized forecast for New York City and vicinity and a synopsis report. No route information was provided, and the message did not contain hourly weather updates, specific flight precautions, terminal forecasts, or NOTAM's. AIRMET's were not specific, and the message contained only general information on wind, with no specific heights included. The information was not updated hourly, and there were only three recordings a day.

PROCEDURE

Beginning in July 1975, pilots learned of the availability of the new trial PATWAS through an announcement appended to the basic PATWAS recording. The basic PATWAS also remained operational throughout the testing. (The terms "basic" and "trial" PATWAS have been used in lieu of "old" and "new" PATWAS, since the terms "old" and "new" are prejudicial.) Although the number of access lines was increased to virtually eliminate busy signals, the toll-free access areas to the trial PATWAS were intentionally kept the same as the basic PATWAS to allow for relative comparisons. This may account for the inappreciable effect of the trial PATWAS on ISP pilot briefings. In November, publicity brochures announcing the new experimental service were distributed to all pilots registered with the General Aviation District Offices at Farmingdale, New York and Teterboro, New Jersey. Approximately 26,000 pilots were mailed literature and also a questionnaire toward the end of the trial period (July 1975 through June 1976). The questionnaire was designed to measure the degree in which the trial PATWAS satisfied the flight-planning needs of the respondents and to determine if it constituted a significant improvement over the basic PATWAS. Appropriate follow-up efforts were made to obtain an input from nonrespondents to the primary questionnaire. In addition, a supplemental survey of 3,152 volunteer pilots was taken to measure pilot reaction to the trial PATWAS after recurrent use of the system. It was hypothesized that the supplemental survey would provide weightier opinions on the acceptability and effectiveness of the trial PATWAS.

RESULTS

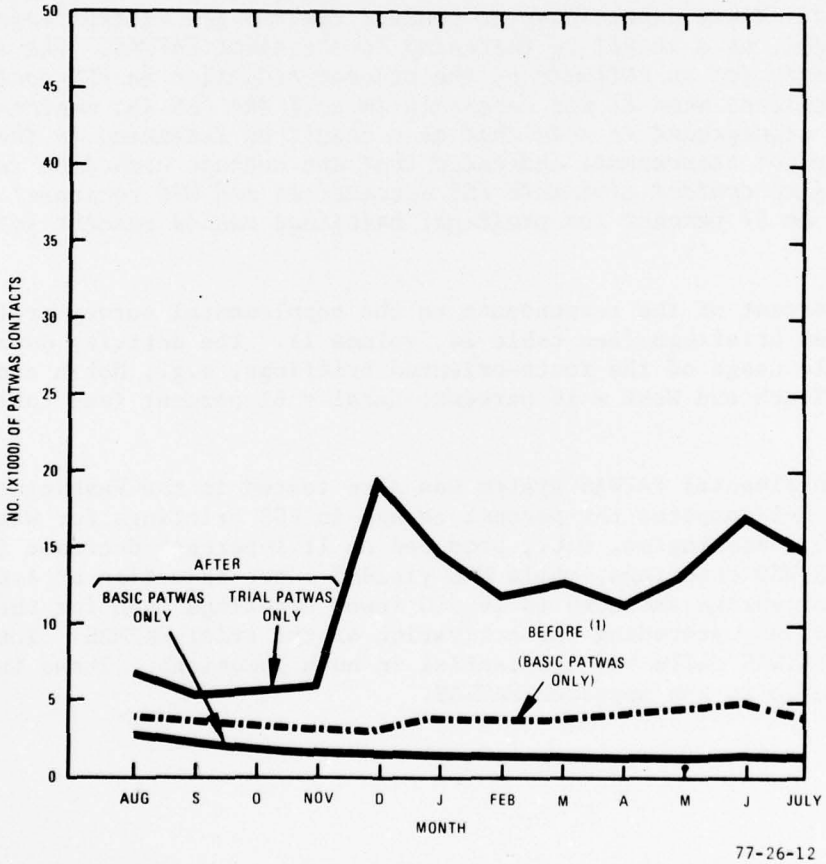
In general, the reaction to the trial PATWAS was highly favorable. The preponderant majority of the questionnaire respondents preferred the trial PATWAS to the basic PATWAS system.

Since the trial PATWAS was activated, the number of requests for weather information from the La Guardia WSO and the Teterboro FSS decreased, while the number of calls to the trial PATWAS increased. The number of itinerant aircraft departures during the test period changed only very slightly from the prior year's traffic. Thus, the increase in calls was not due to increased traffic. The number of pilot briefings decreased by 15 percent at La Guardia

WSO and 10 percent at Teterboro FSS for the year immediately after the installation of the trial PATWAS. The net reduction of pilot briefings for the above-mentioned installations amounted to 10 percent. On the other hand, the pilot briefings at Islip FSS increased by 2 percent for the same period of time.

It is apparent that similar favorable results would have been experienced at ISP if toll-free access had been provided.

From the outset, the trial PATWAS served a substantial portion of the PATWAS calls. The percentage served increased sharply during December following the publicity mailing and has remained at a very high, unprecedented level ever since. Figure E-1 depicts the inordinately high number of PATWAS calls after the trial PATWAS became available. On the other hand, the amount of basic PATWAS activity has rapidly declined, falling lower, even in the first 2 full months of trial PATWAS operation, than the level reached in the prior year. A gradual decline began in October 1975 and continued until December, when a minimum service level seems to have been established at an average of 1,435 calls per month.



1. For the year immediately prior to trial PATWAS activation
2. Trial PATWAS activated July 24, 1975

FIGURE E-1. PATWAS CONTACTS

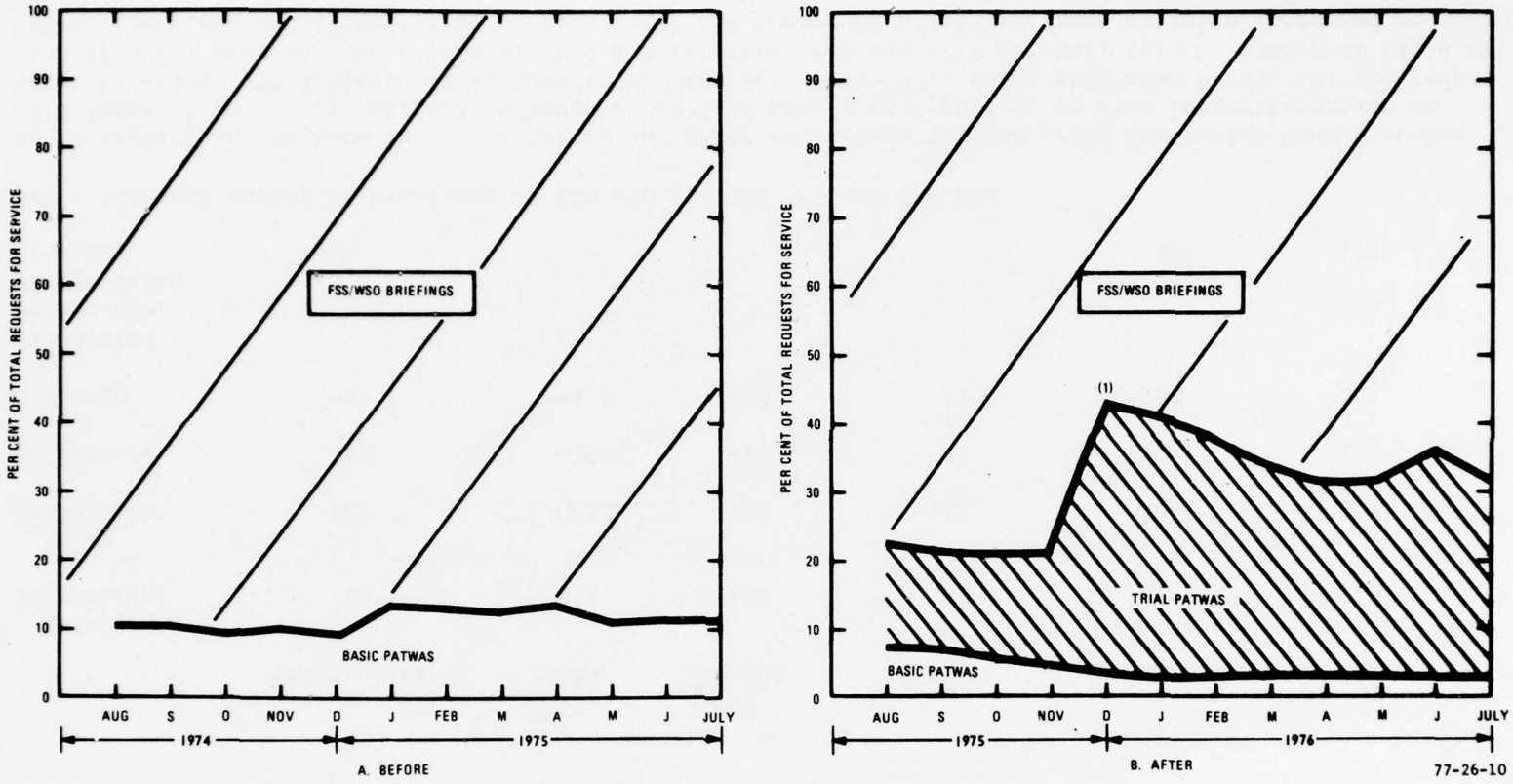
The effectiveness of the trial PATWAS was evident from the fact that it handled an average of 14,218 calls per month or 91 percent of the total number of PATWAS calls during the 8-month period from December through July. The basic PATWAS handled an average of only 9 percent for the same period of time.

Figure E-2 shows that the percentage of weather information requests served by FSS/WSO personnel decreased since the trial PATWAS went into operation. The left side ("A. Before") shows that before trial PATWAS activation, FSS/WSO briefings satisfied approximately 88 percent of the requests for weather information. (This percentage and all other "Before" numbers are for the comparable period in the year immediately preceding trial PATWAS activation.) The right side ("B. After") shows that after trial PATWAS activation, briefings satisfied an average of approximately 64 percent from December on.

The supplemental survey revealed that 63 percent of the pilot response indicated that it was unnecessary to contact the FSS for preflight weather information after listening to the trial PATWAS. Sixty-seven percent of the returns indicated that it was unnecessary to contact the FSS for weather information while in flight, as a result of listening to the trial PATWAS. The supplemental survey asked for an estimate of the percent reduction in FSS contact time for those occasions when it was necessary to call the FSS for weather information. It is significant to note that as a result of listening to the trial PATWAS, the pilot respondents indicated that the average reduction in FSS weather briefing contact time with FSS specialists and WSO personnel was estimated to be 51 percent for preflight briefings and 44 percent for in-flight briefings.

Ninety-six percent of the respondents to the supplemental survey preferred the route-oriented briefings (see table 24, volume I). The activity data reflected a considerable usage of the route-oriented briefings, e.g., North and East = 21 percent; South and West = 18 percent; Local = 61 percent (see table 26, volume I).

A similar experimental PATWAS system was also tested in the Washington, D.C., area. Table E-1 compares the percent change in FSS briefings for Washington, D.C., and NYC. Washington, D.C., produced an 11.1-percent decrease in the number of FSS WSO briefings, while NYC yielded a net reduction of 4.6 percent. The latter percentage amounted to 16,000 fewer briefings than for the 1-year period immediately preceding the activation of the trial PATWAS. The percentage increase in PATWAS calls was substantial in both locations. These increases are attributable to the upgraded PATWAS.



NOTE: 1. PUBLICITY MAILING BEGUN IN NOVEMBER AND COMPLETED IN DECEMBER 1975.

FIGURE E-2. DISTRIBUTION OF RESPONDING TYPES OF SERVICE BEFORE AND AFTER THE TRIAL PATWAS ACTIVATION

TABLE E-1. EFFECTIVENESS OF PATWAS AT TWO LOCATIONS

	FSS/WSO Briefings (X 1,000)				PATWAS CALLS (X 1,000)	
	Wash., D.C.	NYC Total	LGA WSO and TEB FSS	ISP FSS	Wash., D.C.	NYC
Before Improvement	190	351	188	163	200	46
After Improvement	169	3 35	169	166	404	157
Difference	-21	-16	-19	+3	+204	+111
% Change	-11.1	-4.6	-10	+2	+102	+241
Stimulated Demand (No. of New Calls Created)	-	-			204	111

NYC = Combined number of briefings at LGA WSO and TEB FSS and ISP FSS.

It is significant to note that if a before and after comparison is made using the period from December 1975 (time of publicity mailing) to November 1976 as the "after" period, an even larger reduction in pilot briefings was achieved at La Guardia WSO and Teterboro FSS. Using this time frame, (a) the reduction of pilot briefings at La Guardia WSO and Teterboro FSS was 12.9 percent, (b) the number of calls to PATWAS increased by 130,000 or 283 percent, (c) the number of pilot briefings at Islip increased by 3 percent.

Trial PATWAS activated July 24, 1975.

CONCLUSIONS

The following major conclusions have been drawn from the New York City PATWAS experiment:

1. The trial PATWAS produced a substantial decrease in the number and length of FSS person-to-person briefings.

2. Route briefings were very popular with the users, and any national design should incorporate route-oriented PATWAS recordings.

3. The general aviation public expressed satisfaction with all aspects of the trial PATWAS.

4. The trial PATWAS was responsible for disseminating an unprecedented amount of weather information for preflight planning to general aviation pilots in the NYC metropolitan area. The automatic text preparation capability and the Hazeltine 2000 Request/Reply Terminal Subsystem proved to be extremely effective in both performance and manpower savings.

5. Large numbers of users expressed the desire to reach PATWAS through a toll-free telephone number. Requests for toll-free access constituted the most frequent comment received from the respondents to the questionnaire. Seventy-nine percent of the pilots who requested toll-free access to PATWAS resided in the counties outside the toll-free areas. The largest number of requests came from Suffolk County, New York, which is outside the toll-free area.

6. In our opinion, continual improvements to PATWAS will provide better service to the flying public and have a positive effect on flying safety and comfort.

7. The trial PATWAS is superior to the basic PATWAS for flight planning.

8. During non-VFR weather, it was necessary to commit the services of one person full time to the preparation of trial PATWAS recordings.

9. The trial PATWAS information-gathering, recording, and playback equipment worked efficiently.

10. The "barge-in" connection was acceptable to the users (i.e., connection to the message at some point other than the beginning). However, from an operational standpoint, the "barge-in" connection tends to increase the line hold time and therefore is not cost effective. It should be noted that the users have not been exposed to an alternative connection as the basic PATWAS also provides the "barge-in" connection.

11. The speech and recording techniques of the speakers on both the basic and trial PATWAS recordings could be improved.

12. The full potential of PATWAS for disseminating weather information has not been realized as yet.

RECOMMENDATIONS

The following recommendations are divided into two groups: those that can be achieved through operational changes and those that have research and development implications.

OPERATIONAL.

1. Eliminate the basic NYC PATWAS and replace it with the improved trial PATWAS on a permanent basis.

2. Provide an expanded toll-free access for NYC PATWAS to include ISP FSS area.

3. Provide periodic publicity for the improved PATWAS.

4. Make the following changes to the NYC PATWAS message:

   a. Provide local time in addition to Greenwich mean time.
   b. Provide information on cloud tops when feasible.

5. The speaker assigned to record aviation weather briefings on PATWAS should be screened for articulation and pronunciation problems prior to selection. He must be able to speak clearly, distinctly, and in a well modulated manner at a rate between 100 and 120 words per minute. He must be able to control his delivery for articulatory error, loudness, and rate. Deficiencies in any of these areas will adversely influence the quality of the communication. A quality control system should be established to help ensure adequate speech proficiency. Additional training in the preparation of mass-dissemination recordings should be made available to maintain speech proficiency.

RESEARCH AND DEVELOPMENT.

1. To fully exploit the far-reaching potential of PATWAS as an aid to flight planning, a system with the following enlarged capability is needed:

   a. Noninterrupting fast-time updating of weather information.
   b. Multiple message storage.
   c. Accessing message at beginning.
   d. Multiple message availability on any telephone line.
   e. One telephone number access.
   f. Automatic message composition.
   g. Centralized message composition.
   h. User selection of specific message segments.

The existing PATWAS system, utilizing cartridge tapes and magnetic drums, can be improved by changes in message content and format and by furnishing more telephone lines, as evidenced by the NYC PATWAS experiment. These improvement, although important, are nevertheless narrowly limited in scope and thus do not provide any far-reaching benefits for FSS modernization. On the other hand, a

national mass-dissemination system based on digital technology has the potential of reaching, in our opinion, more aviation users with better products and at no increase in personnel.

2. Develop a national system design for improving the mass dissemination of aviation weather information.

3. Give the pilot the option of filing a flight plan through PATWAS. This would provide one-call service.

INTRODUCTION

OBJECTIVE.

As part of the Near Term Flight Service Station Improvement Program, the Federal Aviation Administration (FAA), in conjunction with the National Weather Service (NWS), conducted a controlled experiment known as the New York City (NYC) Pilots Automatic Telephone Weather Answering Service (PATWAS) Test. The purpose of the experiment was to test and evaluate new PATWAS products, schedules, user acceptance, the effects on the telephone briefing workload at the flight service station (FSS), and to gather technical performance data.

BACKGROUND.

Prime responsibility for conducting and financing the NYC PATWAS test was assigned to the FSS Branch (ARD-440) of the FAA. With technical support from the FAA's National Aviation Facilities Experimental Center (NAFEC), ARD-440 was responsible for the following:

1. Design, procurement, and installation of system equipment.

2. Development of a test plan delineating the method of data collection, analysis, and interpretation of the results obtained.

3. Cooperation with the NWS to assist in the definition of procedures, products, and schedules for the test.

The NWS was responsible for the following:

1. Detailed operational aspects.

2. Weather product design and scheduling.

3. Manpower required to develop the necessary products and text.

4. The manual preparation of the recordings.

The rapid growth in general aviation has made it necessary to improve and expand the present system for disseminating aviation weather information to the flying public. It is apparent that the projected growth of the flying public will give rise to a corresponding increase in the demand for preflight weather briefings. One of the most effective techniques currently being utilized to disseminate aviation weather information is the telephone-accessed prerecorded PATWAS. The purpose of PATWAS is to provide aviation users with weather information for preflight planning.

Operational since July 1975, a trial PATWAS system in the NYC area provides telephone access to three tailored independent recordings at three different phone numbers. One phone number provides the local New York area (50 nautical mile (nmi) radius) conditions. Briefing information for routes northbound is available at a second number. The third number provides pertinent information for routes south and westbound. Selected Notices to Airmen (NOTAM's) which affect flight safety or the use of aeronautical facilities are appended to the appropriate recordings. The number of access lines was increased to virtually eliminate busy signals. Other improvements included new magnetic tape equipment, expanded message content, improved message format, more frequent updating of information, and reduction in the time required for updating. In order to meet the pilot's need for current weather information in the early hours, presumably when he is doing his flight planning, two special early morning recordings were developed in addition to those prepared in the morning, afternoon, and evening. All messages were updated hourly, and if conditions demanded, more frequently. The new system contained the capability to request meteorological and aeronautical information from the Weather Message Switching Center (WMSC) for incorporation into the PATWAS message.

The trial PATWAS provides the following information:

1. Flight precautions,
2. Winds aloft,
3. Synopsis,
4. Area or route forecasts,
5. Terminal forecasts,
6. Hourly observations from selected locations, and
7. NOTAM's pertaining to flight safety or the use of aeronautical facilities at these locations.

Prior to the installation of the trial PATWAS, the only PATWAS service provided in the NYC metropolitan area was that offered by the La Guardia Weather Service Office (LGA WSO). This basic PATWAS system provided a two-line access for calls originating in the local area (toll-free) and "message unit" toll calls from other areas on Long Island. In addition, a foreign exchange line provided toll-free access to the same announcement from the Teterboro, New Jersey, area. These services remained operational during trial PATWAS testing.

The content of the basic PATWAS message was limited to a generalized forecast for New York City and vicinity and a synopsis report. No route information was provided, nor hourly weather, specific flight precautions, terminal forecasts, or NOTAM's. AIRMET's were not specific. The message contained only general information on wind. No specific heights were included. Recordings were updated three times a day.

Initially, pilots learned of the availability of the new trial PATWAS through the basic PATWAS recording, which also remained operational throughout the testing period. (The terms "basic" and "trial" PATWAS have been used in lieu of "old" and "new" PATWAS, since the terms "old" and "new" are prejudicial.)

The trial PATWAS was evaluated in a number of ways as shown in table 1. One of the principal methods of evaluation consisted of a questionnaire that was mailed to all pilots registered with the General Aviation District Offices (GADO's) in Farmingdale, New York, and Teterboro, New Jersey (table 2). Approximately 26,000 pilots received the questionnaire. The questionnaire was designed to measure the degree in which the trial PATWAS satisfied the flight planning needs of the respondents and to determine if it constituted a significant improvement over the basic PATWAS. Appropriate follow-up efforts were made to obtain an input from nonrespondents to the primary questionnaire. In addition, a supplemental survey of 3,152 volunteer pilots was taken to measure pilot reaction to the trial PATWAS after recurrent use of the system. It was hypothesized that the supplemental survey would provide weightier opinions on the acceptability and effectiveness of the trial PATWAS.

The test procedures and time periods during which they occurred are listed in table 3.

DISCUSSION

FUNCTIONAL DESCRIPTION.

Each of the three trial PATWAS messages is composed of five message segments arranged to provide for rapid message update. Each segment is recorded on an endless-loop magnetic tape cartridge. During the message segment recording process, a cue tone is placed immediately to the end of each message segment. The cue tone is used to trigger the start of the next message segment. The detection of the cue tone and start of the next message segment is so rapid as to be undetected by the listener.

The trial PATWAS is an assemblage of data acquisition equipment, studio quality recording/playback equipment, and telephone company equipment. Briefing data are acquired from the Weather Message Switching Center via a 110-baud, American Standard Code for Information Interchange (ASCII) dedicated line. The data are received by a Hazeltine 2000 cathode ray tube (CRT) terminal equipped with a thermal printer. Software changes made at the WMSC computers facilitated an automatic text preparation for the update of the various recordings.

Message segments are read from a prepared script into a microphone. The resulting utterances are recorded on a separate cartridge recorder/player. Immediately following the recording process, the message segments are auditioned for content and clarity. The updated message segment is then manually loaded into the appropriate cartridge slot in the message player, replacing the former segment.

Access to the message player is through the telephone company supplied barge-in equipment. The system operates as shown in figure 1. A pilot calls the appropriate telephone number. If no one else is connected to the message he has dialed, completion of his call starts the message at the beginning. From that time, each message segment is sequenced until he terminates the call. After he hangs up, the message will continue to sequence to the end of the last

TABLE 1. SUMMARY OF DATA COLLECTION METHODS

No.	System Response		Source of Data		What the Data are Expected to Show	Comment
	Type	Method of Measuring	Organization	Procedure		
1	User Acceptance	No. of completed phone calls (Objective)	N.Y. Bell Tel. Co.	Counter on phone lines	Increased number of calls indicates pilot acceptance since they are actually using the system more	Long term trends in demand, seasonal, and weather variations must be taken into account
2	User Acceptance, FSS workload	No. briefings given per month (Objective)	F.S.S. Supervisors and Briefers	Monthly record of briefings given	Decrease in number of briefings	Same as above
3	User Acceptance	**Questionnaire sent by FAA (i.e., pilot opinion) (Subjective)**	NAFEC contact pilots	Mailed questionnaire	**Pilot reactions to trial as compared with basic PATWAS, judgement of acceptability of various aspects**	
4	User Acceptance	Post-Flight Contact with Stratified Sample (Subjective)	NAFEC contact pilots	Phone and mail contact with selected sample of pilots	**Superiority of trial PATWAS as compared with basic; acceptability of changes in content, form, or format, and schedule**	
5	System Line Loading	Time on line after contact (Objective)	NAFEC	Print-out from timer on line	Whether or not "barge-in" is troublesome	Comparison of time on line with actual message length reveals extent to which requester listens to more than one cycle of message
6	WSO workload	Workload changes (Subjective)	W.S.O. Supervisors and Operators, PATWAS test personnel	Workload determined from supervisory judgment, operator opinion, and observations by test personnel	**One operator can handle workload so that there is no increase in personnel required to operate trial PATWAS**	
7	Equipment/ procedural adequacy	Direct observation (Subjective)	NWS Supervisors and Operators, PATWAS test personnel	Expert opinion and operator judgement	Nature of changes (if any) required in equipment and/ or procedures	

TABLE 2. COUNTIES OF RESIDENCE AND AIRPORTS INCLUDED IN NYC PATWAS TEST

Counties of Residence*

New Jersey	New York
Passaic	Queens
Hunterdon	Manhattan
Hudson	Brooklyn
Bergen	Nassau
Middlesex	Bronx
Morris	Richmond
Somerset	Westchester
Essex	Orange
Union	Suffolk
Sussex	Sullivan
Mercer	Rockland
Monmouth	Putnam
	Dutchess
	Ulster

Airports**

Morristown	La Guardia
Teterboro	J. F. Kennedy
Newark	Farmingdale
	Islip
	White Plains

*Included all personnel registered with the General Aviation District Office (GADO) at Farmingdale and Teterboro.
**Includes NYC area airports with FAA control towers

TABLE 3. TEST PROCEDURES AND AFFECTED TIME PERIODS

Time Period Starting	Ending	Test Procedure
Prior to	April 1975	Planning and Design
April 1975	May 1975	Equipment procurement
June 1975	July 1975	Equipment installation and checkout
July 24, 1975	to present	Equipment operational
August 1975	July 1976	Gather 12-month period of data for the following activities: PATWAS, FSS/WSO briefings, itinerant aircraft departures
November 1975	December 1975	Distribute announcements of test and descriptive material
May 1976	June 1976	Initial distribution of questionnaire
August 1976	September 1976	Follow-up distribution of questionnaire
August 1976	August 1976	Distribution of supplementary evaluative material
During November 1976		Telephone contact with selected nonrespondents
April 1976	October 1976	Determination of PATWAS message length, user time on line, and weather day
	November 30, 1976	Date data collection ended.

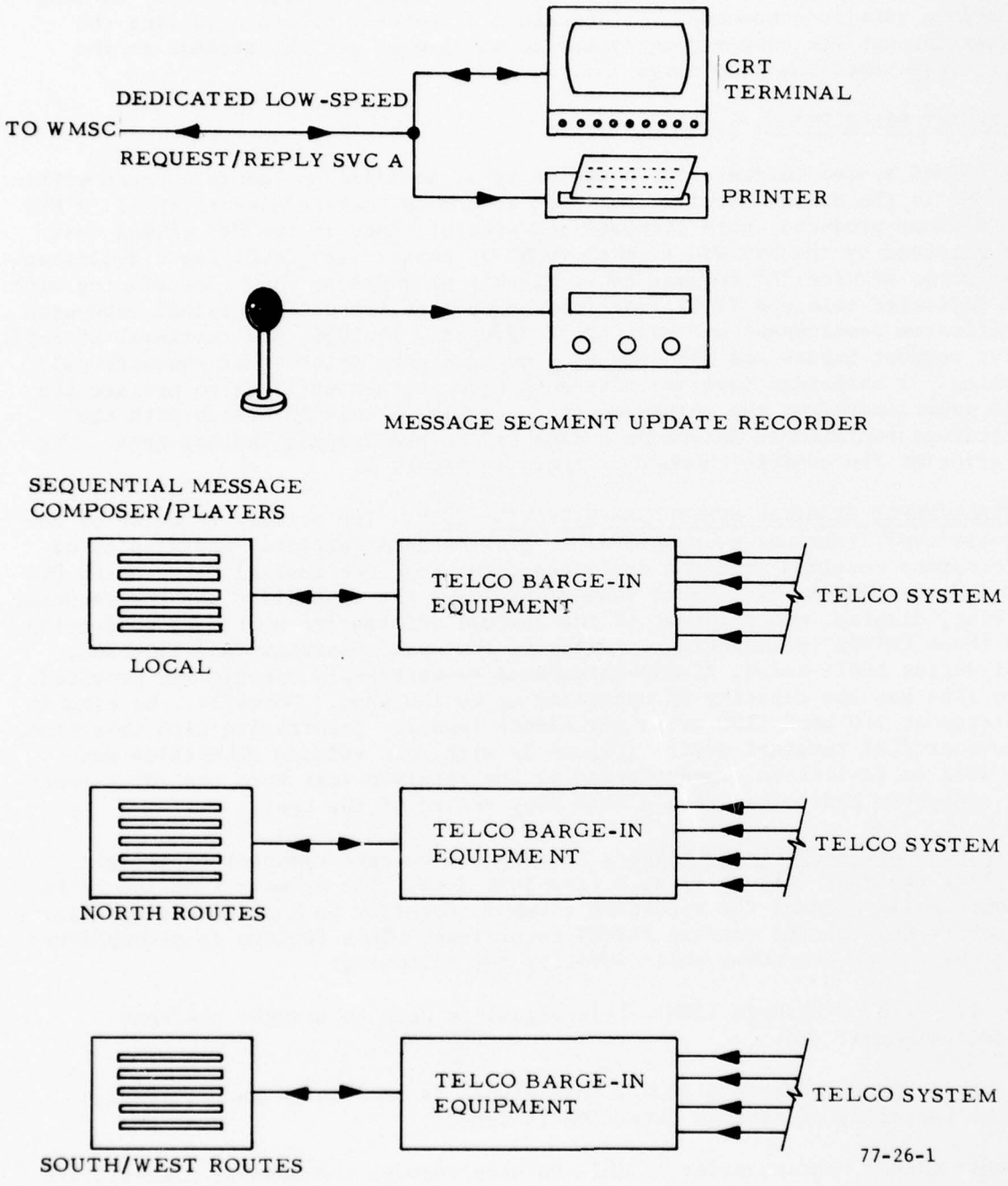


FIGURE 1. FUNCTIONAL DESCRIPTION OF THE TRIAL PATWAS OPERATION

segment and then stop. If additional pilots should call while the initiating pilot is still connected to system, the system will continute to play as long as anyone remains connected. As described elsewhere, pilots acquiring the system through the barge-in equipment do not always get the message at the beginning--hence the term barge-in.

EQUIPMENT DESCRIPTION.

The PATWAS system hardware is installed in an acoustic enclosure located within the WSO in the Marine Terminal Building at the La Guardia Airport (LGA) in NYC. All weather products, both standard and special, used in the NYC PATWAS test are received by the NYC WSO from the WMSC at Kansas City (MKC) via a dedicated, low-speed, service "A" request/reply circuit provided by FAA. Interfacing with the dedicated teletype (TTY) line from WMSC, a keyboard CRT terminal subsystem facilitates development and editing of requests, storage, and retrieval of repetitive request inputs and CRT display, and hard copy printout of requests and replies. A cartridge tape recorder subsystem is then utilized to prepare the tape recordings from the retrieved text. Trunk circuit interface with the recordings facilitates telephone access to the prerecorded weather data. The interior of the console chamber is shown in figure 2.

REQUEST/REPLY TERMINAL SUBSYSTEM--HAZELTINE 2000. The primary function of the request/reply terminal subsystem is to provide data retrieval and display of information received from the dedicated communications channel between the NYC WSO and the WMSC at MKC. This channel provides the capability for the request, receipt, display, and printout of the textual information necessary to develop the three PATWAS recordings. A dedicated low-speed, service "A," 110-baud, half-duplex ASCII-coded, RS-232-interfaced request/reply circuit was provided. This line has the capacity of operating up to 150 baud. Normally, the circuit operates at 110 baud (100 words per minute (wpm)). Interfacing with this line, a keyboard/CRT terminal device (figure 3) with full editing capability was provided to facilitate transcription of the received text onto the voice recorder subsystem and to maintain a hard copy record of the text.

CARTRIDGE TAPE RECORDER SUBSYSTEM. Model 305C message composer cartridge playback recorder (figure 4) is a five-bank deck. Its primary function is to automatically connect the recording elements together in a serial, sequential manner to develop the various PATWAS recordings. This feature is accomplished with the use of cue tones which indicate the following:

1. End of Message (EOM): this signal is used to trigger the next message element; and

2. Start of Message (SOM): this signal is used to advance a message to the beginning of message after EOM is sensed.

In this manner, the recorder is able to step through the message elements and produce a continuous integral PATWAS recording.

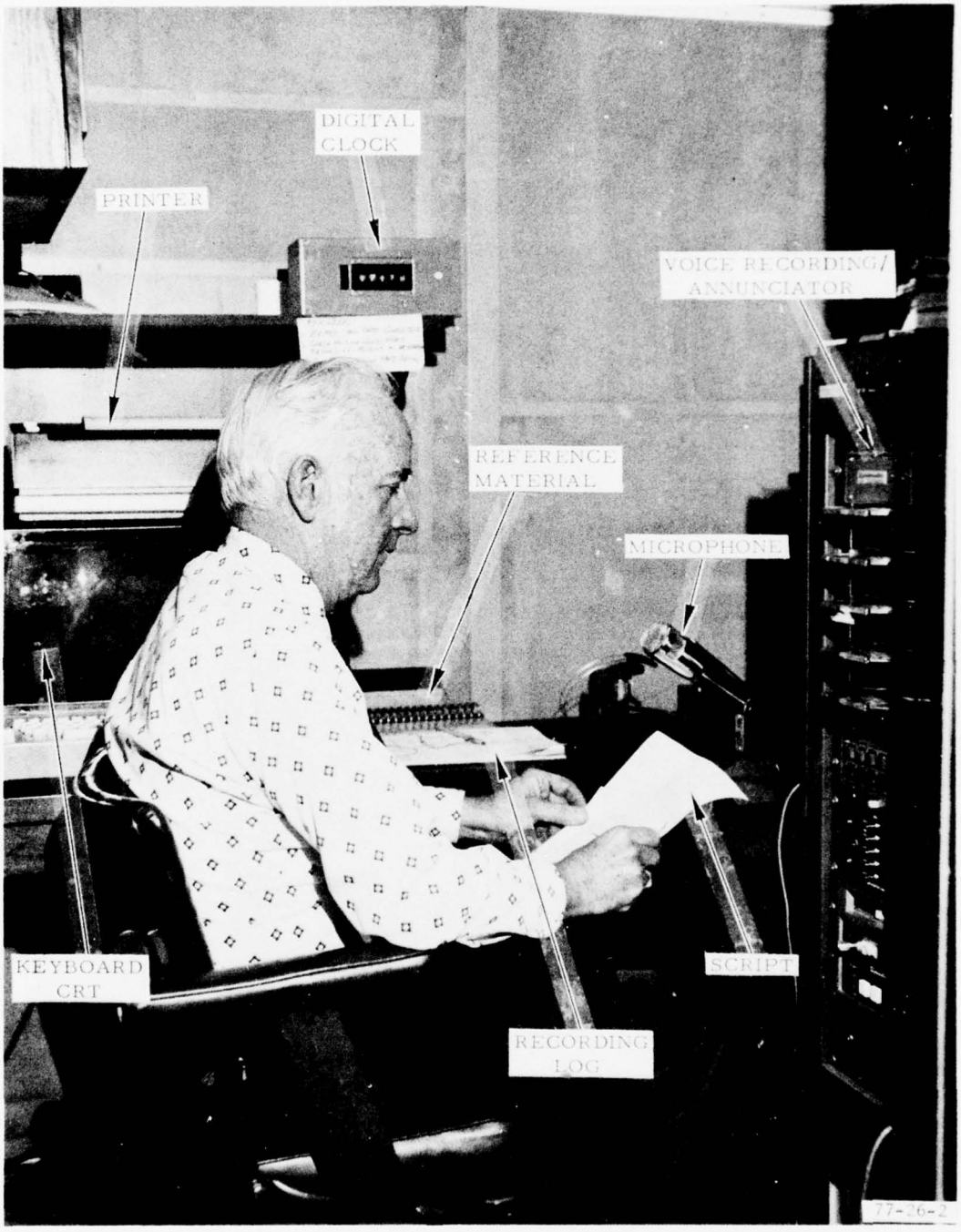


FIGURE 2. ACOUSTIC CHAMBER, INTERIOR

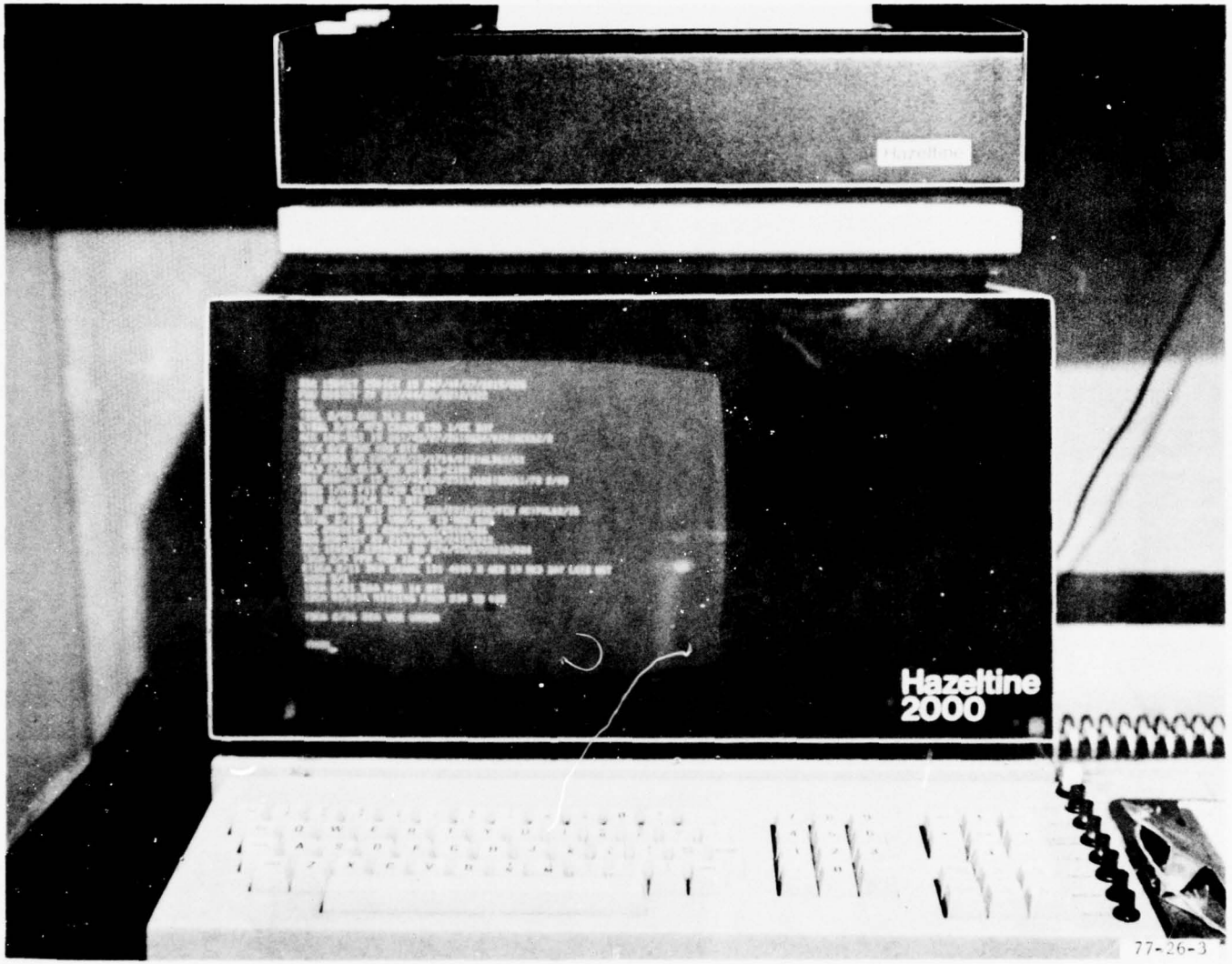


FIGURE 3. KEYBOARD CRT AND PRINTER

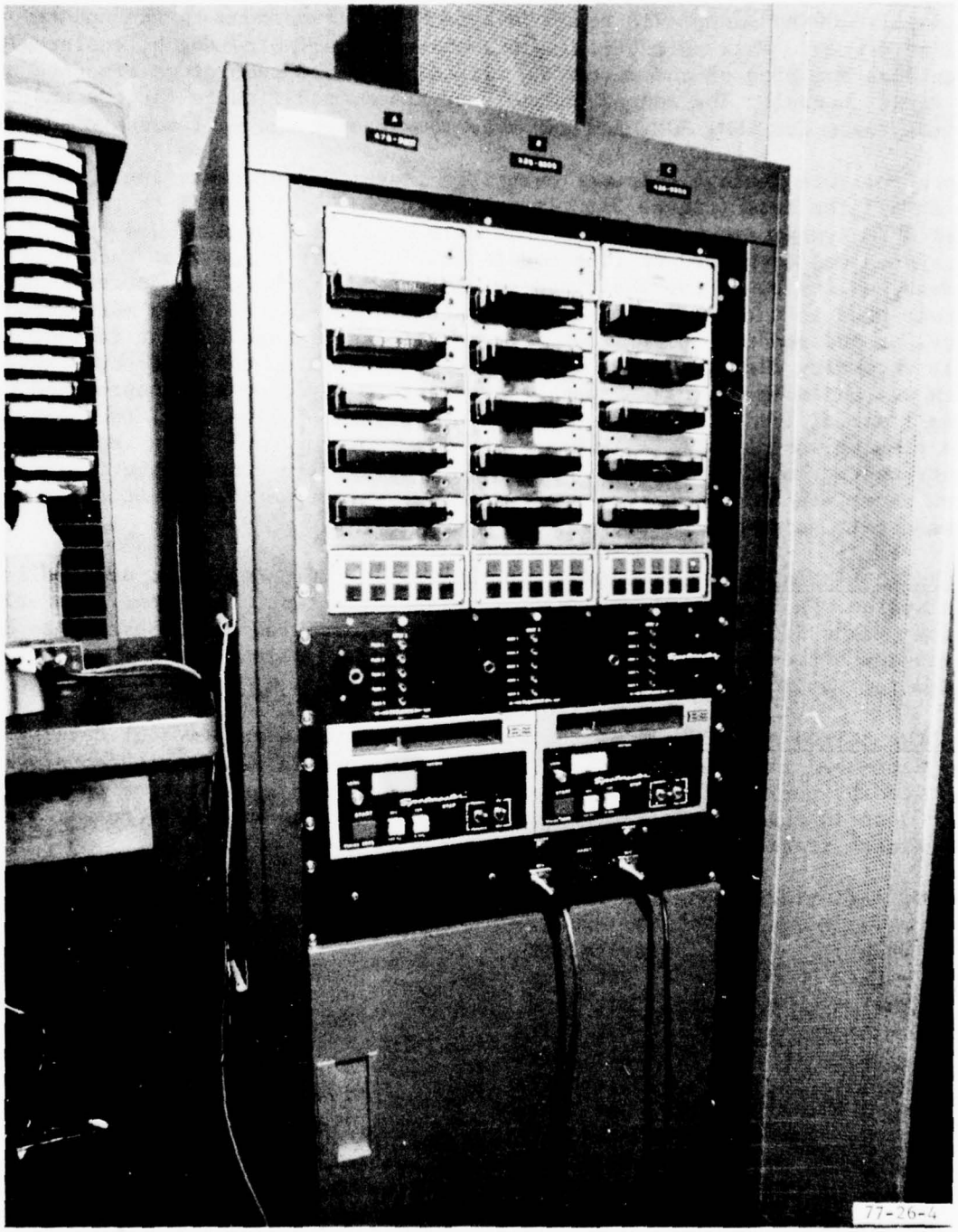


FIGURE 4. RECORDER/ANNUNCIATOR

The model 3200 RP monophonic record/playback unit functions as the update/ editing device. This unit utilizes two-channel, variable-length, endless-loop cartridges for each of the recording elements. Voice recordings are done on the first channel. The second channel, or track, facilitates the cue and control tones for SOM, EOM, and cue tone to sequence the next message segment.

A more reliable message composer cartridge playback system was installed at LGA at a later date (figure 5). It was functionally identical to the earlier model 305C system, the main difference between the two systems was that the new system was comprised of five model 3100P's. This meant that each message element had its own drive shaft and motor instead of the common driveshaft concept used in the earlier system. This feature permitted much more redundancy, or independent operation. That is, if one message element failed, the whole recording didn't. This was made possible by a special time-out feature which was added to the new system. This feature detected the nonpresence of signal, and if this condition existed for a period of 5 seconds, the next message element was automatically started. The operator could then replace the faulty unit. In addition, the units were electrically conditioned for better noise rejection between units to avoid premature triggerings of succeeding decks due to noise transients.

TELEPHONE LINE ACTIVITY RECORDING EQUIPMENT. The purpose of the data collection system was to monitor and record, on magnetic tape, the phone line utilization of the NYC PATWAS installation. This information was necessary to help assess the effectiveness of the trial system and to help determine line capacity needed for future installation.

DATA COLLECTION AND FORMAT. Data collection efforts were aimed at determining user line-hold time per connection, number of lines in use simultaneously, and peak loading periods during the day. The information was recorded on the magnetic tape in a seven-track digital format; six tracks were data channels, while the seventh track was used for an odd-parity bit.

The six data tracks constitute a modulo-six character shown below.

Track 7	Parity Bit
Track 6	2 Bit Tens
Track 5	1 Bit Tens
Track 4	8 Bit Units
Track 3	4 Bit Units
Track 2	2 Bit Units
Track 1	1 Bit Units

Six characters are assembled in the proper sequence to form a logical record for each line transaction that occurs. On-line disconnect, an "off bit," is set in the appropriate location in the logical record. A typical example appears in figure 6. This assemblage of data constitutes a record of line activity of the PATWAS installation at New York.

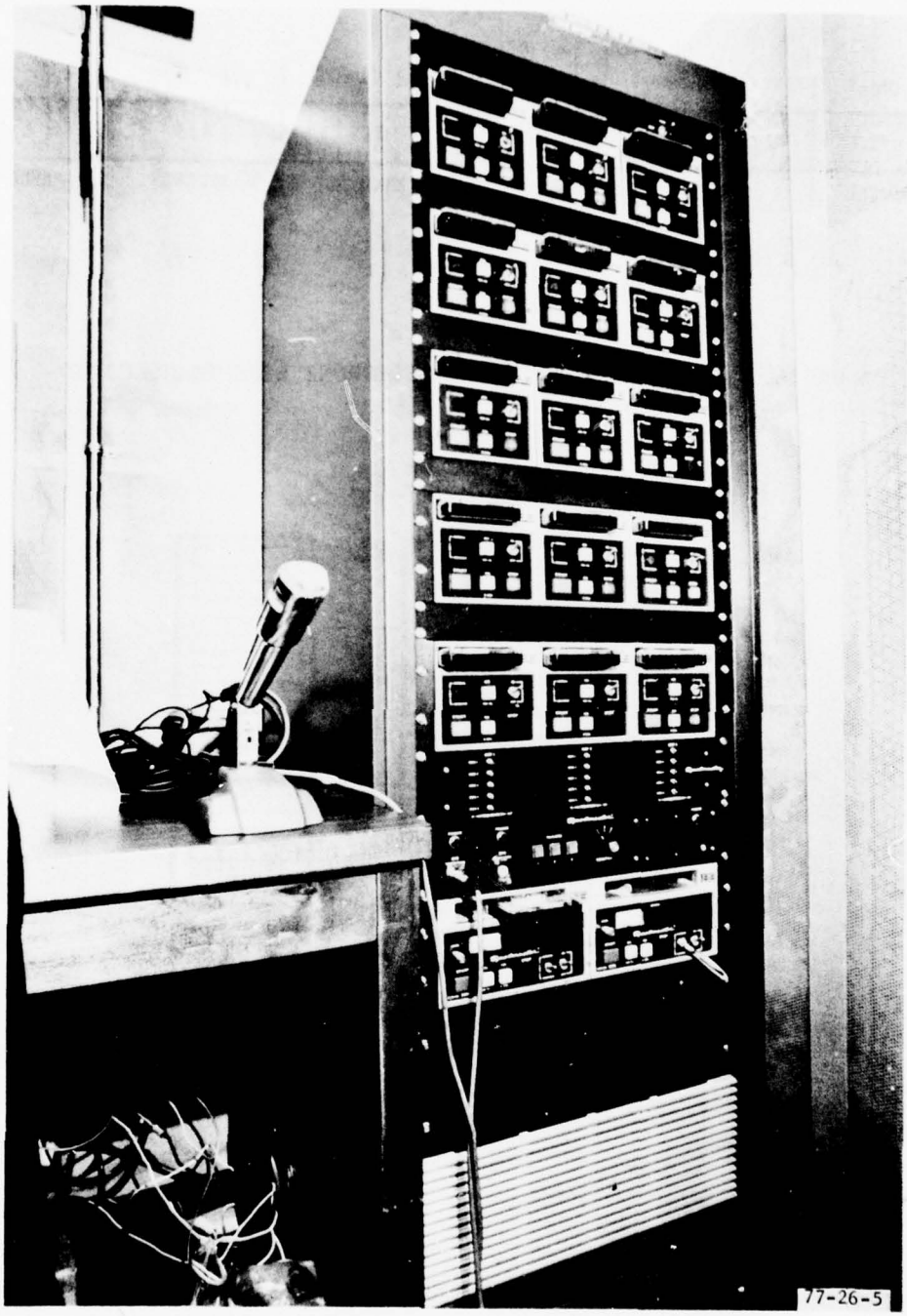


FIGURE 5. IMPROVED RECORDER/ANNUNCIATOR

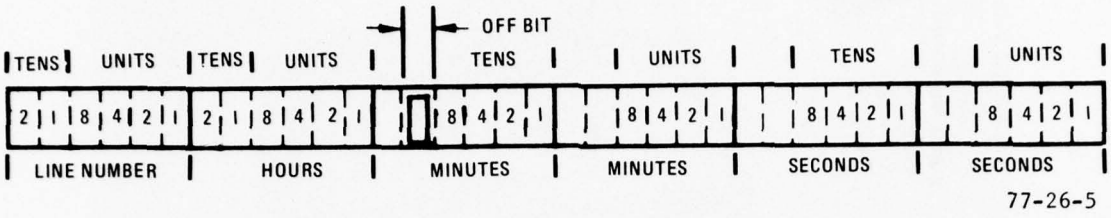


FIGURE 6. LOGICAL RECORD OF A TELEPHONE LINE TRANSACTION

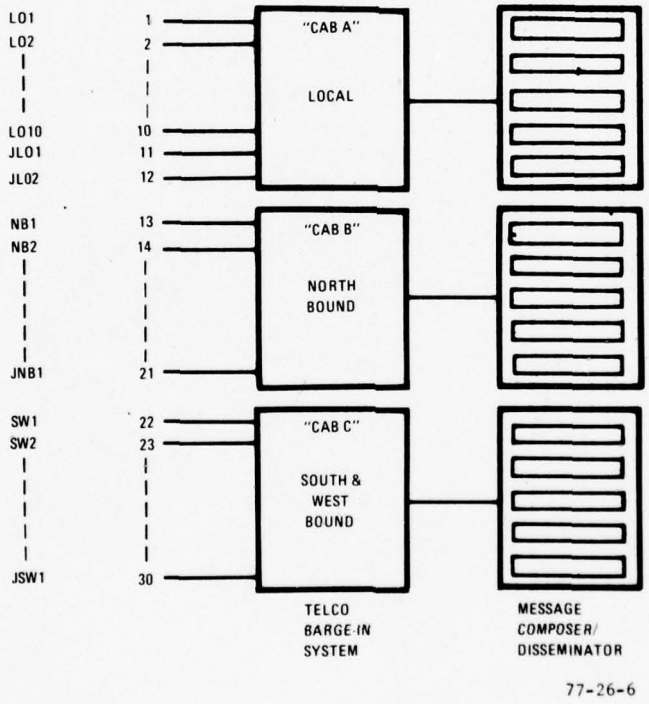


FIGURE 7. TELEPHONE COMPANY/FAA EQUIPMENT INTERFACE, BLOCK DIAGRAM

The computer reduction and analysis of these raw data provide the additional feature of calendar date information. This feature allows for correlation of usage of the system with different weather conditions. Additional statistical analyses and parameter comparisons felt pertinent to describe system utilization can be implemented through software techniques.

DESCRIPTION OF PATWAS INSTALLATION. The message composer/disseminator unit is the device which transmits the prepared message on the phone line when an initiation signal is received from the barge-in system. If another pilot calls up during this message transmission, he "barges in" at that point in time and receives the remainder of the message transmission. The barge-in cabinet is serviced by the trunk line as is shown in figure 7. It should be noted that a barge-in cabinet and message composer/disseminator unit are needed for each route-oriented message and that the phone lines in a particular barge-in cabinet are dedicated to that message and cannot be utilized to transmit a different route-oriented message.

INSTRUMENTATION PACKAGE DESCRIPTION. A block diagram of the instrumentation system package is shown in figure 8. The line-scanner logic identifies each line with a number and continuously scans the 30 lines every 2 seconds. The scanner logic also sequentially provides enable signals for the line-sample-and-hold circuitry.

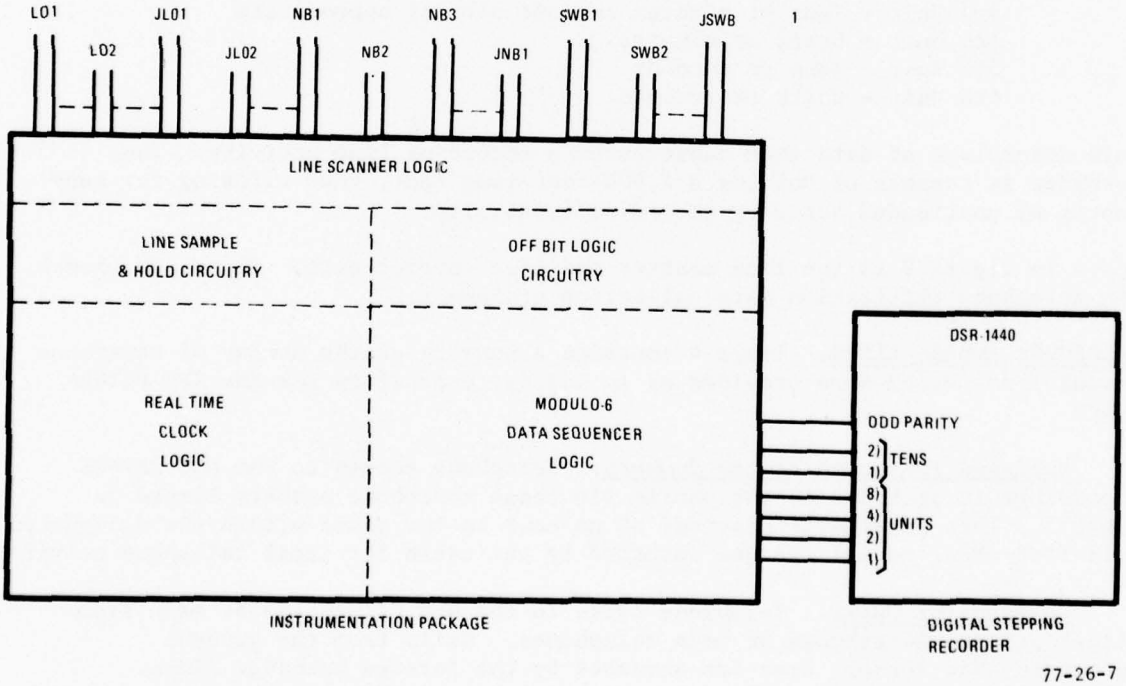


FIGURE 8. TELEPHONE LINE TRANSACTION INSTRUMENT SYSTEM, BLOCK DIAGRAM

Telco provides relay contact closures for each of the 30 telephone lines in the PATWAS installation at New York. These contact closures provide the line status signal information required by the line-sample-and-hold circuitry. This circuitry senses a change in line status and only allows transmission of information to the tape recorder for a particular line on line-connect or disconnect. The "off bit" logic senses a line disconnect and provides a "logic one" indication in the appropriate location in the logical record word.

The real-time clock uses line frequency as its time source. This clock provides timing information of line transactions to be included in the logical record word.

The modulo-six data sequencer logic performs the task of presenting the information to the tape recorder in the proper format and sequence. Since the tape recorder is a data-driven device, the step-and-record signals are also provided by this logic.

The information to assemble a logical record is clocked to the recorder in six-bit units. Six units are required to establish a logical record. The information is transmitted in the following sequence:

1st Unit - Line number
2nd Unit - Tens and units of hours
3rd Unit - Tens of minutes and off bit, if appropriate
4th Unit - Units of minutes
5th Unit - Tens of seconds
6th Unit - Units of seconds

This assemblage of data then constitutes a record of line activity. The recorder is capable of holding a 2,400-foot-long tape, thus allowing for many months of unattended activity recording capability.

Shown in figure 9 is the line monitor and tape control unit. Figure 10 showss the telephone utilization data collection equipment.

TELEPHONE ACCESS LINES. Table 4 contains a summary of the number of telephone access lines which were provided as an initial capability for the NYC PATWAS test.

Assigned Telephone Access Numbers. Telephone access to the NYC PATWAS recordings is provided to the public via those telephone numbers listed in table 5. This service is provided at no cost to the users within the designated toll-free area, normal charges incurred by the users for local telephone service.

Charges for Calls. Telephone calls to the NYC PATWAS can be made from either private telephones or coin telephones. Calls from the general Teterboro, New Jersey, area are accessed by the foreign exchange lines. These calls are treated as local calls and assessed the same charge as any local call in the Teterboro exchange area.

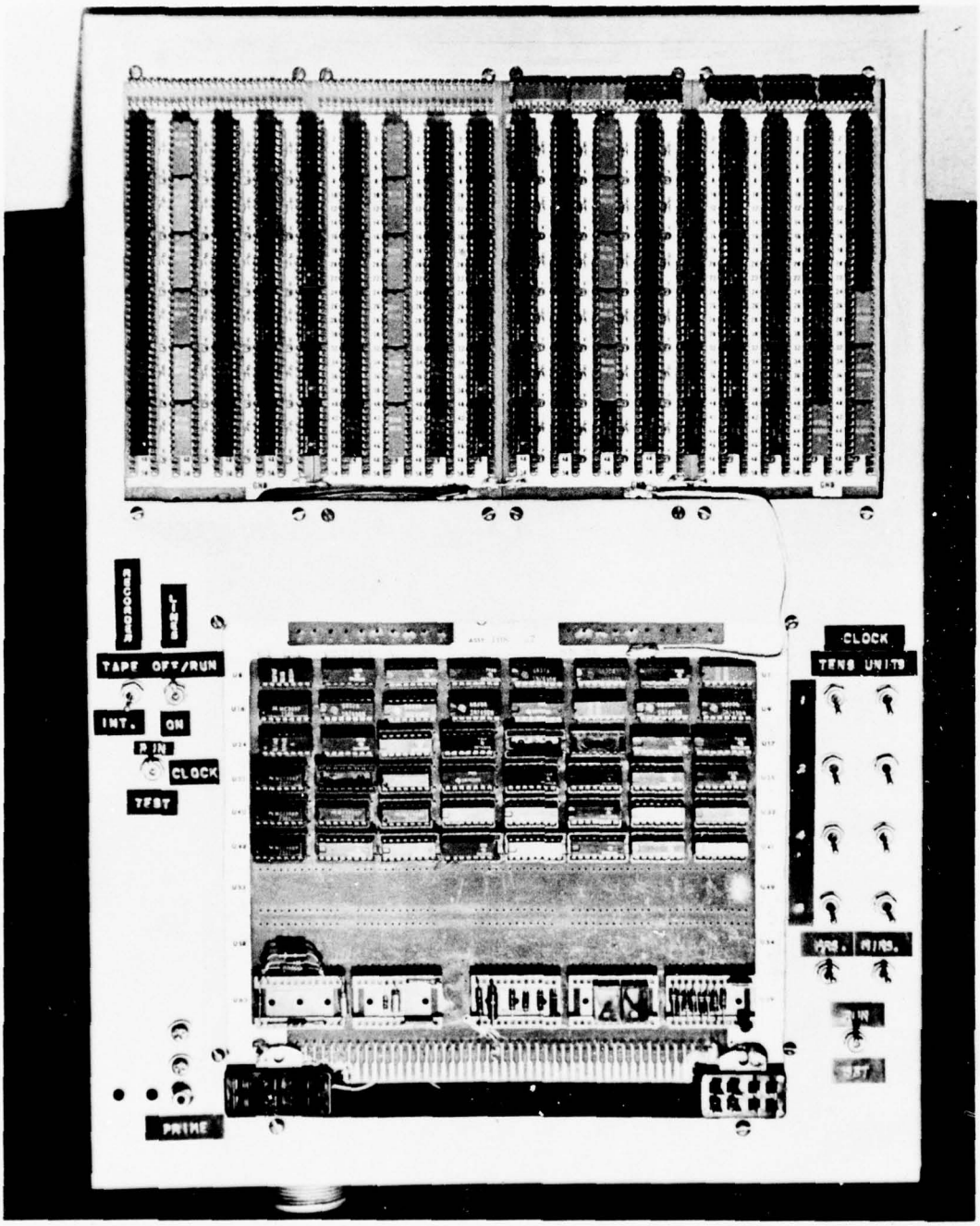


FIGURE 9. LINE MONITOR AND TAPE CONTROL UNIT

FIGURE 10. TELEPHONE UTILIZATION DATA COLLECTION EQUIPMENT

TABLE 4. ACCESS LINES

Recording	Local Lines (No.)	Foreign Exchange Lines (No.)	Total Lines (No.)
Local	10	2	12
North	8	1	9
South/West	8	1	9

TABLE 5. TELEPHONE NUMBERS ASSIGNED* FOR THE NYC PATWAS TEST

Recording	Local Exchange	Foreign Exchange
Local	(212) 476-8800	(201) 288-3100
North	(212) 426-8300	(201) 288-5570
South/West	(212) 426-9300	(201) 288-9250

*Not available prior to July 1975.

Charges for calls made in the NYC five boroughs and Nassau County, Amityville, Cold Spring Harbor, Farmingdale, and Southern Westchester County depend on the type of service the pilot user has. If he has message rate service, message units are applied to all calls within the message unit area. If he has "flat rate service," message units are applied to some calls within the message unit area. In either case, the number of message units charged varies according to where the call is made and the length of the conversation. (A message unit is not a call, it is a unit of charge for local calls.)

Individual message rate service includes 50 message units. Message units that are used over this allowance are billed at 8.2¢ each (6.0¢ in off-peak hours, 9 p.m. to 9 a.m.). All message units are billed at 8.2¢ each under "basic budget service," another type of message rate service.

If a pilot has a flat rate service, he may call anywhere in the primary local calling area with no restrictions on either the number of calls or the call duration. Message units apply here also, for all calls made outside the primary local calling area. Again, message units are billed at 8.2¢ each (6.0¢ in off-peak hours, 9 p.m. to 9 a.m.). Calls from coin telephones are at a minimum charge of 10¢ per call.

Table 6 lists the message unit charges, initial period, and overtime charges for message unit calls to the NYC PATWAS at the LGA WSO from areas within the NYC metropolitan exchange area. (Toll call rates apply to calls made from outside the New York metropolitan exchange area.) These charges are the same as any other local call.

PATWAS RECORDING CONTENT AND SCHEDULE.

The content and weather products contained on each of the recordings is described below. In order to meet pilots' needs for current weather information in the early hours when he is doing his flight planning, two special early morning recordings were developed in addition to the morning, afternoon, and evening updates. The recordings are available daily in accordance with the following schedule:

Recording	Time of Availability	
Special PATWAS	0530	
Special PATWAS	0630	Surface Aviation (SA's) and NOTAM's
Morning PATWAS	0730	are updated at least hourly.
Midday PATWAS	1430	
Evening PATWAS	1830	

Recordings are updated at least hourly or as required to incorporate specials and pertinent flight precautions.

Listed below is the order in which information is presented on each of the three PATWAS recordings.

TABLE 6. MESSAGE UNIT CHARGES FOR NY METROPOLITAN EXCHANGE AREA

Borough or County	Rate Zone	Message Unit Charges To NYC PATWAS
Manhattan	1	1
	2	1
	3	1
Bronx	3	1
	4	1
	5	1
Brooklyn	6	1
	7	1
	8	1
Queens	9	1
	10	1
	11	1
	12	1
	13	2
Staten Island	14	2
	15	3
Nassau County	N1	2
	N2	2
	N3	2
	N4	3
	N5	3
	N6	3
	N7	4
	N8	4
	N9	4
Suffolk County	Amityville	5
	Cold Spring Harbor	5
	Farmingdale	5
Southern Westchester County	W1	2
	W2	2
	W3	2
	W4	3
	W5	3
	W6	3
	W7	4
	W8	4
	W9	4

OVERTIME CHARGES

Initial Charge	Initial Period	Overtime Charges
2 Unit Calls	3 min.	1 unit for each add. 2 min.
3-4 Unit Calls	3 min.	1 unit for each add. 1 min.
5 Unit Calls	3 min.	1 unit for each add. 1 min.
6 Unit Calls	3 min.	2 units for each add. 1 min.
7 Unit Calls	3 min.	2 units for each add. 1 min.

A. RECORDING 1.

Local New York City metropolitan area forecast and observations within 50 nmi of NYC.

Tape 1: Introduction - "This forecast was prepared, etc...."

Synopsis - NYC synopsis issued three/day with transcribed weather broadcast (TWEB) package. Expanded to cover entire PATWAS area including New York City (NYC)-Binghamton (BGM)-Albany(ALB)-Boston(BOS)-Philadelphia(PHL)-Washington, D.C (DCA). Local Winds - for JFK 3, 6, and 12,000-foot FD issued two/day, plus any amendments.

Tape 2 Flight precautions - from BOS WA/WS or WAC. Only those pertaining to NYC, New Jersey (NJ), Connecticut (CONN), and Long Island (LI) are used. If no AIRMET's or SIGMET's are in effect, it is so stated.

Tape 3: Introduction - "Forecast valid from ....." NYC metropolitan area aviation forecast - issued three/day containing a local vicinity forecast (TWEB 080) valid for 12 hours for morning and midday and 18 hours in the evening.

Tape 4: Terminal forecasts - first 12-hour portion of the FT's used for the morning and midday and 18-hour portion for evening for the following terminals: La Guardia (LGA), Teterboro (TEB), Islip (ISP), and White Plains (HPN).

Tape 5: Hourly observation plus selected NOTAM's - LGA, JFK, TEB, Newark (EWR), ISP, Bridgeport (BDR), and HPN are updated each hour. The contents of the hourly observation includes the ceiling, visibility, weather, obstruction to vision, wind, and selected remarks pertaining to these elements, and any NOTAM'S regarding these same stations.

B. RECORDING 2.

Routes north and northeast out of New York City.

New York-Hartford-Boston (TWEB 009).
New York-Albany (TWEB 014).
New York-Block Island-Nantucket (TWEB 019) (included on recording from Memorial Day - Labor Day).

Tape 1: Introduction - "This forecast was prepared, etc.... is valid until _____ and covers areas: _____." New York City synopsis - covering entire area of PATWAS test, i.e., from NYC-BGM-ALB-BOS-PHL-DCA: prepared three/day by WSFO NYC valid for 12 hours for morning and midday and 18 hours for evening recording. Winds aloft - FD's, 3, 6, and 12,000 feet for JFK, ALB, and BOS out to 12 hours (FDUS1). Issued two/day plus amendments.

Tape 2: Flight precautions - from BOS, WA/WS or WAC, applicable to area of recording 2.

Tape 3: Introduction - "Forecasts valid from..."12- or 18-hour route forecasts--TWEB routes 080, 009, 014, and 019 (Memorial Day-Labor Day) are transcribed so that they are emanating from NYC. Issued three/day and amended as necessary.

Tape 4: Terminal forecasts - for BOS, Nantucket (ACK) (Memorial Day to Labor Day only), and ALB - valid 12 hours in the morning and midday and 18 hours in the evening.

Tape 5: Hourly observations and selected NOTAM's - LGA, ISP, HPN, JFK, Poughkeepsie (POU), Bradley (BDL), BOS, ACK (Memorial Day to Labor Day only), and ALB. These are updated each hour and provide ceiling, visibility, weather, obstruction to vision, wind, and pertinent remarks applicable to the above elements, plus any NOTAM's regarding these same stations.

C. RECORDING 3.

Routes west and south out of NYC.

NYC-Elmira (ELM) (TWEB 020)
NYC-Philadelphia-Washington (TWEB 027)

Tape 1: Introduction - to recording. Synopsis - NYC synopsis covering entire area of PATWAS test, i.e., NYC-BGM-ALB-BOS-PHL-DCA: prepared three/day by WSFO NYC valid for 12 hours for morning and midday. Winds aloft - FD's 3, 6, and 12,000 feet for JFK and EMI out to 12 hours - issued two/day plus amendments.

Tape 2: Flight precautions - from BOS and DCA, WA/WS or WAC applicable to area of broadcast.

Tape 3: 12- or 18-hour route forecasts - TWEB 020, 027, and 080 are transcribed so that they are emanating from NYC. Issued three/day and amended as necessary.

Tape 4: Terminal forecasts - for Allentown (ABE) and DCA.

Tape 5: Hourly observations and selected NOTAM's - for LGA, ISP, HPN, JFK, PHL, ABE, BGM, and DCA. Contains ceiling, visibility, weather, obstruction to vision, and selected remarks pertaining to the above elements, plus any NOTAM's regarding these same stations updated each hour.

Scheduling of PATWAS recordings. The morning PATWAS recording should be completed in phases by 0730 local time.

1. At 0530 local time, WSO LGA prepares a special recording for the three NYC PATWAS outlets.

A. RECORDING 1 - Local NYC forecast.

Tape 1: Introduction - "..." Special synopsis - prepared by WSFO NYC and stored in TWEB 081. It is valid for 12 hours and covers entire PATWAS area. It is stored in request/reply by 0430 local time. Local winds - for JFK, 3, 6, and 12,000 feet FD's.

Tape 2: Flight precautions - from BOS.

Tape 3: 0500 hourly observations and selected NOTAM's - from LGA, JFK, TEB, EWR, ISP, BDR, and HPN provides ceiling, visibility, weather, obstruction to vision, winds, and appropriate remarks pertaining to these elements.

Tape 4: Fixed statement - "the 0600 hourlies and new terminals will be available by 0630 local time and a complete package by 0730."

B. RECORDING 2 - Routes north and northeast out of NYC.

Tape 1: Introduction - "..." Special synopsis - and winds aloft 3, 6, and 12,000 feet FD's for JFK, ALB, and BOS.

Tape 2: Flight Precautions

Tape 3: 0500 hourly observations and selected NOTAM's - for LGA, ISP, HPN, JFK, POU, BDL, BOS, ACK, and ALB.

Tape 4: Fixed statement - same as recording 1.

C. RECORDING 3 - Routes south and west out of NYC.

Tape 1: Introduction - Special synopsis - Winds 3, 6, and 12,000 feet FD's for JFK and Westminster (EMI).

Tape 2: Flight precautions

Tape 3: 0500 hourly observations and selected NOTAM's - for LGA, ISP, HPN, JFK, PHL, ABE, BGM, and DCA.

Tape 4: Fixed statement - same as recording 1.

2. At 0630 local time, a second special recording for the three NYC PATWAS outlets is prepared by the WSO LGA.

A. RECORDING 1.

Tape 1: (In most cases, this tape does not need updating from 0530 to 0630.) Introduction - Special synopsis - Winds aloft 3, 6, and 12,000 feet for JFK.

Tape 2: Flight precautions - from BOS.

Tape 3: Terminal forecasts - for LGA, JFK, TEB, EWR, ISP, and HPN plus the fixed statement, "A complete new PATWAS statement will be available by 0730 local time."

Tape 4: 0600 hourlies - for LGA, JFK, TEB, EWR, ISP, BDR, and HPN.

B. RECORDING 2.

Tape 1: (In most cases, this tape does not need updating from 0530 to 0630.) Introduction - Special synopsis - and winds aloft 3, 6, and 12,000 feet for JFK, ALB, and BOS.

Tape 2: Flight precautions - from BOS.

Tape 3: Terminal forecasts - for BOS and ALB plus the fixed statement, "A complete new PATWAS statement will be available by 0730 local time."

Tape 4: 0600 hourlies and selected NOTAM's - for LGA, ISP, HPN, JFK, POU, BDL, BOS, ACK, and ALB.

C. RECORDING 3.

Tape 1. (In most cases, this tape does not need updating from 0530 to 0630.) Introduction - Special synopsis - (TWEB 081) and winds aloft 3, 6, and 12,000 feet for JFK and EMI.

Tape 2: Flight precautions - from BOS and DCA.

Tape 3: Terminal forecasts - for ABE and DCA plus the fixed statement, "A complete new PATWAS package will be available by 0730 local time." At 0730, a complete package is entered into the system, and previously recorded tapes can be shifted to proper locations.

Tape 4: 0600 hourlies and selected NOTAM's - for LGA, ISP, HPN, JFK, PHL, ABE, BGM, and DCA.

WSFO's NYC, ALB, BOS, PHL, and DCA will prepare either route and/or terminal forecasts or both and distribute via request/reply systems as follows:

FT's	Routes	TWEB	WSFO
BDL, BOS, ACK	BOS-BDL-NYC	009	BOS
ALB, BGM	ALB-NYC	014	ALB
JFK, LGA, ISP, TEB	NYC-ELM	020	NYC
HPN, EWR	NYC-Block Island (BID)-ACK	019	NYC
	NYC Metropolitan Area	080	NYC
PHL	NYC-PHL-DCA	027	PHL
DCA			DCA

RESULTS

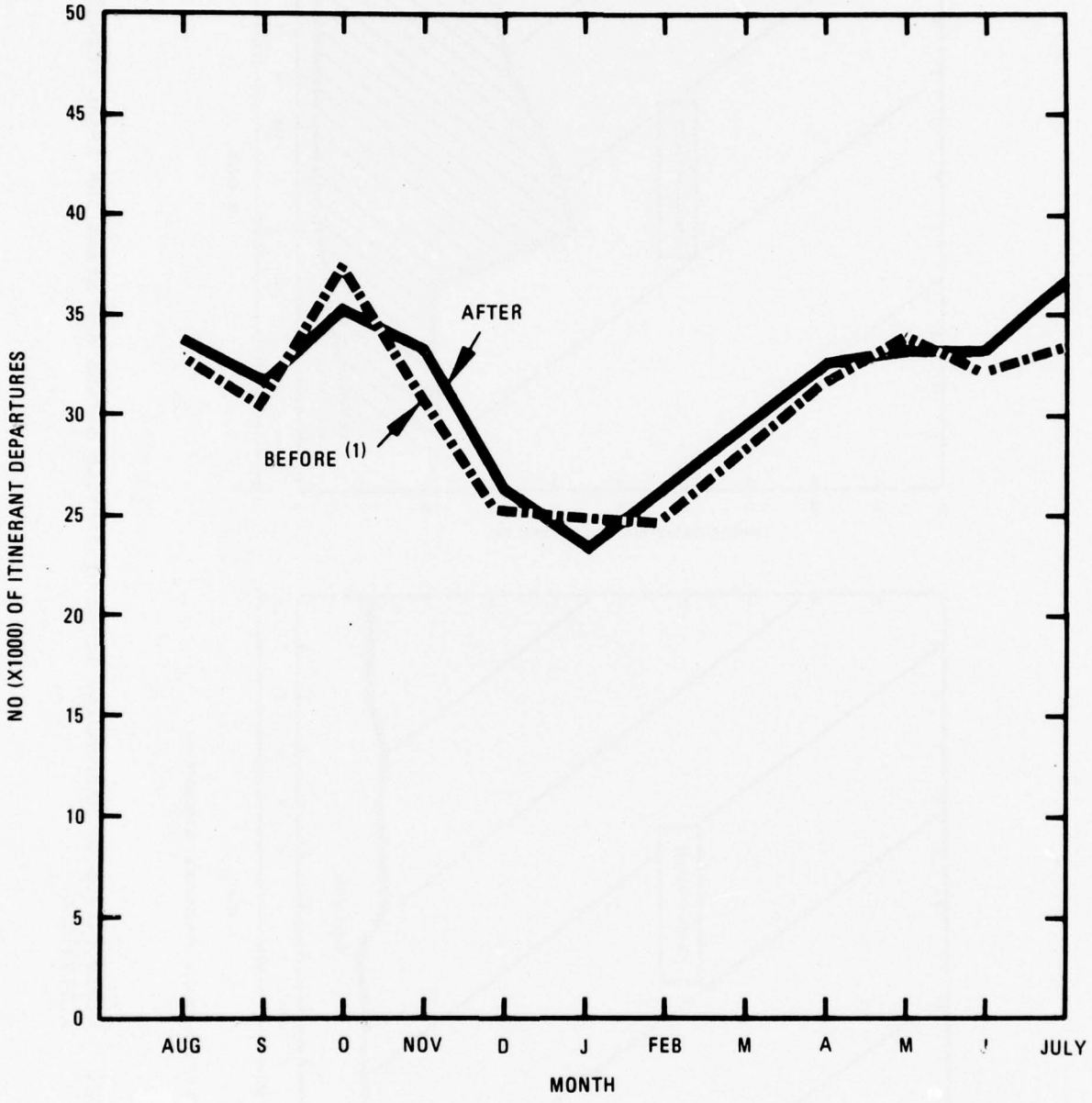
PATWAS CONTACTS AND FSS/WSO BRIEFINGS.

Since the trial PATWAS was activated, the number of requests for weather information from the La Guardia WSO and the Teterboro FSS decreased, while the number of calls to the trial PATWAS increased. As shown in figure 11, the number of itinerant aircraft departures during the test period changed only very slightly from the prior year's traffic. Thus, the increase in calls was not due to increased traffic. The number of pilot briefings decreased by 15 percent at La Guardia WSO and 10 percent at Teterboro FSS for the year immediately after the installations of the trial PATWAS. The net reduction of pilot briefings for the above mentioned installation amounted to 10 percent. On the other hand, the pilot briefings at Islip FSS for the same period of time increased by 2 percent. This was probably due to the fact that toll-free access to LGA PATWAS was not provided for the ISP area.

Figure 12 shows that the percentage of weather information requests served (the term "requests served" means the sum of all contacts with PATWAS and FSS/WSO) by FSS/WSO personnel decreased since the trial PATWAS went into operation. The left side ("A. Before") shows that before trial PATWAS activation, FSS/WSO briefings satisfied approximately 88 percent of the requests for weather information. (This percentage and all other "Before" numbers are for the comparable period in the year immediately preceding trial PATWAS activation.) The right side ("B. After") shows that after trial PATWAS activation, briefings satisfied an average of only 64 percent from December on.

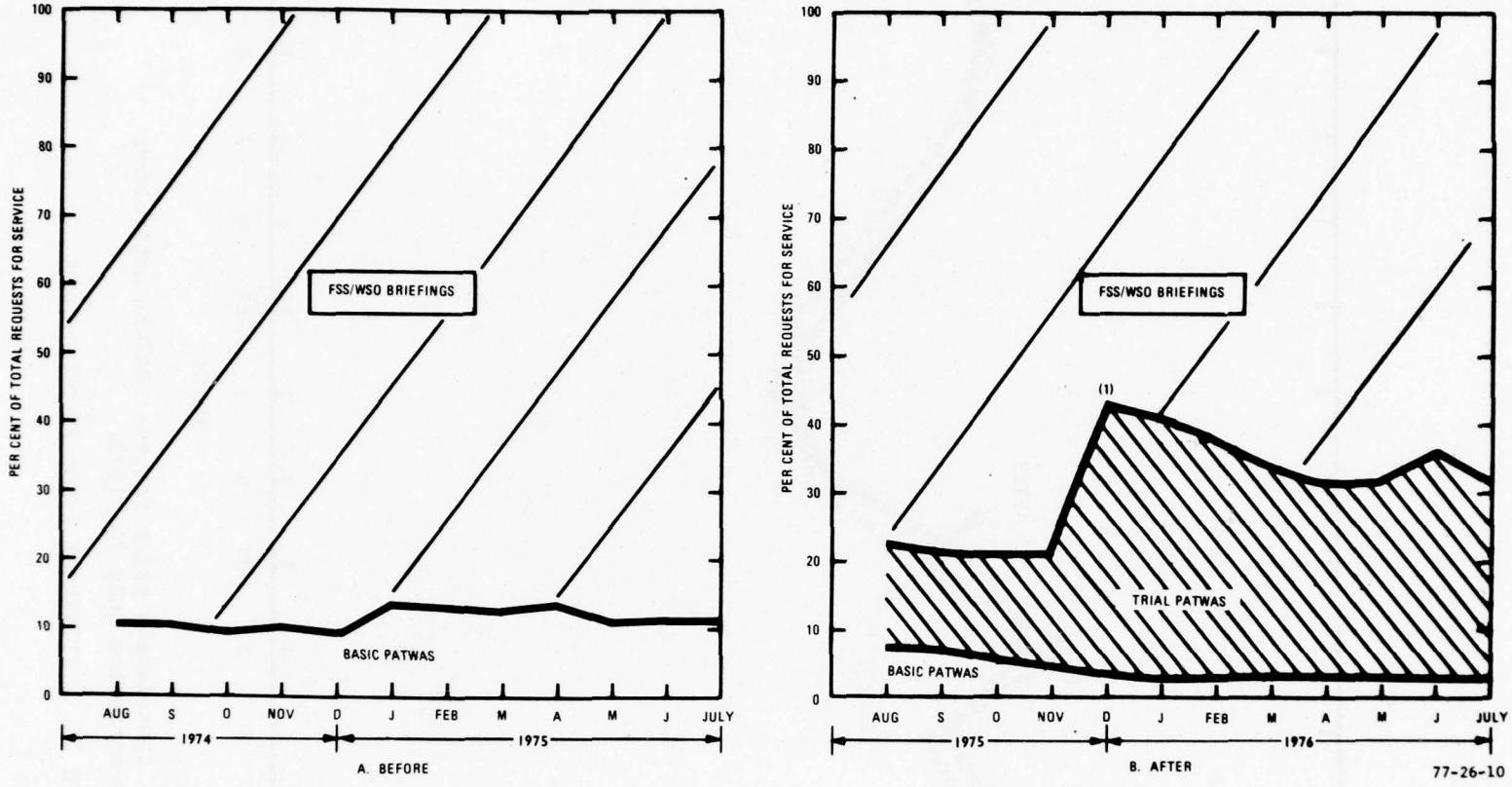
Figure 13 reveals that for 7 of the 12 test months, the number of FSS/WSO briefings was less than for the period preceding trial PATWAS activation, For 2 months (November and April), they were nearly the same, and for 3 months (December, March, and July), they were greater.

From the outset, the trial PATWAS served a substantial portion of the PATWAS calls. The percentage served increased sharply during December following the publicity mailing and has remained at a very high, unprecedented level ever since. (Figure 14 depicts the strikingly higher number of PATWAS calls after the trial PATWAS became available.) On the other hand, the amount of basic PATWAS activity has rapidly declined; falling lower, even in the first 2 full



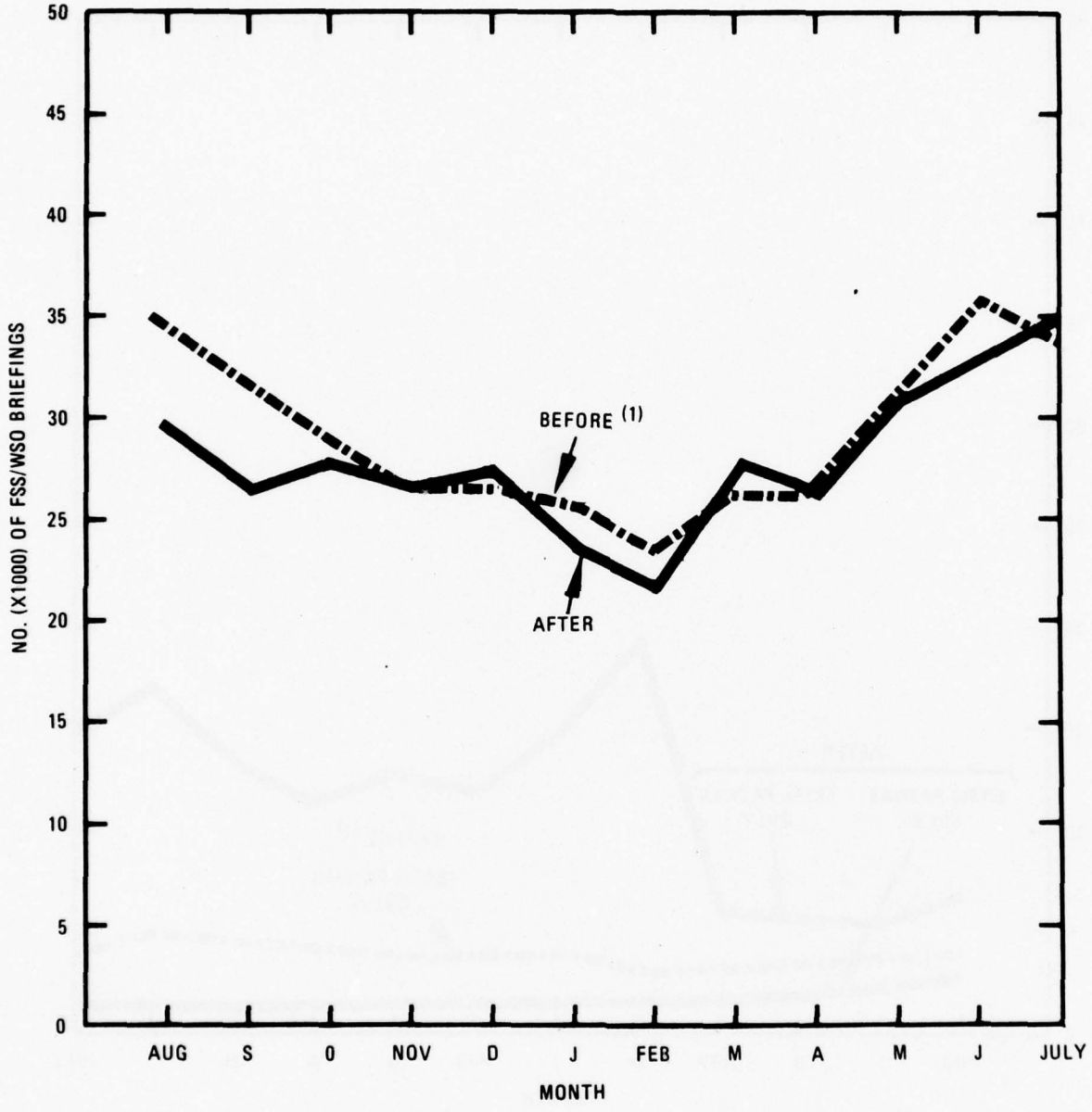
1. For the year immediately prior to trial PATWAS activation
2. Trial PATWAS activated July 24, 1975.

FIGURE 11. ITINERANT AIRCRAFT DEPARTURES



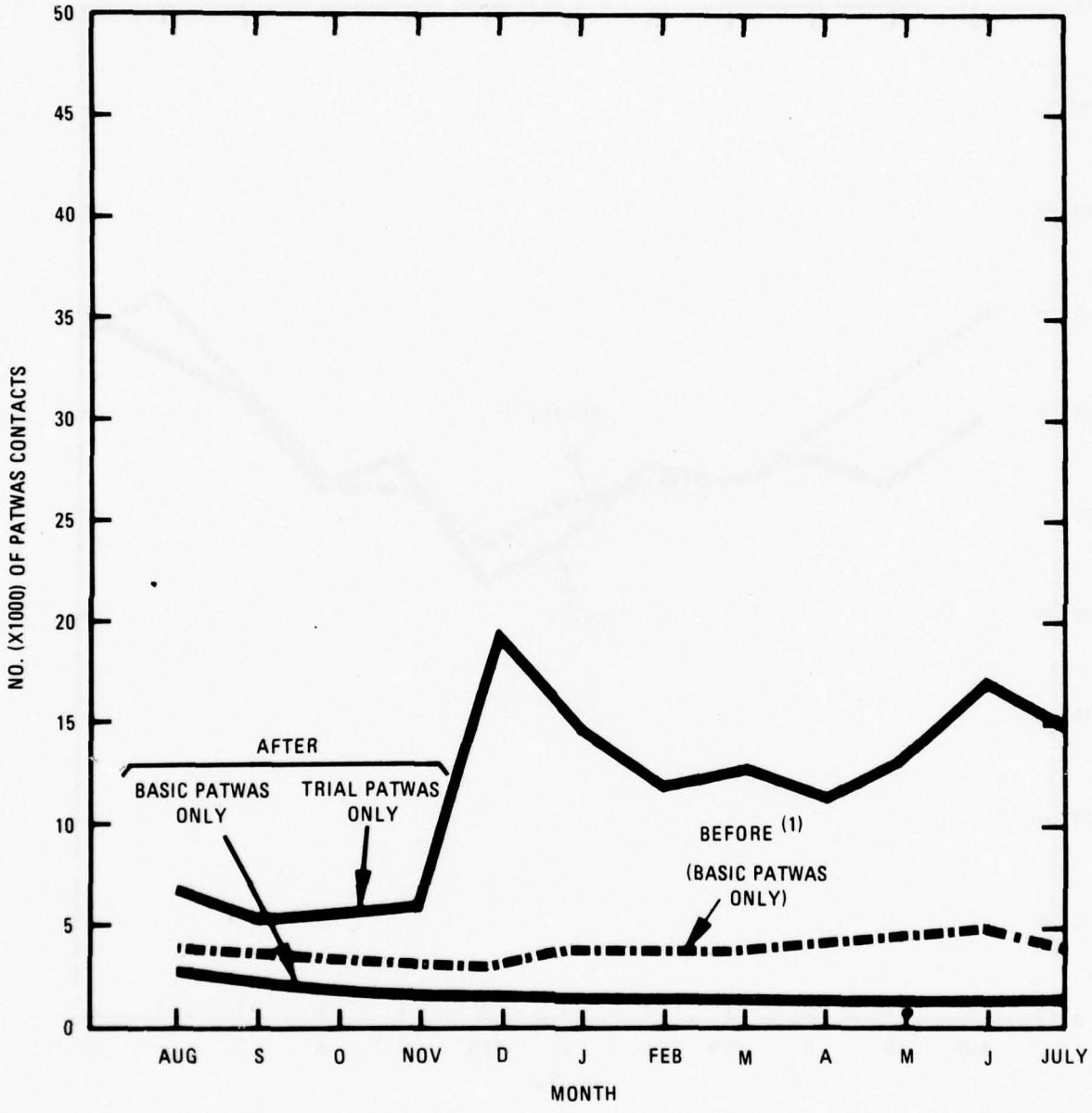
NOTE: 1. PUBLICITY MAILING BEGUN IN NOVEMBER AND COMPLETED IN DECEMBER 1975.

FIGURE 12. DISTRIBUTION OF RESPONDING TYPES OF SERVICE BEFORE AND AFTER THE TRIAL PATWAS ACTIVATION



1. For the year immediately prior to trial PATWAS activation
2. Trial PATWAS activated July 24, 1975

FIGURE 13. FSS/WSO BRIEFINGS



77-26-12

1. For the year immediately prior to trial PATWAS activation
2. Trial PATWAS activated July 24, 1975.

FIGURE 14. PATWAS CONTACTS

months of trial PATWAS operation, than the level reached in the prior year. A gradual decline began in October 1975, and continued until December, when a minimum service level seems to have been established at an average of 1,435 calls per month.

The effectiveness of the trial PATWAS was evident from the fact that it handled an average of 14,218 calls per month, or 91 percent of the total number of PATWAS calls during the 8-month period from December through July. The basic PATWAS handled an average of only 9 percent for the same period of time.

COMPARISON WITH WASHINGTON, D.C. Tables 7 and 8 compare the Washington, D.C. activity with that in NYC. Washington, D.C., produced an 11.1-percent decrease in the number of FSS/WSO briefings, while NYC (combined number of briefings at LGA, WSO, and TEB FSS and ISP FSS) yielded a net reduction of 4.6 percent. The latter percentage amounted to 16,000 fewer briefings for the 1-year period immediately preceding the activation of the trial PATWAS. The percentage increase in PATWAS calls was substantial in both locations. These increases were attributable to the upgraded PATWAS.

AMOUNT OF INFORMATION PRESENTED. Figure 15 shows that substantially more than the predicted amount of weather briefing information was disseminated after the trial PATWAS went into operation. For each of the months from October through June, the "actual" line is above the "predicted" line.

The "predicted" level of activity for each of the 12 months shown in figure 15 was derived from aircraft operations data in the expectation that requests for weather briefing information would be related directly to the amount of traffic. The predicted levels are based on the number of itinerant aircraft departures. August is presented first, since it is the first full month after activation. Except as noted below, historical precedent is based on 3 years of data. The trial PATWAS was activated on July 24, 1975. July 1975, therefore, is counted as a "before activation" month, since minimal service began sufficiently into that period as to have minimal impact. Although it contains some trial PATWAS activity, it is included in preference to the less desirable alternative of using an 11-month test period. One would not expect an increase in use initially, since the only publicity given the new service was an announcement on the basic PATWAS recording. This expectation is fulfilled during August and September where there is almost no difference between the "actual" and "predicted" values. During October, however, the "actual" curve begins to depart from the "predicted." For November, the actual level is very much higher than predicted. This suggests that during October, the general aviation public was beginning to respond to the announcement regarding the existence of the trial PATWAS and that this momentum carried over into November, where it was reinforced by the first publicity mailings.

The publicity mailing consisted of a descriptive leaflet, together with a wallet card containing the telephone number of PATWAS and a covering letter. The mailing was completed in December, and the exceptionally large spike in the actual curve is undoubtedly due to the effectiveness of the communications. The actual level for December is almost 70 percent greater than predicted.

TABLE 7. PATWAS ACTIVITY AT TWO LOCATIONS

LOCATION	NUMBER (X1000) OF REQUESTS FOR WEATHER INFORMATION SERVED			PATWAS % OF TOTAL	
	FSS/WSO BRIEFINGS	PATWAS CALLS	TOTAL	IMPROVEMENT STATUS BEFORE	IMPROVEMENT STATUS AFTER
WASHINGTON - CY 1974[1]	190	200	390	51	-
WASHINGTON - CY 1975[2]	169	404	573	-	71
NEW YORK CITY - 8/74-7/75[1]	351	46	397	12	-
NEW YORK CITY - 8/75-7/76[2]	335	157	492	-	32

1. Before PATWAS improvements.
2. After PATWAS improvements.
3. Trial PATWAS activated July 24, 1975.

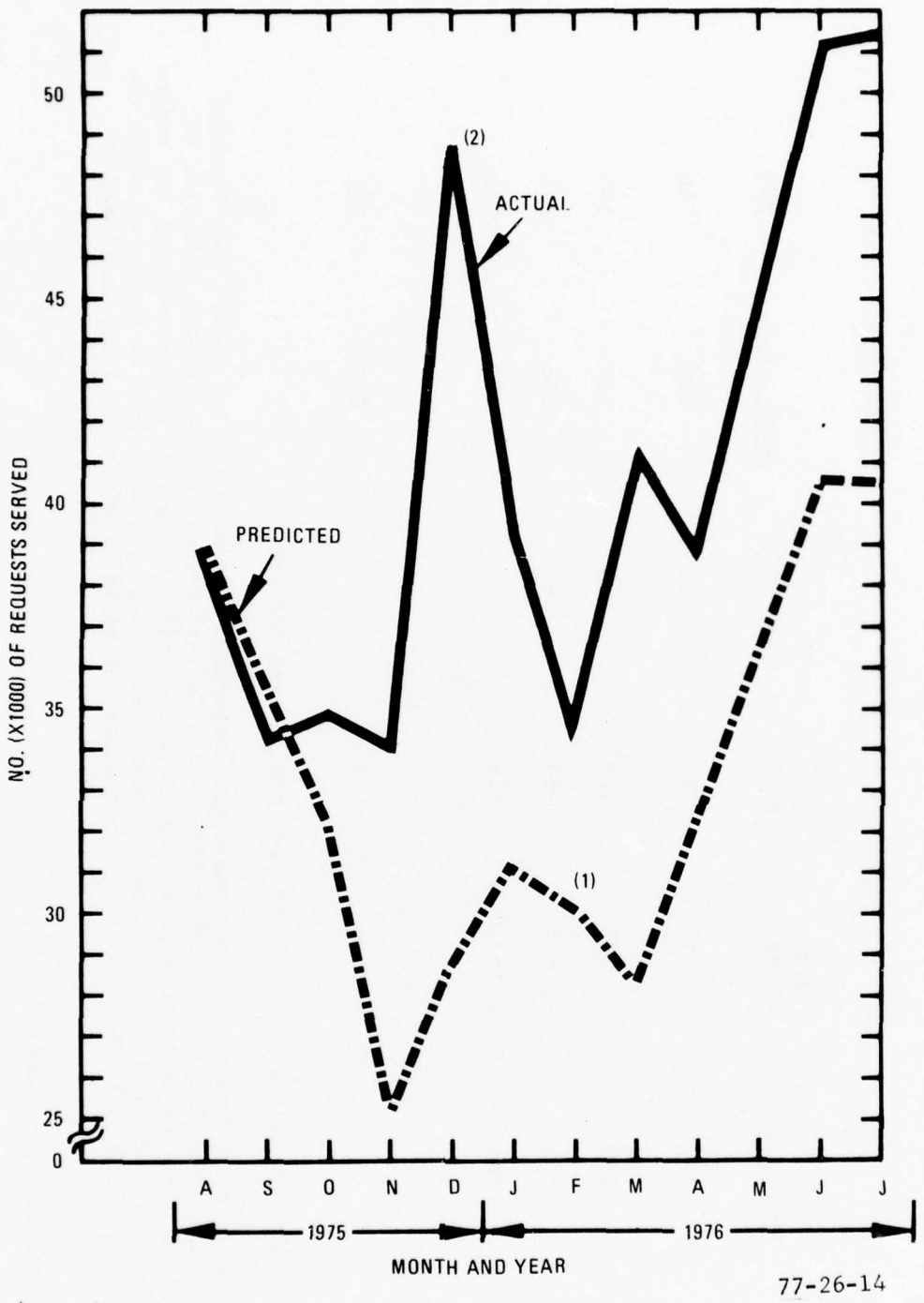
TABLE 8. EFFECTIVENESS OF PATWAS AT TWO LOCATIONS

	FSS/WSO Briefings (X 1,000)				PATWAS CALLS (X 1,000)	
	Wash., D.C.	NYC Total	LGA WSO and TEB FSS	ISP FSS	Wash., D.C.	NYC
Before Improvement	190	351	188	163	200	46
After Improvement	169	335	169	166	404	157
Difference	-21	-16	-19	+3	+204	+111
% Change	-11.1	-4.6	-10	+2	+102	+241
Stimulated Demand (No. of New Calls Created)	-	-			204	111

NYC = Combined number of briefings at LGA WSO and TEB FSS and ISP FSS.

It is significant to note that if a before and after comparison is made using the period from December 1975 (time of publicity mailing) to November 1976 as the "after" period, an even larger reduction in pilot briefings was achieved at La Guardia WSO and Teterboro FSS. Using this time frame, (a) the reduction of pilot briefings at La Guardia WSO and Teterboro FSS is 12.9 percent, (b) the number of calls to PATWAS increased by 130,000 or 283 percent, (c) the number of pilot briefings at Islip increased by 3 percent.

Note: Trial PATWAS activated July 24, 1975.



NOTES: 1. PREDICTIONS BASED ON TREND LINES, EXCEPT FEBRUARY AND JULY WHICH USED ARITHMETIC MEAN.

2. PUBLICITY MAILING BEGUN IN NOVEMBER, COMPLETED IN DECEMBER.

3. TRIAL PATWAS ACTIVATED JULY 24, 1975.

FIGURE 15. ACTUAL VERSUS PREDICTED NUMBER OF REQUESTS SERVED

The relative decline during January and February suggests that the initial novelty effect was wearing off and that some base level may have been reached at that time. During the remaining period of observation, the actual curve follows the slope of the predicted curve in a general way, but at a noticeably higher level. This suggests the effectiveness of trial PATWAS in disseminating more weather briefing information than had been distributed before its activation.

TRIAL PATWAS EFFECTIVENESS. Figure 12 supports the contention that the trial PATWAS is responsible for the increase in the number of weather briefing requests served. The preceding discussion of that figure points out that FSS/WSO personal briefers dealt with approximately 88 percent of the requests for weather information during each of the 12 months prior to the trial PATWAS activation.

Figure 12B shows the distribution of service after the trial PATWAS was activated. The portion handled by the trial PATWAS is illustrated by the heavily lined area in the lower half of the figure. It indicates that from the outset, the trial PATWAS began to serve a substantial portion of the requests. The percentage served increased very significantly during December when the publicity mailing was completed and has remained at a very high unprecedented level ever since.

The effectiveness of the trial PATWAS is clearly seen in figure 12 B, which shows that it handled an average of 34 percent of the total number of requests for information from December on. The basic PATWAS handled an additional 3 percent, so that both systems combined dealt with 37 percent of the requests during the 8-month period from December 1975 through July 1976.

Since figure 15 indicates a large increase in the number of requests served and figure 12B shows that the trial PATWAS is handling a substantial percentage of these, it is reasonable to infer that the trial PATWAS has increased the total number of requests for weather information and has handled them directly.

OVERALL EFFECTS. Table 9 highlights the results of the 12-month trial period. It is indicated that the trial PATWAS is serving the purpose for which it is intended. It disseminates more weather briefing information and decreases the FSS/WSO briefer workload.

BASIS FOR DETERMINATION.. Conceptually, the method employed related the number of requests for weather information served to the number of itinerant aircraft departures. This was done in the belief that itinerant departures would generate most of the demand for weather briefing information. The assumption that there would be a fixed relationship between the number of itinerant departures and the number of requests for weather information is substantiated by the statistically significant linear correlation coefficients that were found in 26 of the 31 cases examined. This relationship was then used to predict the number of requests for weather information to be expected from the number of itinerant aircraft departures observed after the trial PATWAS went into operation. Whenever the number of requests for weather

information served deviated significantly from the expected value, it is concluded that the trial PATWAS is responsible. This is reasonable since, insofar as can be determined, the introduction of the trial PATWAS is the only altered variable that might influence this factor.

TABLE 9. HIGHLIGHTS OF 12-MONTH TRIAL PERIOD RESULTS

	Result	No. of Months Producing (1)
1.	Increase in total number of weather information requests served	9
2.	Increase in percentage of total requests served by PATWAS	11
3.	Increase in number of calls to PATWAS attributable to trial PATWAS	11
4.	Decrease in number of calls to basic PATWAS	10
5.	Decrease in number of FSS/WSO briefings	7

Note: 1. Maximum possible number is 12 since that is the length of the trial period.

UNEXPECTED RELATIONSHIP. In all cases a negative relationship was found between the number of itinerant departures and the number of requests served. The phenomenon is illustrated in figure 16, where it is seen that an increase in the number of departures is correlated with a decrease in the number of requests served. (The straight line is the average of all nine "total" lines presented in the monthly figures.) This contradicted the expectation that an increase in the number of departures would produce a corresponding increase in the requests served. This phenomenon occurred prior to trial PATWAS activation.

PILOT SURVEY.

The opinion of the user is an extremely important determinant of the acceptability of the trial PATWAS. In order to obtain a pilot evaluation of the improved system, two types of questionnaires were used. A primary questionnaire was sent to all pilots registered with the General Aviation District Offices in Farmingdale, New York, and Teterboro, New Jersey. Approximately 26,000 pilots received the questionnaire. An illustrative copy of the primary questionnaire, the covering letter, and subsequent follow-up letters are shown in figures 17, 18, and 19.

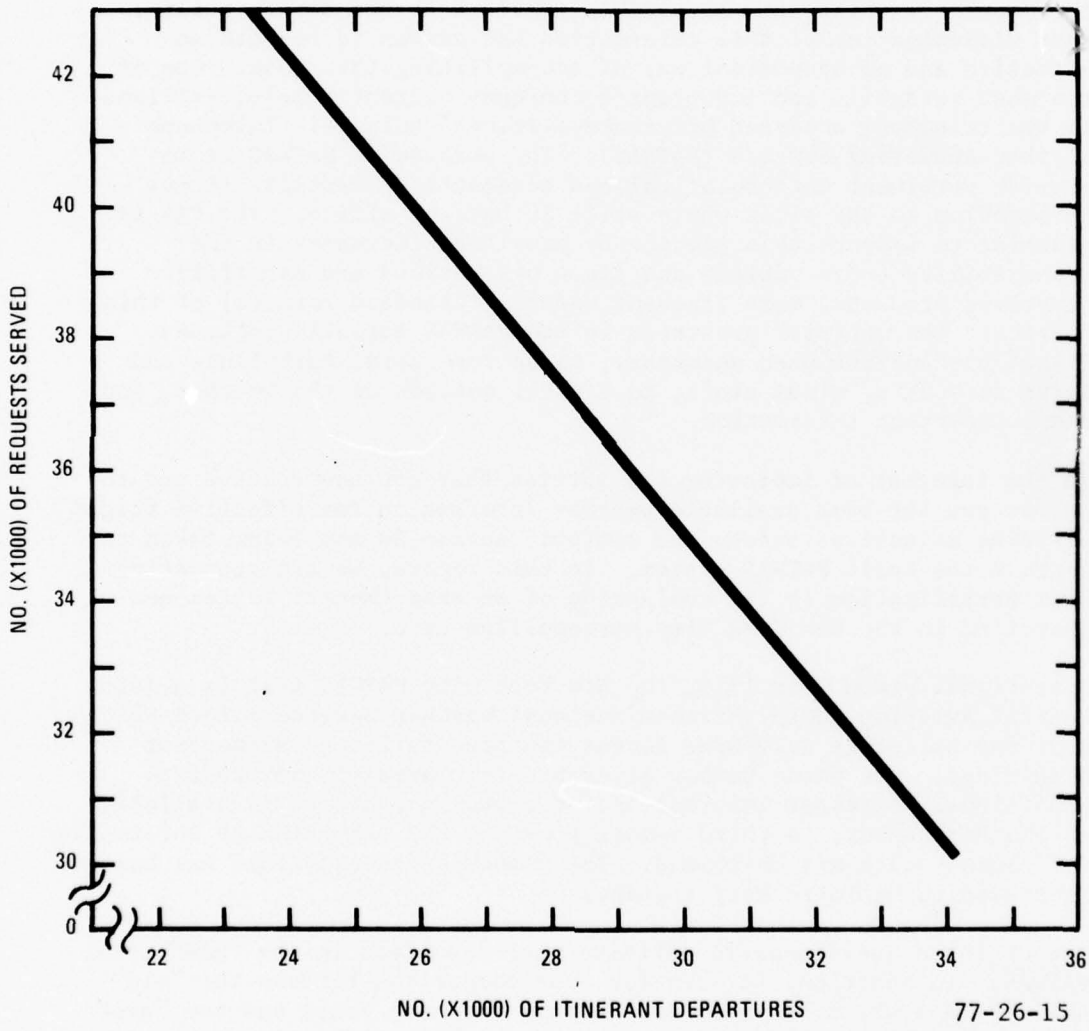


FIGURE 16. NEGATIVE RELATIONSHIP BETWEEN DEPARTURES AND REQUESTS SERVED IN A GIVEN MONTH

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

JFK INTERNATIONAL AIRPORT
JAMAICA, N. Y. 11340

May 25, 1976

Dear Pilot:

The rapid growth in general aviation and the accompanying increase in demand for aviation weather information necessitates improvements in the manner in which this service is provided to the flying public. Mass dissemination of this information has proven to be both an effective and an economical way of accomplishing this task. One of the most versatile and important techniques currently being utilized is the telephone accessed prerecorded Pilots' Automatic Telephone Weather Answering Service (PATWAS). The purpose of PATWAS is to provide pertinent meteorological and aeronautical facility status information to the pilot while still at home or office. The FAA is planning to improve this service by providing increases in the accessibility (more outlets and lines per outlet) and usability (improved products, more frequent updates, standard formats) of this service. The material presented in the PATWAS normally includes flight precautions when necessary, route forecasts, turbulence and icing forecasts, winds aloft, an overall outlook of the weather, and other important information.

In the interest of improving the service that you now receive and to assure you the best available weather information for effective flight planning as well as safety and comfort, action is now being taken to improve the basic PATWAS system. In this regard, we are requesting your participation in the evaluation of an experimental system now operating in the New York City metropolitan area.

Operational since July 1975, the New York City PATWAS test is a joint Federal Aviation Administration/National Weather Service effort which provides toll-free telephone access to three tailored independent recordings. One phone number gives New York area (50 nmi radius) conditions. Forecast information for routes northbound is available at another number. A third number provides the same kind of information for routes south and westbound. The number of access lines has been increased to minimize busy signals.

The enclosed questionnaire solicits your reactions to the "new" trial PATWAS. In addition, it asks for your comparison between the "old" basic PATWAS which has been operational for many years and the "new" trial PATWAS. A preaddressed envelope which requires no postage is enclosed for your response.

77-26-16

FIGURE 17. COVERING LETTER TO PILOTS RECEIVING PRIMARY QUESTIONNAIRE (Page 1 of 2)

In addition, we are soliciting volunteers to participate in a follow-on evaluation. If you are interested in participating in this aspect of the evaluation as well, fill in item 12. No correlation between your name and your response to the survey and follow-on evaluation will be made.

The telephone numbers for the trial and basic PATWAS are as follows:

Telephone Numbers for Trial PATWAS (new)

Recording	In the New York City Area	In Northern New Jersey
Local NYC Area	212-476-8800	201-288-3100
Routes Northbound	212-426-8300	201-288-5570
Routes South and Westbound	212-426-9300	201-288-9250

Telephone Numbers for Basic PATWAS (old)

New York City Area	212-476-5950	201-624-7272

Please complete the questionnaire within 2 weeks from the date you receive it. If you need assistance in completing the questionnaire, you may contact Frank Staiano, National Aviation Facilities Experimental Center, Atlantic City, N.J. 08405. The telephone number is 609-641-8200, ext. 2301.

Thank you very much for your cooperation.

Sincerely,

Duane W. Freer

DUANE W. FREER
Director, Eastern Region

Enclosure

FIGURE 17. COVERING LETTER TO PILOTS RECEIVING PRIMARY QUESTIONNAIRE (Page 2 of 2)

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
NEW YORK PATWAS SURVEY

Form Approved.
OMB No. 04-S76004

THIS REPORT IS AUTHORIZED BY LAW 49 U. S. C. 1348 (b) & 1352. WHILE YOU ARE NOT REQUIRED TO RESPOND, YOUR COOPERATION IS NEEDED TO MAKE THIS SURVEY COMPREHENSIVE, ACCURATE AND TIMELY.

1. WHAT LICENSE/RATING DO YOU HOLD ?
   STUDENT ☐ (1) COMMERCIAL, VFR ☐ (4)
   PRIVATE,VFR ☐ (2) COMMERCIAL, IFR ☐ (5)
   PRIVATE,IFR ☐ (3) AIRLINE TRANSPORT ☐ (6)

2. ARE YOU LICENSED TO OPERATE MULTI-ENGINE AIRCRAFT ? YES ☐ (1) NO ☐ (2)

3. (a) TOTAL FLYING TIME _____ HOURS
   (b) APPROXIMATE NO. OF HOURS DURING THE PAST 12 MONTHS _____

4. COUNTY OF RESIDENCE _____

5. TYPE OF POWER PLANT MOST FREQUENTLY FLOWN PISTON ☐ (1) TURBO ☐ (2) JET ☐ (3)

6. (a) HAVE YOU USED THE OLD PATWAS ? YES ☐ (1) NO ☐ (2)
   (b) IF "YES", ESTIMATED NUMBER OF TIMES ☐

7. (a) HAVE YOU USED THE NEW PATWAS ? YES ☐ (1) NO ☐ (2)
   (b) IF "YES", ESTIMATED NUMBER OF TIMES SINCE JULY 1975 ☐

8. PLACE A CHECK MARK IN THE COLUMN THAT BEST DESCRIBES THE EXTENT TO WHICH YOU AGREE WITH EACH OF THE FOLLOWING STATEMENTS AS THEY APPLY TO THE BRIEFING MESSAGE ON THE TRIAL PATWAS.

REACTION TO TRIAL PATWAS

	STRONGLY DISAGREE (1)	DISAGREE (2)	UNCERTAIN (3)	AGREE (4)	STRONGLY AGREE (5)
A. TOO MUCH INFORMATION IS PROVIDED	☐	☐	☐	☐	☐
B. NOT ENOUGH INFORMATION IS PROVIDED	☐	☐	☐	☐	☐
C. THE INFORMATION PROVIDED IS ACCURATE	☐	☐	☐	☐	☐
D. THE CONTENT OF THE BRIEFING WAS SATISFACTORY	☐	☐	☐	☐	☐
E. THE ORDER IN WHICH THE INFORMATION IS PRESENTED IS SATISFACTORY	☐	☐	☐	☐	☐
F. THE INFORMATION IS SUFFICIENT TO MAKE A DECISION TO FLY OR NOT TO FLY	☐	☐	☐	☐	☐
G. THE MESSAGE IS TOO LONG	☐	☐	☐	☐	☐
H. THE MESSAGE IS TOO SHORT	☐	☐	☐	☐	☐
I. THE SPEAKER IS EASY TO UNDERSTAND	☐	☐	☐	☐	☐
J. THE BACKGROUND NOISE IS SUFFICIENTLY LOW	☐	☐	☐	☐	☐
K. THE SPEAKER TALKED TOO SLOWLY	☐	☐	☐	☐	☐
L. THE SPEAKER TALKED TOO FAST	☐	☐	☐	☐	☐
M. THE RECORDED MESSAGE WAS OBTAINED PROMPTLY AFTER DIALING	☐	☐	☐	☐	☐
N. IT IS EASY TO COMPREHEND THE INFORMATION	☐	☐	☐	☐	☐
O. THE INFORMATION PROVIDES A CLEAR MENTAL PICTURE OF THE WEATHER	☐	☐	☐	☐	☐
P. THE NOTAMS AND FLIGHT PRECAUTIONS ARE USEFUL	☐	☐	☐	☐	☐
Q. IT IS HELPFUL TO HAVE THE INFORMATION UPDATED HOURLY	☐	☐	☐	☐	☐

NA FORM 7233-9 (1-76)

RIS NA 1770-1 (1-76)
77-26-17

FIGURE 18. PRIMARY QUESTIONNAIRE (Page 1 of 2)

9. CHECK THE BOXES TO INDICATE WHETHER OR NOT YOU CONTACTED THE FSS FOR ADDITIONAL INFORMATION AFTER LISTENING TO THE TRIAL PATWAS. IF YOU DID, HOW LENGTHY WAS THE CONTACT ?

	FSS CONTACTED ?		IF YES, GIVE CONTACT LENGTH			
	YES (1)	NO (2)	LESS THAN 1 MINUTE (3)	BETWEEN 1 TO 5 MIN. (4)	BETWEEN 6 TO 10 MIN. (5)	MORE THAN 10 MIN. (6)
A PRE-FLIGHT	☐	☐	☐	☐	☐	☐
B IN-FLIGHT	☐	☐	☐	☐	☐	☐

10. PLACE A CHECK MARK IN THE COLUMN THAT INDICATES HOW YOU BELIEVE THE TRIAL PATWAS COMPARES WITH THE BASIC PATWAS WITH RESPECT TO EACH OF THE FOLLOWING CHARACTERISTICS.

COMPARISON BETWEEN BASIC PATWAS AND TRIAL PATWAS

CHARACTERISTIC	BASIC BETTER THAN TRIAL (1)	NO SIGNIFICANT DIFFERENCE (2)	TRIAL BETTER THAN BASIC (3)
A. AMOUNT OF INFORMATION PROVIDED	☐	☐	☐
B. ACCURACY OF INFORMATION PROVIDED	☐	☐	☐
C. ADEQUACY TO SUPPORT A GO/NO-GO DECISION	☐	☐	☐
D. YOUR SATISFACTION WITH BRIEFING	☐	☐	☐
E. ORDER IN WHICH INFORMATION IS PRESENTED	☐	☐	☐
F. MESSAGE LENGTH	☐	☐	☐
G. QUALITY OF SPEAKING VOICE	☐	☐	☐
H. AMOUNT OF BACKGROUND NOISE	☐	☐	☐
I. SPEAKING RATE	☐	☐	☐
J. CONNECTED PROMPTLY TO RECORDED MESSAGE	☐	☐	☐
K. MINIMIZES ADDITIONAL PREFLIGHT INFORMATION FROM FSS	☐	☐	☐
L. MINIMIZES ADDITIONAL INFLIGHT INFORMATION FROM FSS	☐	☐	☐
M. EASE OF COMPREHENSION	☐	☐	☐
N. USEFULLNESS OF INFORMATION	☐	☐	☐
O. RESPONSIVE TO YOUR NEEDS	☐	☐	☐
P. PROVIDES A CLEAR MENTAL PICTURE OF THE WEATHER	☐	☐	☐
Q. AMOUNT OF UNNECESSARY INFORMATION PROVIDED	☐	☐	☐

11. IF THERE ARE ANY COMMENTS OR SUGGESTIONS YOU WOULD LIKE TO MAKE REGARDING THE TRIAL PATWAS, PLEASE RECORD THEM HERE.

_____

_____

_____

_____

_____

12. NEW YORK PATWAS SURVEY (MAILING LIST REQUEST)
YOUR NAME AND ADDRESS ARE REQUESTED SOLELY FOR THE PURPOSE OF DETERMINING RESPONDENTS. HOWEVER, IF YOU DESIRE, YOUR RESPONSE MAY BE ANONYMOUS.
A SUPPLEMENTAL SURVEY WILL BE CONDUCTED TO GATHER ADDITIONAL INFORMATION. THIS SURVEY WILL BE STRICTLY ON A VOLUNTARY BASIS.

DO YOU WISH TO PARTICIPATE IN THE SUPPLEMENTAL SURVEY? YES ☐ (1) NO ☐ (2)

NAME _____

ADDRESS _____

FIGURE 18. PRIMARY QUESTIONNAIRE (Page 2 of 2)

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

NATIONAL AVIATION FACILITIES
EXPERIMENTAL CENTER
ATLANTIC CITY, NEW JERSEY 08405

August 20, 1976

Dear Pilot:

In May of this year we sent you a questionnaire soliciting your opinion of the trial PATWAS (Pilots Automatic Telephone Weather Answering Service) located at LaGuardia Airport. If you have already returned the questionnaire please disregard this reminder and accept our sincere appreciation for your cooperation. If you have not yet completed the questionnaire, we earnestly request that you do so as soon as possible.

The success of this survey depends, to a large extent, on the number of responses obtained. Therefore, we are most anxious to get your reaction to the trial PATWAS. Your participation will help ensure that the flying public gets the best available weather information, which in turn will help make flying safer and more enjoyable.

Sincerely,

Frank T. Staiano

FRANK T. STAIANO
NAFEC Program Manager

77-26-18

FIGURE 19. FOLLOW-UP LETTER TO NONRESPONDENTS

The primary questionnaire was designed to measure the degree in which the trial PATWAS satisfied the flight planning needs of the respondents and to determine if it constituted a significant improvement over the basic PATWAS. The first mailing yielded 2,745 responses. The second mailing to all nonrespondents produced an additional 3,020 responses.

Questionnaire items 1 through 8 are classification variables included to determine whether or not pilot opinion varied as a function of the value of these parameters. Items 8A through 8Q seek an absolute judgement of various aspects of the trial PATWAS system. Items 10A through 10Q request a comparative judgement with the basic PATWAS. Some items appear in both sections, others do not. Item 9 asks whether or not the FSS still had to be contacted and, if so, for an estimate of its length. Item 11 accepts a free response. Item 12 invites participation in a follow-up supplemental survey.

The second type of schedule used was a supplemental questionnaire. This was sent to all respondents who volunteered to participate in a supplemental survey. The purpose of the supplemental survey was to determine whether or not there were noticeable differences in responses as a function of experience with the trial PATWAS. It was assumed that weightier opinions could be obtained after recurrent use of the trial PATWAS. An illustrative copy of the supplemental questionnaire and the covering letter are shown in figures 20 and 21. A total of 3,152 respondents volunteered for the supplemental survey. Each volunteer was sent three supplemental survey questionnaires. Each questionnaire was to be completed after a single flight. A total of 1,154 returns were received from those pilots who volunteered.

In general, the reaction to the trial PATWAS was highly favorable. The preponderant majority of the questionnaire respondents preferred the trial PATWAS to the basic PATWAS system.

PRIMARY QUESTIONNAIRE. The results obtained from the primary questionnaire are discussed below in the following order:

1. Comparison between basic PATWAS and trial PATWAS--Question 10.
2. Reaction to trial PATWAS--Question 8.
3. Effect of trial PATWAS on FSS contacts--Question 9.
4. Free responses--Question 11.

1. Comparison between Basic PATWAS and the Trial PATWAS--Question 10. Many of the respondents did not answer question 10 at all, and some of those who did failed to deal with all the items. The average numbers who did answer are as follows:

a. Initial respondents - 1,482,
b. Follow-up respondents - 979.

This produced a total of 2,461 people who answered question 10.

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

NATIONAL AVIATION FACILITIES
EXPERIMENTAL CENTER
ATLANTIC CITY, NEW JERSEY 08405

August 4, 1976

Dear Pilot:

Thank you for volunteering for the PATWAS supplemental survey. The purpose of the supplemental survey is to measure pilot reaction to the trial PATWAS after recurrent use of the system.

We have enclosed three supplemental survey forms and another PATWAS questionnaire. Please fill out a supplemental survey form after completing a single flight. In addition, to determine if there are any significant changes to your initial reaction to the trial PATWAS, you are requested to complete items 1 through 9 of the original questionnaire after completion of the last supplemental survey form. If you do not plan to make three flights before September 30, 1976, we would appreciate receiving as many forms as you have completed.

Please return all of the forms together in the enclosed stamped preaddressed envelope by September 30, 1976. Thank you very much for your additional cooperation. Wishing you many years of safe and enjoyable flying.

Yours in aviation,

Frank T Staiano

FRANK T. STAIANO
NAFEC Program Manager

5 Enclosures

77-26-19

FIGURE 20. COVER LETTER TO VOLUNTEERS PARTICIPATING IN SUPPLEMENTAL SURVEY

NEW YORK PATWAS SURVEY

(SUPPLEMENTAL SURVEY)

(INFORMATION TO BE PROVIDED IMMEDIATELY AFTER COMPLETING A SINGLE FLIGHT)

1. HAS YOUR LICENSE/RATING CHANGED SINCE YOUR LAST REPORT? (1) ☐ NO (2) ☐ YES

2. WHEN WAS PATWAS CALLED? DATE _____

TIME _____

3. PATWAS BRIEFING RECEIVED:

(1) ☐ NORTHBOUND (2) ☐ SOUTH & WESTBOUND (3) ☐ LOCAL

4. DO YOU LIKE SELECTING ONE BRIEFING FROM AMONG THREE ALTERNATIVES?

(1) ☐ NO (2) ☐ YES

5. WHAT FLIGHT CONDITIONS PREDOMINATED WHILE YOU WERE AIRBORNE?

(1) ☐ VFR (2) ☐ MARGINAL VFR (3) ☐ IFR

6. DID THE BRIEFING RECEIVED FROM THE TRIAL PATWAS MAKE IT UNNECESSARY FOR YOU TO CALL THE FLIGHT SERVICE STATION (FSS) FOR WEATHER INFORMATION?

	YES	NO	UNCERTAIN
A. PRE-FLIGHT	☐	☐	☐
B. IN-FLIGHT	☐	☐	☐

7. IF YOU STILL HAD TO CALL THE FSS FOR WEATHER INFORMATION, DID THE BRIEFING RECEIVED FROM THE TRIAL PATWAS REDUCE THE TIME ON LINE WITH THE FSS?

	NO	YES	% TIME REDUCED
A. PRE-FLIGHT	☐	☐	_____
B. IN-FLIGHT	☐	☐	_____

8. IF THERE ARE ANY COMMENTS OR SUGGESTIONS YOU WOULD LIKE TO MAKE REGARDING THE TRIAL PATWAS SERVICE, PLEASE RECORD THEM HERE _____

_____

_____

_____

_____

_____

_____

77-26-20

FIGURE 21. SUPPLEMENTAL QUESTIONNAIRE

Table 10 summarizes the dominant responses to each of the 17 items comprising question 10. The symbol "X" is used to highlight the primary impression produced by the data.

All 17 items produced responses favorable to the trial PATWAS. This is indicated by X marks in the "Trial Better than Basic" column for the 13 items in table 10, group A, and in the "No Significant Difference" column for the four items in group B. The group A items are all those for which the response "Trial Better than Basic" is favorable to the trial PATWAS system. The group B items are all those for which the response was "No Significant Difference."

Two group A items have X marks in two columns, 10B and 10J. This signifies an approximately equal number of responses in each of the two categories.

The percentages for question 10 are given in table 11. The circled items identify the data producing the X marks in table 10. The tabulations encompass returns from the initial and follow-up respondents; a total of 2,461.

Scale of measurement. Question 8 and question 10 of the questionnaire were both scored in terms of a Likert scale. Guilford (p. 459) discusses the justification for and utility of handling three- and five-point response scales in this form. Weights of 1 through 5 are assigned the categories in the five-point scale and 2, 3, and 4 to each of the categories in the three-point scale. Although there may be some debate on the point, it is commonly considered that this method yields an interval scale to which statistical operations appropriate to such a scale can be applied (see, for example, Stevens, S. S. (p. 25)).

Question 10 results. Statistically significant differences were found for the following: (1) number of engines, (2) type of power plant, (3) number of times listened to basic and the trial PATWAS, and (4) IFR versus VFR capability. The differences in response levels are shown in figures 22 through 26.

In each figure, the five most discriminating characteristics are listed in the order of the strength of effect (i.e., that with the largest univariate F ratio is listed first, followed by the next largest, etc.). The data from which these plots and listings are obtained are presented in volume II.

Although only the five most distinguishing characteristics are listed, there may be others that are also highly discriminating. The listing is limited to the first five to give a capsule impression of the considerations that separate the groups most strongly. The complete listings are given in volume II.

It will be noted in all cases that even the lowest ratings are well above the indifference point of 3.0.

TABLE 10. SUMMARY OF DOMINANT RESPONSES TO COMPARATIVE JUDGEMENTS OF TRIAL PATWAS (QUESTION 10)

Stimulus Item		Dominant Response[1]		
No. and Letter	Characteristic	Basic Better Than Trial	No Significant Difference	Trial Better Than Basic
Group A				
10A	Amount of information provided			X
10B	Accuracy of information provided		X	X
10C	Adequacy to support a Go/No Go decision			X
10D	Your satisfaction with briefing			X
10E	Order in which information is presented			X
10F	Message length			X
10J	Connected promptly to recorded message		X	X
10K	Minimizes additional preflight information from FSS			X
10L	Minimizes additional inflight information from FSS			X
10M	Ease of comprehension			X
10N	Usefulness of information			X

TABLE 10. SUMMARY OF DOMINANT RESPONSES TO COMPARATIVE JUDGEMENTS OF TRIAL PATWAS (QUESTION 10) (Continued)

Stimulus Item		Dominant Response[1]		
No. and Letter	Characteristic	Basic Better Than Trial	No Significant Difference	Trial Better Than Basic
Group A (Cont.)				
10O	Responsive to your needs			X
10P	Provides a clear mental picture of the weather			X
Group B				
10G	Quality of speaking voice		X	
10H	Amount of background noise		X	
10I	Speaking rate		X	
10Q	Amount of unnecessary information provided		X	

(1) More detailed information is given in Tables 11 and 13.

TABLE 11. PERCENTAGE DISTRIBUTION OF RESPONSES TO COMPARATIVE JUDGEMENTS OF THE TRIAL PATWAS (QUESTION 10)

Stimulus Item		Percentage Response			
NO. AND LETTER	CHARACTERISTIC	BASIC BETTER THAN TRIAL	NO SIGNIFICANT DIFFERENCE	TRIAL BETTER THAN BASIC	TOTAL
Group A					
10A	AMOUNT OF INFORMATION PROVIDED	11.43	16.04	(72.53)(1)	100.00(2)
10B	ACCURACY OF INFORMATION PROVIDED	6.68	(46.50)	(46.82)	100.00
10C	ADEQUACY TO SUPPORT A GO/NO-GO DECISION	8.09	35.52	(56.39)	100.00
10D	YOUR SATISFACTION WITH BRIEFING	9.55	19.17	(71.28)	100.00
10E	ORDER IN WHICH INFORMATION IS PRESENTED	9.58	38.62	(51.79)	100.00
10F	MESSAGE LENGTH	12.79	30.83	(56.38)	100.00
10J	CONNECTED PROMPTLY TO RECORDED MESSAGE	8.92	(45.23)	(45.84)	100.00
10K	MINIMIZES ADDITIONAL PREFLIGHT INFORMATION FROM FSS	8.00	26.16	(65.84)	100.00
10L	MINIMIZES ADDITIONAL INFLIGHT INFORMATION FROM FSS	6.59	41.36	(52.05)	100.00
10M	EASE OF COMPREHENSION	7.99	43.69	(48.32)	100.00
10N	USEFULNESS OF INFORMATION	7.88	22.42	(69.70)	100.00

1. The circled items produced the "X" marks in Table 10.
2. All percentages are based on an average total of 2,461 responses.

TABLE 11. PERCENTAGE DISTRIBTUION OF RESPONSES TO COMPARATIVE JUDGEMENTS OF THE TRIAL PATWAS (QUESTION 10) (Continued)

Stimulus Item		Percentage Response			
NO. AND LETTER	CHARACTERISTIC	BASIC BETTER THAN TRIAL	NO SIGNIFICANT DIFFERENCE	TRIAL BETTER THAN BASIC	TOTAL
Group A (Cont.)					
10O	RESPONSIVE TO YOUR NEEDS	8.34	24.08	(67.58)[1]	100.00
10P	PROVIDES A CLEAR MENTAL PICTURE OF THE WEATHER	7.96	30.56	(61.48)	100.00
Group B					
10G	QUALITY OF SPEAKING VOICE	8.84	(52.62)	38.54	100.00
10H	AMOUNT OF BACKGROUND NOISE	9.03	(55.55)	35.43	100.00
10I	SPEAKING RATE	7.38	(59.96)	32.66	100.00
10Q	AMOUNT OF UNNECESSARY INFORMATION PROVIDED	13.13	(48.67)	38.21	100.00

1. The circled items produced the "X" marks in Table 10.

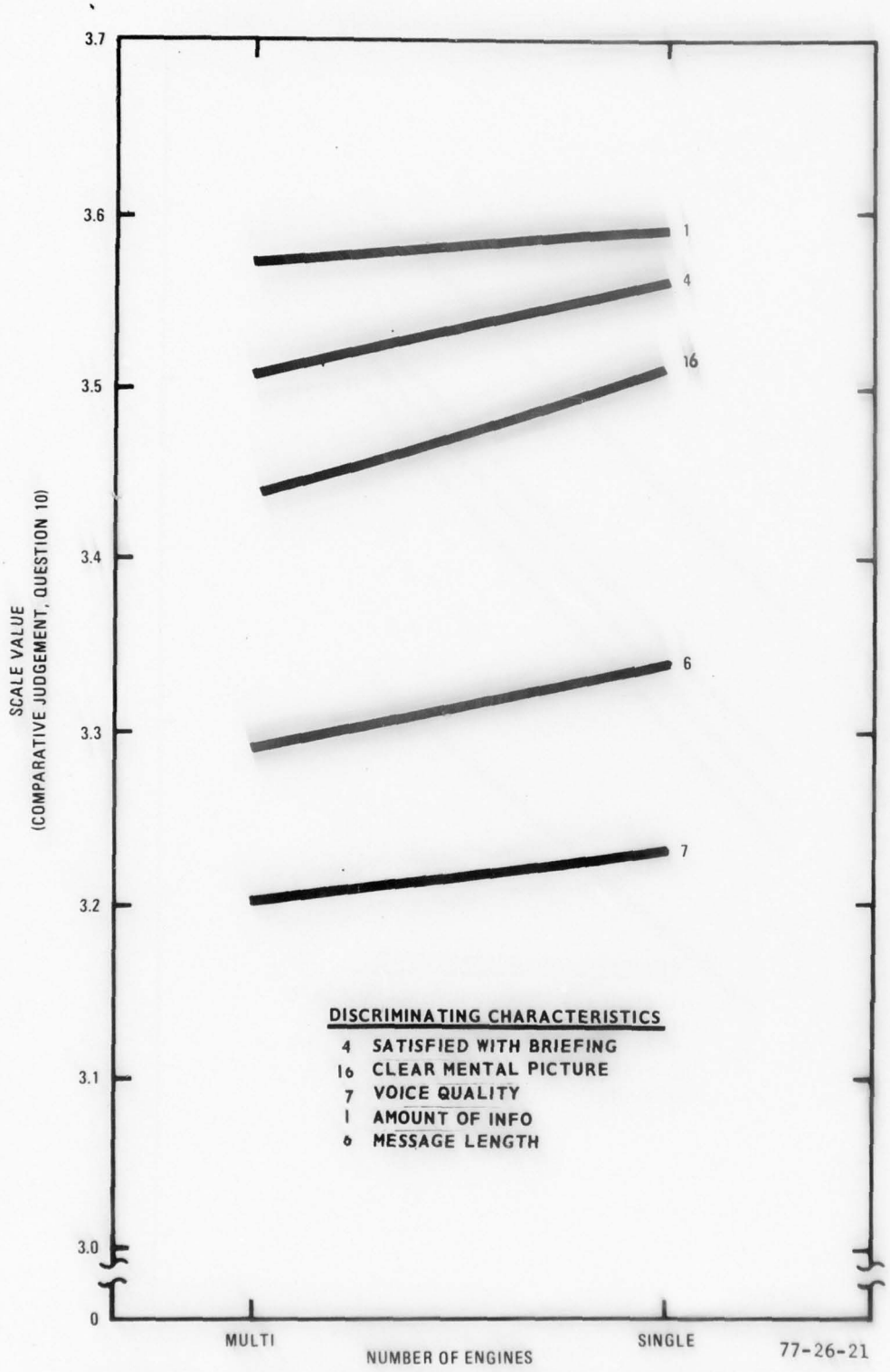


FIGURE 22. TRIAL PATWAS RATED HIGHER BY SINGLE-ENGINE PILOTS

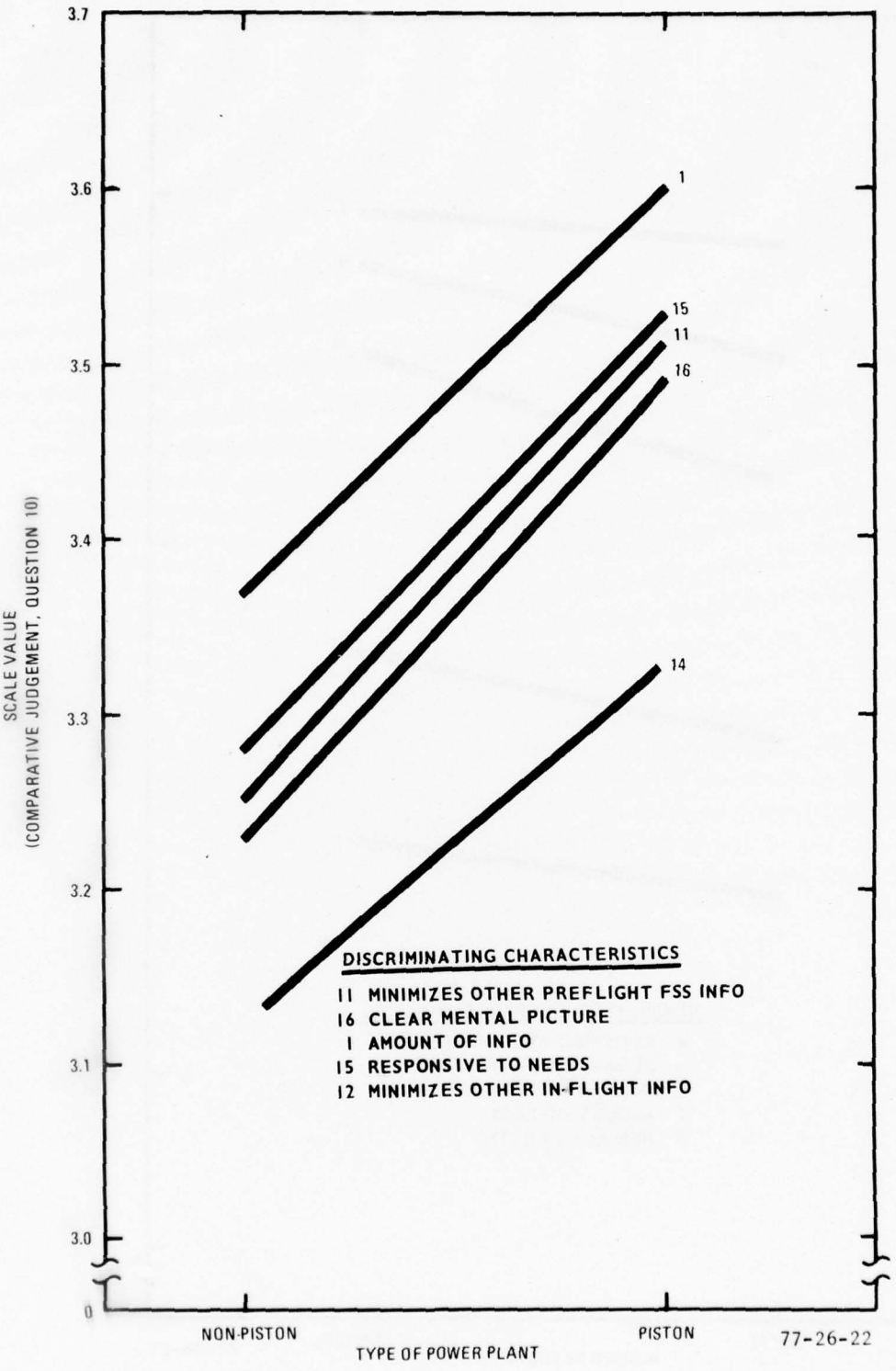


FIGURE 23. TRIAL PATWAS RATED HIGHER BY PISTON-ENGINE PILOTS

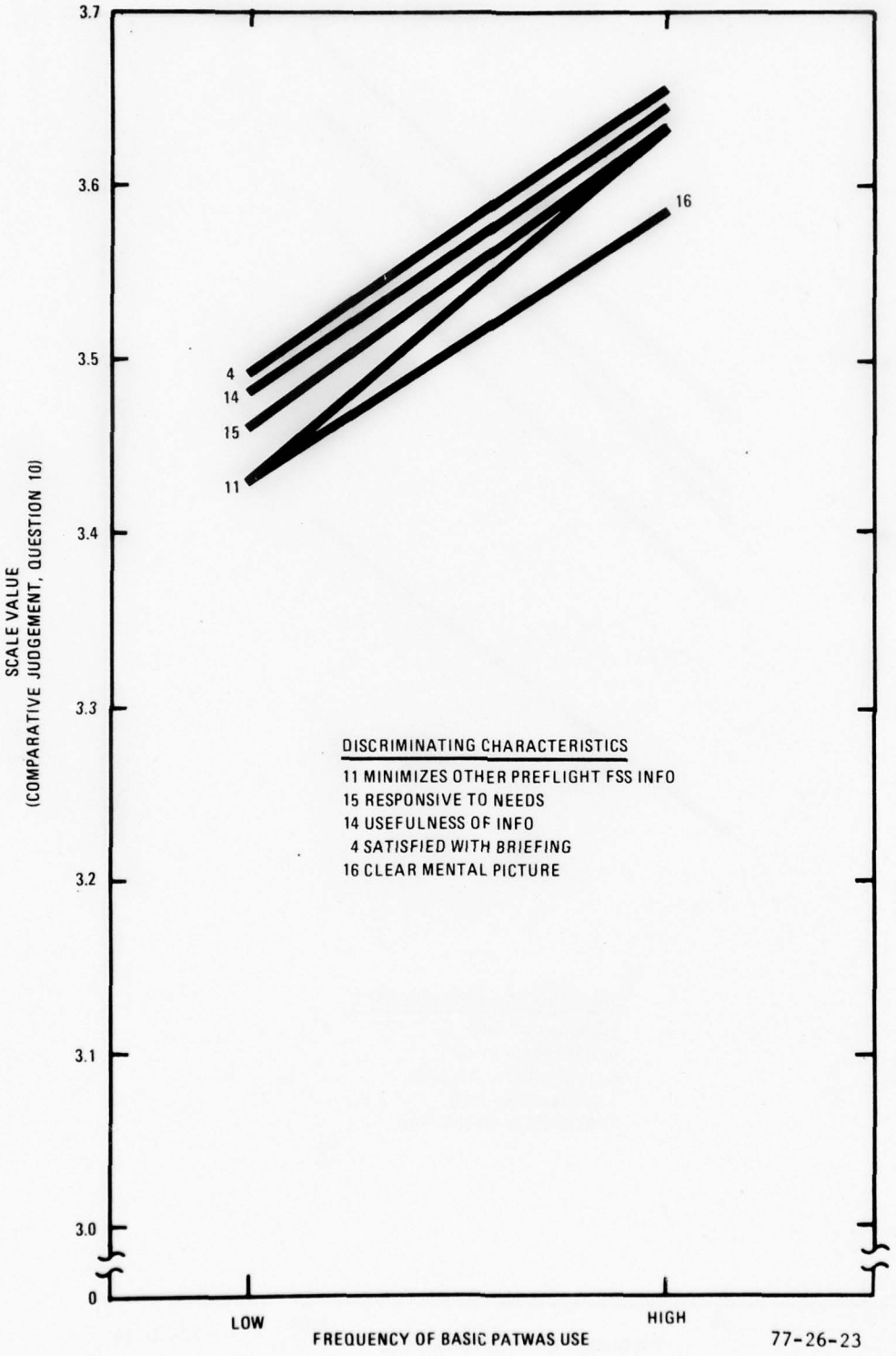


FIGURE 24. TRIAL PATWAS RATED HIGHER BY FREQUENT BASIC PATWAS USERS

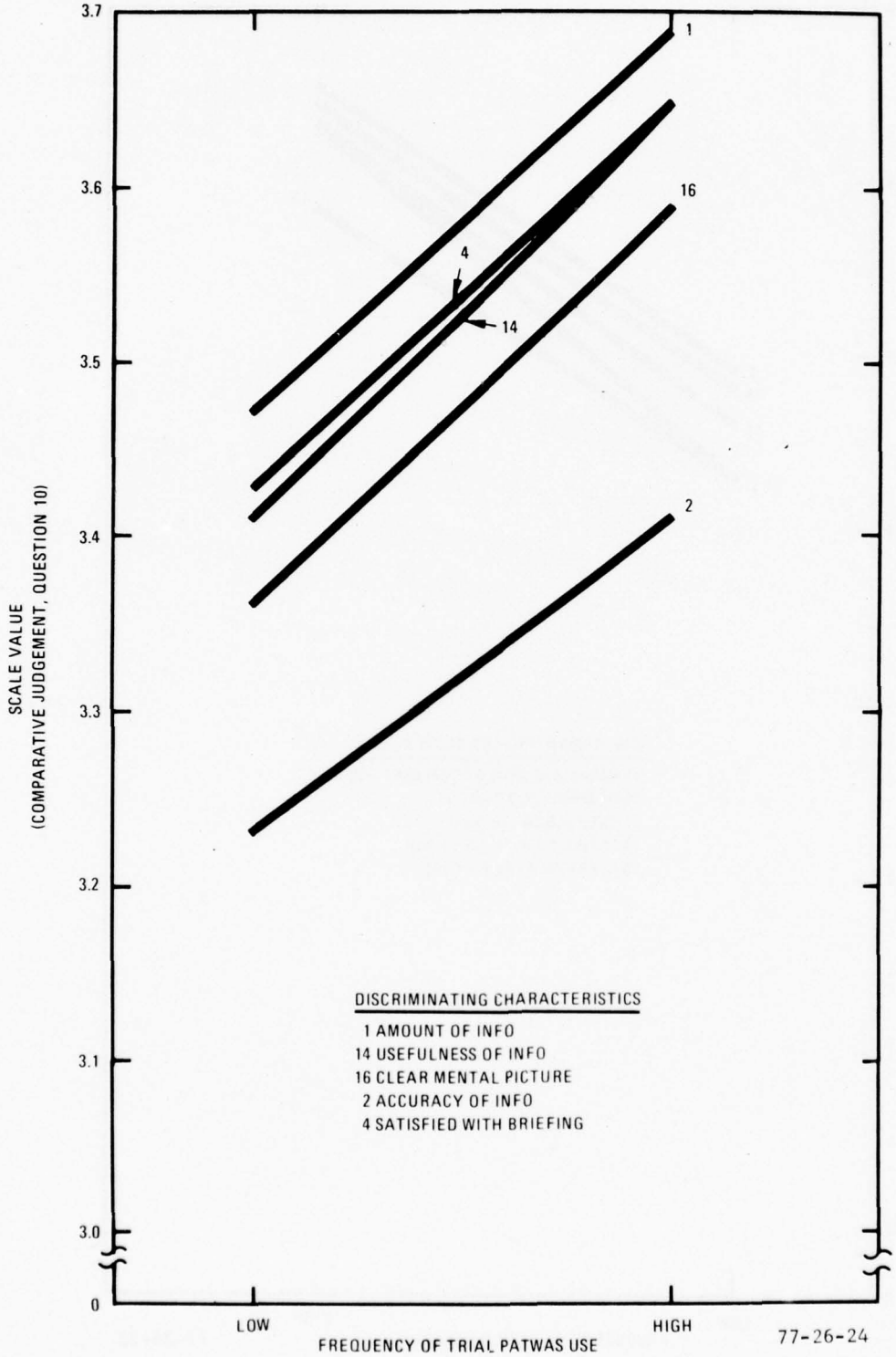


FIGURE 25. TRIAL PATWAS RATED HIGHER BY FREQUENT USERS

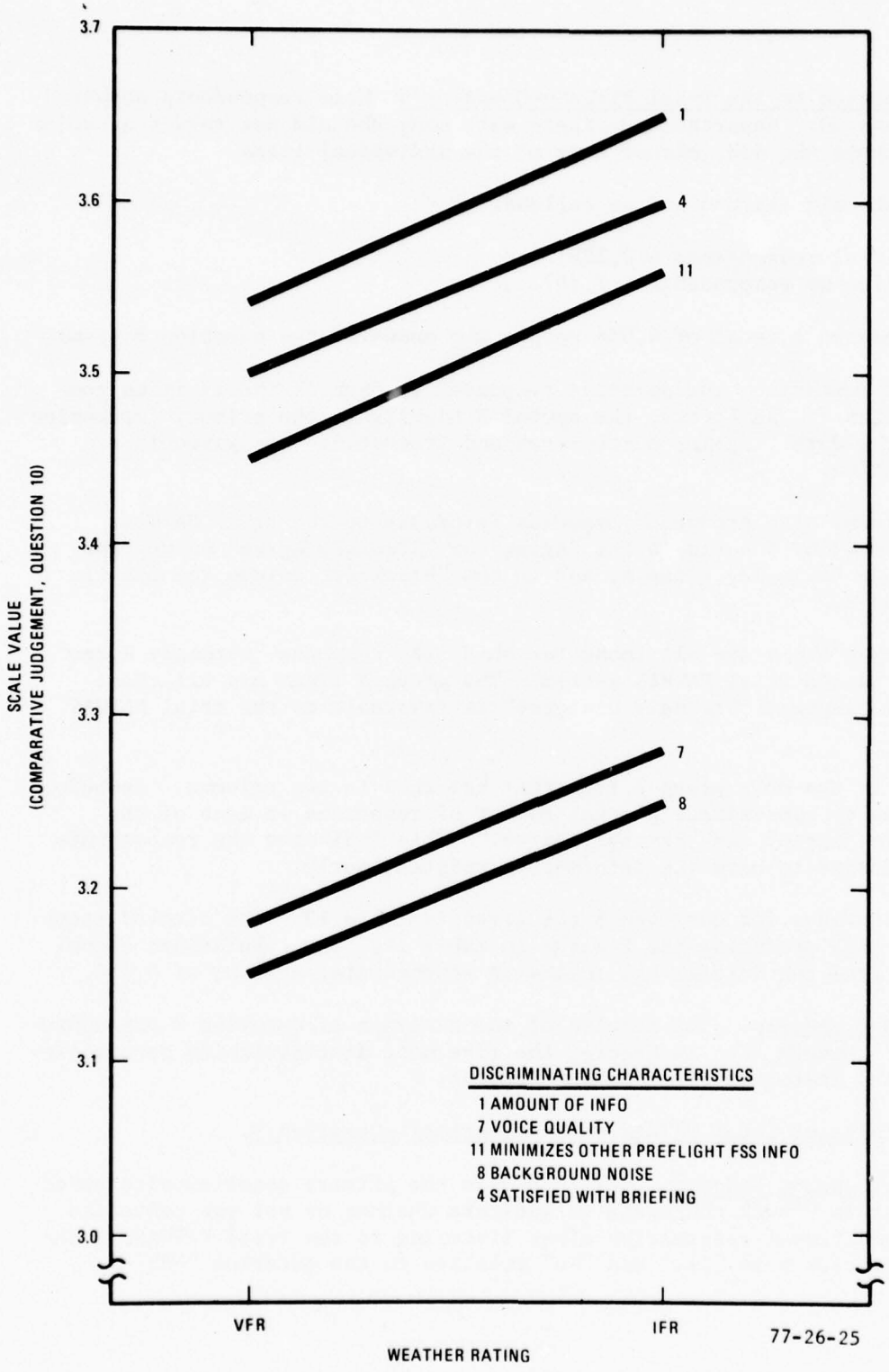


FIGURE 26. TRIAL PATWAS RATED HIGHER BY IFR PILOTS

2. Reaction to the Trial PATWAS--Question 8 More respondents answered question 8 than 10. Nevertheless, there were many who did not answer question 8, and some of those who did, missed some of the individual items.

The numbers who did respond are as follows:

a. Initial respondents - 2,289, and
b. Follow-up respondents - 1,767.

This produced a total of 4,056 people who answered the question 8 items.

Table 12 summarizes the dominant responses to each of the 17 items comprising question 8. As before, the symbol X highlights the primary impression produced by the data. Again, percentages and frequencies are given in a following section.

All 17 items also produced responses favorable to the trial PATWAS. This is indicated by X marks in the "Agree" or "Strongly Agree" column for the 11 items in table 12, group A, and in the "Disagree" column for the six items in group B.

The group A items are all those for which the response "Strongly Agree" is favorable to the trial PATWAS system. The group B items are all those for which the response "Strongly Disagree" is favorable to the trial PATWAS system.

Item 8Q is the only group A item that has an X in two columns. As before, this signifies an approximately equal number of responses in each of the two categories "Agree" and "Strongly Agree." This indicates the respondents very strong desire to have the information updated hourly.

The percentages for question 8 are given in table 13. The circled items identify the data producing the X marks in table 12. The tabulations encompass returns from the initial and follow-up respondents; a total of 4,056.

Question 8 results. The results of the analysis of question 8 are shown in figures 27 through 32. As before, the five most distinguishing parameters are plotted and listed in order in the figures.

3. Effects of Trial PATWAS on FSS Contacts--Question 9.

FSS Contact Reduced. Question 9 in the primary questionnaire asked the respondent to "check the boxes to indicate whether or not you contacted the FSS for additional information after listening to the trial PATWAS." The response categories were "Yes" and "No" relative to the question "FSS Contacted?"

TABLE 12. SUMMARY OF DOMINANT RESPONSES TO ABSOLUTE JUDGEMENTS OF THE TRIAL PATWAS (QUESTION 8)

Stimulus Item		Dominant Response				
No. and Letter	Characteristic	Strongly Disagree	Disagree	Uncertain	Agree (1)	Strongly Agree
Group A						
8C	The information provided is accurate				X	
8D	The content of the briefing was satisfactory				X	
8E	The order in which the information is presented is satisfactory				X	
8F	The information is sufficient to make a decision to fly or not to fly				X	
8I	The speaker is easy to understand				X	
8J	The background noise is sufficiently low				X	
8M	The recorded message was obtained promptly after dialing				X	
8N	It is easy to comprehend the information				X	

TABLE 12. SUMMARY OF DOMINANT RESPONSES TO ABSOLUTE JUDGEMENTS OF THE TRAIL PATWAS (QUESTION 8) (Continued)

Stimulus Item		Dominant Response				
No. and Letter	Characteristic	Strongly Disagree	Disagree (1)	Uncertain	Agree (1)	Strongly Agree
Group A (Cont.)						
8O	The information provides a clear mental picture of the weather				X	
8P	The NOTAMs and Flight Precautions are useful				X	
8Q	It is helpful to have the information updated hourly				X	X
Group B						
8A	Too much information is provided		X (1)			
8B	No enough information is provided		X			
8G	The message is too long		X			
8H	The message is too short		X			
8K	The speaker talked too slowly		X			
8L	The speaker talked too fast		X			

(1) "X" marks in this category favor Trial PATWAS

TABLE 13. PERCENTAGE DISTRIBUTION OF RESPONSES TO ABSOLUTE JUDGEMENTS OF THE TRIAL PATWAS (QUESTION 8)

Stimulus Item		Percentage Response					
NO. AND LETTER	STATEMENT	STRONGLY DISAGREE	DISAGREE	UNCERTAIN	AGREE	STRONGLY AGREE	TOTAL
Group A							
8C	THE INFORMATION PROVIDED IS ACCURATE	0.64	5.02	20.15	(70.12)(1)	4.06	(2) 100.00
8D	THE CONTENT OF THE BRIEFING WAS SATISFACTORY	0.72	7.33	8.29	(78.01)	5.64	100.00
8E	THE ORDER IN WHICH THE INFORMATION IS PRESENTED IS SATISFACTORY	1.18	6.53	12.38	(75.49)	4.42	100.00
8F	THE INFORMATION IS SUFFICIENT TO MAKE A DECISION TO FLY OR NOT TO FLY	3.25	16.16	18.61	(53.23)	8.75	100.00
8I	THE SPEAKER IS EASY TO UNDERSTAND	2.22	9.04	8.23	(70.60)	9.91	100.00
8J	THE BACKGROUND NOISE IS SUFFICIENTLY LOW	2.76	9.23	8.56	(72.15)	7.31	100.00
8M	THE RECORDED MESSAGE WAS OBTAINED PROMPTLY AFTER DIALING	5.20	10.91	6.81	(62.92)	14.17	100.00
8N	IT IS EASY TO COMPREHEND THE INFORMATION	0.92	6.45	8.24	(75.96)	8.44	100.00
8O	THE INFORMATION PROVIDES A CLEAR MENTAL PICTURE OF THE WEATHER	1.54	10.11	19.67	(62.59)	6.08	100.00

1. The circled items produced the "X" marks in Table 12
2. All percentages are based on an average total of 4,056 responses.

TABLE 13. PERCENTAGE DISTRIBUTION OF RESPONSES TO ABSOLUTE JUDGEMENTS OF THE TRIAL PATWAS (QUESTION 8) (Continued)

Stimulus Item		Percentage Response					
NO. AND LETTER	STATEMENT	STRONGLY DISAGREE	DISAGREE	UNCERTAIN	AGREE	STRONGLY AGREE	TOTAL
Group A							
8P	THE NOTAMS AND FLIGHT PRECAUTIONS ARE USEFUL	0.56	2.30	7.59	(66.54)[1]	23.01	100.00
8Q	IT IS HELPFUL TO HAVE THE INFORMATION UPDATED HOURLY	0.66	1.12	4.91	(46.78)	(46.54)	100.00
Group B							
8A	TOO MUCH INFORMATION IS PROVIDED	23.15	(57.88)	10.32	7.60	1.05	100.00
8B	NOT ENOUGH INFORMATION IS PROVIDED	9.65	(47.20)	20.32	20.27	2.56	100.00
8G	THE MESSAGE IS TOO LONG	6.55	(57.93)	18.90	13.82	2.80	100.00
8H	THE MESSAGE IS TOO SHORT	7.89	(58.26)	22.71	9.89	1.26	100.00
8K	THE SPEAKER TALKED TOO SLOWLY	8.55	(76.03)	11.34	3.56	0.52	100.00
8L	THE SPEAKER TALKED TOO FAST	5.80	(63.50)	13.87	14.62	2.22	100.00

1. The circled items produced the "X" marks in Table 12

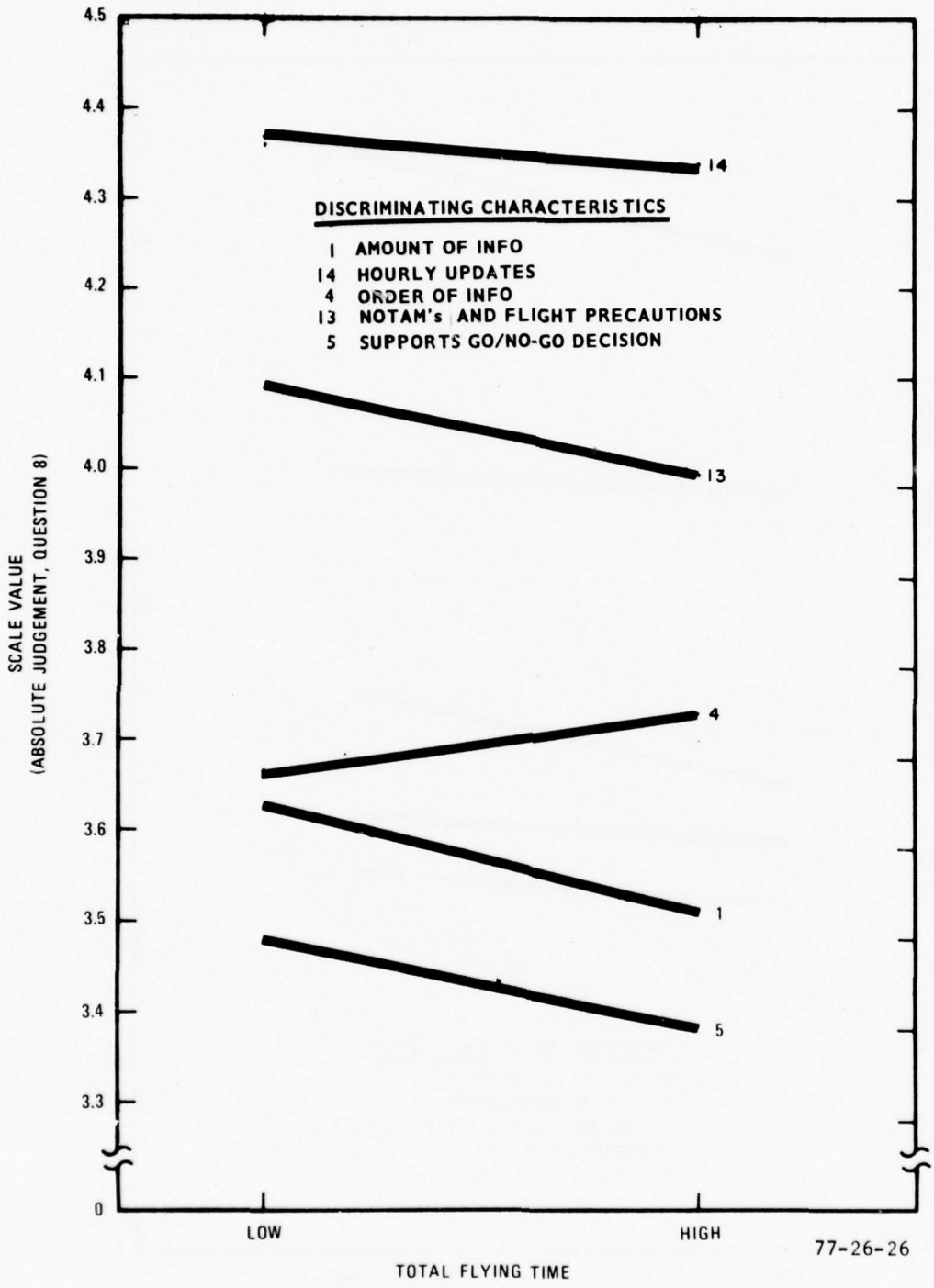


FIGURE 27. TRIAL PATWAS RATED HIGHER BY LESS EXPERIENCED PILOTS

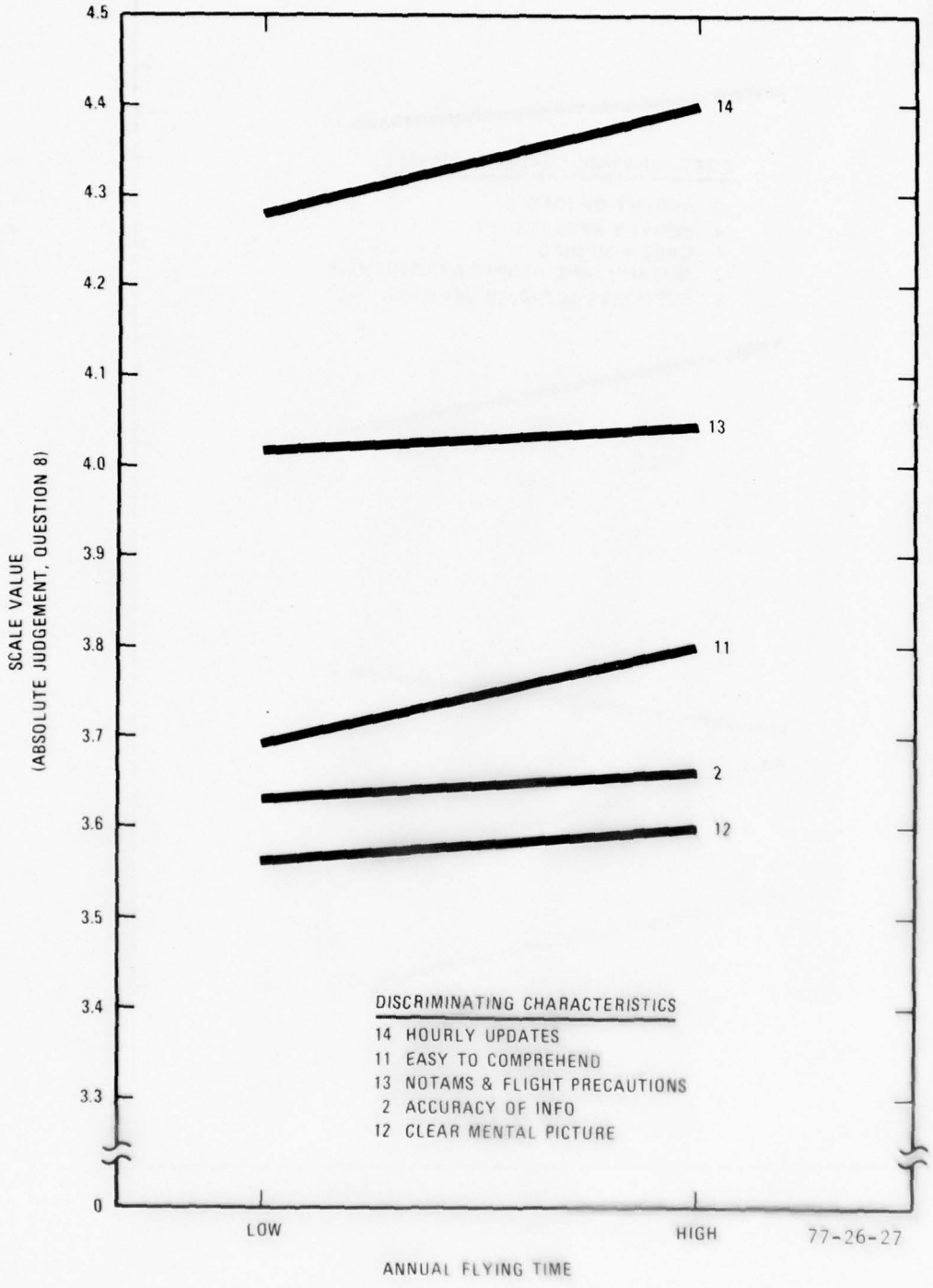


FIGURE 28. TRIAL PATWAS RATED HIGHER BY MORE ACTIVE PILOTS

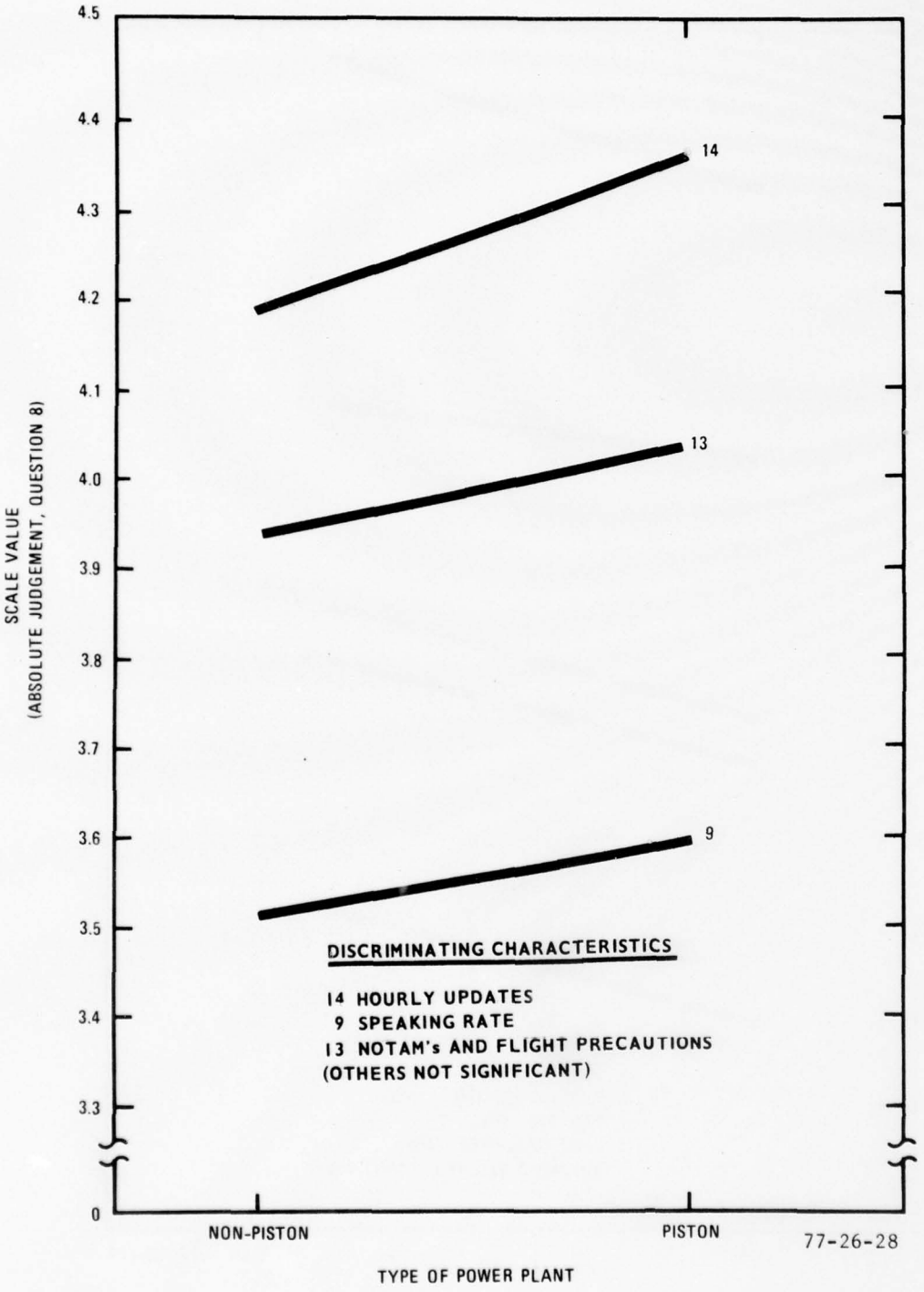


FIGURE 29. TRIAL PATWAS RATED HIGHER BY PISTON-ENGINE PILOTS

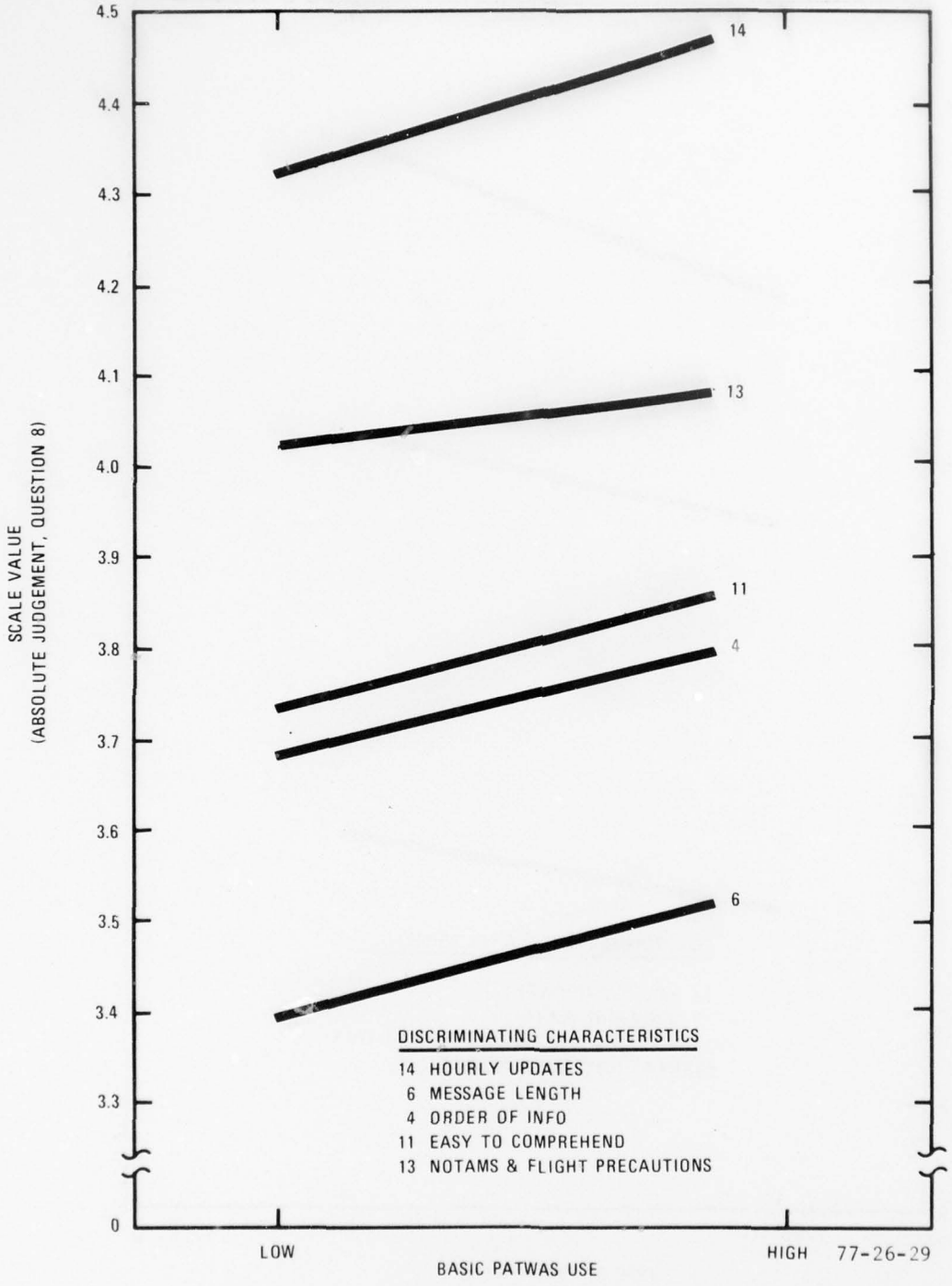


FIGURE 30. TRIAL PATWAS RATED HIGHER BY FREQUENT BASIC PATWAS USERS

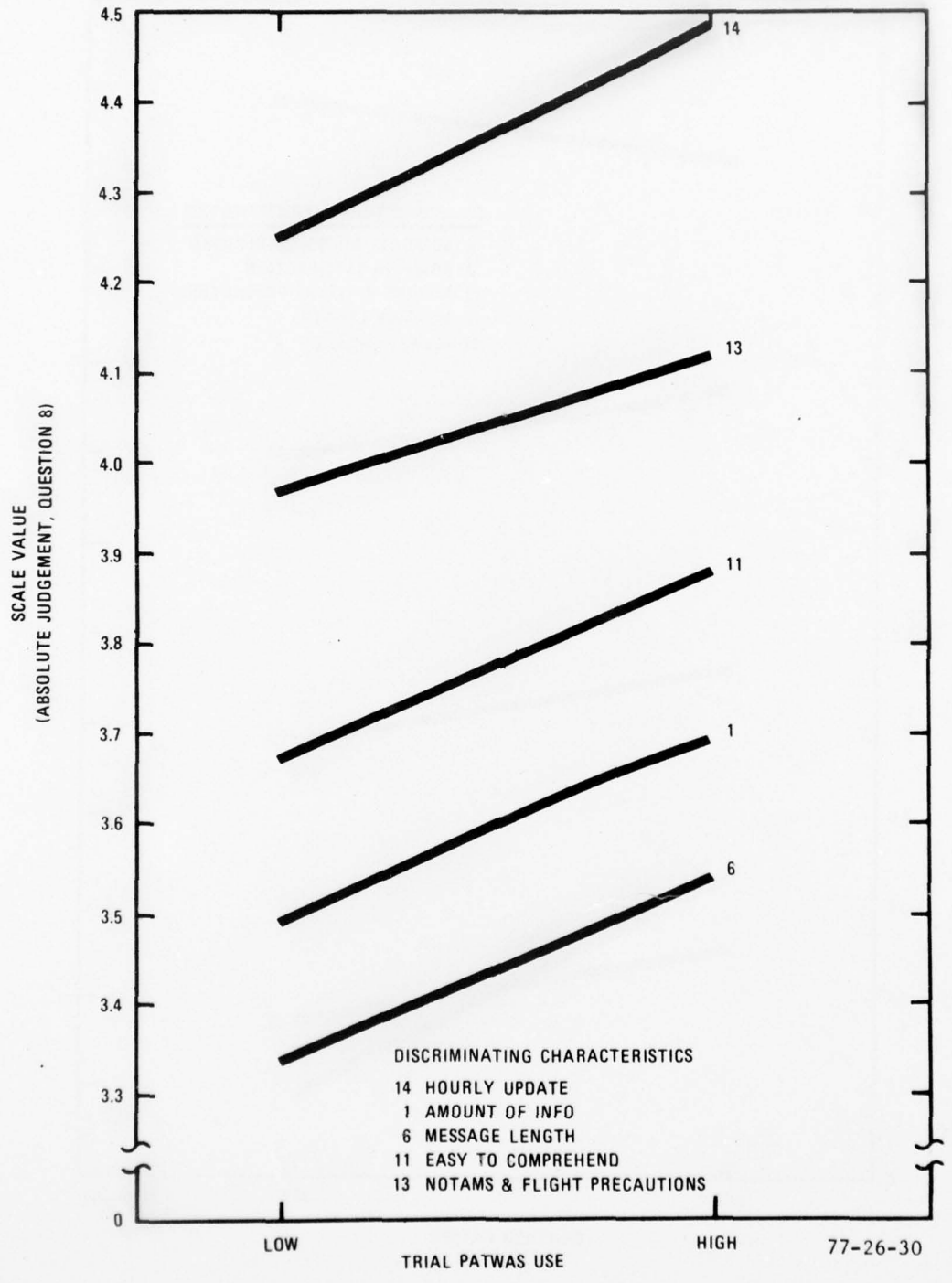


FIGURE 31. TRIAL PATWAS RATED HIGHER BY FREQUENT USERS

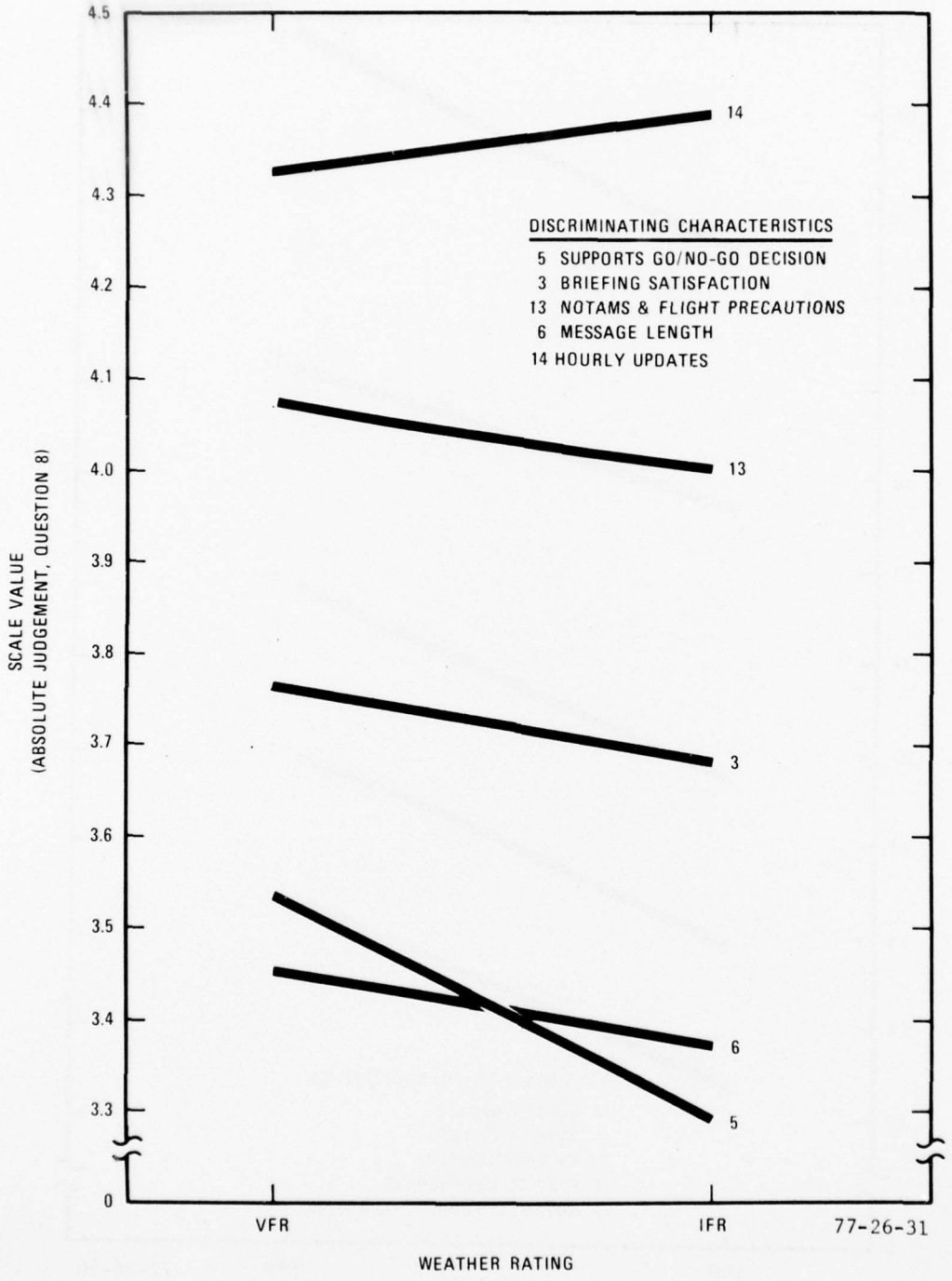


FIGURE 32. TRIAL PATWAS RATED HIGHER BY VFR PILOTS

Table 14 shows that 26 percent of the respondents indicated that they did not contact the FSS for additional information after listening to the trial PATWAS. Surprisingly, 46 percent indicated that they did not contact the FSS for in-flight information. These figures represent a significant reduction in the demand for weather information from the FSS.

TABLE 14. PERCENT OF PRIMARY RESPONDENTS CONTACTING FSS FOR WEATHER INFORMATION AFTER LISTENING TO THE TRIAL PATWAS

Type of Contact	FSS Contacted?		
	No	Yes	Total
Pre-Flight	26	74	100(1)
In-Flight	46	54	100(2)

1. The total number of respondents was 4,096.
2. The total number of respondents was 3,412.

FSS contact length. For those that answered "yes" to the above question, the primary questionnaire asked for an estimate of FSS contact length after listening to the trial PATWAS. The percentage of respondents estimating various contact lengths is summarized in table 15. It is seen that 72 percent of the respondents requesting preflight information estimated the contact length to be between 1 and 5 minutes in duration.

TABLE 15. DISTRIBUTION OF FSS-ESTIMATED CONTACT LENGTH BY PERCENT OF RESPONDENTS

Type of Contact	Contact Length (Minutes)				
	<1	1-5	6-10	>10	Total
Pre-Flight	22	72	4	2	100(1)
In-Flight	61	36	1	2	100(2)

1. Total number of respondents was 3,013.
2. Total number of respondents was 1,841.

4. Free Response--Question 11.

Write-in comments. Questionnaire item 11 invited respondents to write any comments or suggestions they wished to offer regarding the trial PATWAS. Table 16 summarizes the types of comments that were received.

The various categories of responses are listed in the first column. The second column lists the percentage distribution of comments from the initial group. Similarly, the other columns depict the distribution of responses made by the other groups.

The following capsule statements illustrate the types of comments falling into the various categories: (Numbers in parentheses indicate the number of pilots making the suggestion.)

Suggestions for Improvement (Item 1a)

Should include information on cloud tops. (49)
Would like to know freezing level, dew point, and temperature aloft. (43)
Want more accurate wind reports below 10,000 feet. (32)
Want hourly thunderstorm reports in areas where storms are expected.(28)

Commending Present Practices (Item 1b)

Like frequent hourly updates. (164)
General information is excellent. (131)

Mechanics of Presentation (Item 2)

Voice clarity and enunciation are bad (accents). (74)
Poor narration and quality. (59)
Tape is too fast. (66)
Tape is too long. (59)

Improvements in Telephone Service (Item 3)

Want a toll-free number. (422)
Experience difficulty in getting connected. (100)
Cannot get number even with operator assistance. (5)
Need more access lines during peak hours. (25)
The connection is poor. (19)

Generally Laudatory (Item 4)

Program should be continued. (103)
Program should be extended to other areas. (109)

SUMMARY OF MULTIVARIATE TEST RESULTS. The multivariate analysis program was used to explore other differences that might exist among various classifications of respondents. The details are presented in volume II. Some descriptive statistics dealing with the input data and the program execution are given in table 17.

TABLE 16. SUMMARY OF QUESTIONNAIRE WRITE-IN COMMENTS

Type of Comment		Information Source			
		Initial	Follow-up	Supplemental	Telephone
1. Sufficiency of information to make a decision to fly or not to fly.		36 %	19 %	31 %	21 %
a. Suggestions for improvement		(29)	(14)	(25)	(19)
b. Commending present practices		(7)	(5)	(6)	(2)
2. Mechanics of presentation		29	10	19	8
3. Pertained to telephone service		20	12	10	13
4. Generally laudatory		10	16	22	14
5. Never use PATWAS or use FSS also		-	32	12	39
6. Cannot make desired comparisons		-	7	1	-
7. Miscellaneous		5	4	5	5
Total Responses	Percent	100	100	100	100
	Number	2188	1255	1171	96

TABLE 17. SOME DESCRIPTIVE STATISTICS DEALING WITH THE MULTIVARIATE ANALYSIS OF QUESTIONS 8 AND 10

Parameter	Question Number	
	8	10
Total number of cells in design (2^8)	256	256
Number of filled cells	155	142
Number of empty cells	101	114
Total number of returns (N)	4298	2587
Number of degrees of freedom for multivariate test of equality of mean vectors		
For vectors	14	17
For error (within cell)	4276	2562
Number of degrees of freedom for multivariate test of hypothesis on each main effect		
Main effect	1	1
Error (within cell)	4289	2578
Rank of the model for significance testing and for estimation	9	9
Computer used	IBM 360/9020	IBM 360/9020
Execution Time (Minutes)	12.80	15.39
Amount of core available (words)	12800	12800
Amount of core used (words)	7696	9337
Percent of available core used	60	73

MULTIVARIATE MODEL. The program was run on an IBM 369/9020 computer using the program distributed by International Educational Services. The mathematical foundations are presented by J. D. Finn in "A General Model for Multivariate Analysis."

The input data consisted of the returns from the initial mailing and from the follow-up mailing. The initial intention had been to use the model whose parameters are shown in table 18. This produced a total of 1,684,800 cells. This would have permitted a more refined analysis than that actually employed, since it retained the levels of classification shown in the chi-square tables in this volume. It became quickly apparent that such a detailed model would be intractable. Multiple passes can be made in such cases, but the project schedule would not permit this. Therefore, the less refined analysis actually used was formulated.

Table 19 lists the classification variables, the results of the assessments on the absolute and comparative judgement questions, and indicates the level of statistical significance in each case.

As a group, the respondents are favorably disposed toward the trial PATWAS. It is also desirable to know whether or not large subgroups of respondents are uniformly agreed that the trial PATWAS is superior to the basic PATWAS. Important response differences would point the way to further improvements that might be required in the trial PATWAS to increase its acceptability to identifiable segments of the user population. A knowledge of subgroup differences might also lead to further publicity/educational action should it be found that special interests or capabilities tend to react differently than others.

Questionnaire items 1 through 7 asked the respondents to classify themselves with respect to the following eight variables:

1. License/rating,
2. Multiengine versus single-engine capability,
3. Total flying time,
4. Flying time in 12 months prior to completing questionnaire,
5. County of residence,
6. Type power plant flown most frequently,
7. Number of times basic PATWAS used, and
8. Number of times trial PATWAS used.

From this information, two additional classifications were developed:

9. VFR versus IFR capability, and
10. GADO affiliation.

The responses were categorized appropriately and analyzed by a multivariate analysis of variance. (The Univariate and Multivariate Analysis of Variance, Covariance and Regression Program Version 5.3 required for the analysis was obtained from International Education Service, P.O. Box A3650, Chicago, Ill. 60690.) As the program's developer (reference 13) points out, multivariate analysis facilitates the interpretation of data that consist of

TABLE 18. DETERMINATION OF QUASI F RATIOS (AFTER WINER, PP. 201-205)

Factor			
	Name and Symbol	No. of Levels	Type
α	License/Rating	6	Fixed
β	No. Engines	2	Fixed
γ	Total Flying Time	5	Fixed
δ	Annual Flying Time	6	Fixed
η	County of Residence	26	Random
θ	Type Power Plant	3	Fixed
π	No. Times Used Basic PATWAS	6	Fixed
λ	No. Times Used Trial PATWAS	5	Fixed
ϕ	Sample	2	Random
ψ	Subjects	$\approx$ 5000	Random

Factor to be Tested	Form of Quasi F Ratio	Components of Expected Mean Squares[1]
α (License/ Rating)	$\frac{\alpha+\alpha\eta\theta}{\alpha\phi+\alpha\eta} = \frac{(e+\psi+\alpha\eta\phi+\alpha\eta+\alpha\phi)+(e+\psi+\alpha\eta\phi)}{(e+\psi+\alpha\eta\phi+\alpha\phi)+(e+\psi+\alpha\eta\phi+\alpha\phi)} = \frac{2e+2\psi+2\alpha\eta\phi+\alpha\phi+\alpha\eta+\alpha}{2e+2\psi+2\alpha\eta\phi+\alpha\phi+\alpha\eta}$	
β (No. Engines)	$\frac{\beta+\beta\eta\phi}{\beta\phi+\beta\eta} = \frac{(e+\psi+\beta\eta\phi+\beta\phi+\beta\eta+\beta)+(e+\psi+\beta\eta\phi)}{(e+\psi+\beta\eta\phi+\beta\phi)+(e+\psi+\beta\eta\phi+\beta\eta)} = \frac{2e+2\psi+2\beta\eta\phi+\beta\phi+\beta\eta+\beta}{2e+2\psi+2\beta\eta\phi+\beta\phi+\beta\eta}$	
γ (Total Flying Time)	$\frac{\gamma+\gamma\eta\phi}{\gamma\phi+\gamma\eta} = \frac{(e+\psi+\gamma\eta\phi+\gamma\phi+\gamma\eta+\gamma)+(e+\psi+\gamma\eta\phi)}{(e+\psi+\gamma\eta\phi+\gamma\phi)+(e+\psi+\gamma\eta\phi+\gamma\eta)} = \frac{2e+2\psi+2\gamma\eta\phi+\gamma\phi+\gamma\eta+\gamma}{2e+2\psi+2\gamma\eta\phi+\gamma\phi+\gamma\eta}$	
δ (Annual Flying Time)	$\frac{\delta+\delta\eta\phi}{\delta\phi+\delta\eta} = \frac{(e+\psi+\delta\eta\phi+\delta\phi+\delta\eta+\delta)+(e+\psi+\delta\eta\phi)}{(e+\psi+\delta\eta\phi+\delta\phi)+(e+\psi+\delta\eta\phi+\delta\eta)} = \frac{2e+2\psi+2\delta\eta\phi+\delta\phi+\delta\eta+\delta}{2e+2\psi+2\delta\eta\phi+\delta\phi+\delta\eta}$	
η (County of Residence)	$\frac{\eta}{\eta\phi} = \frac{e+\psi+\eta\phi+\eta}{e+\psi+\eta\phi}$ (Not a Quasi F Ratio)	

[1] Symbology simplified and adapted from Winer

TABLE 18. DETERMINATION OF QUASI F RATIOS (AFTER WINER, pp. 201-205) (Continued)

	Factor to be Tested	Form of Quasi F Ratio	Components of Expected Mean Squares[1]
θ	(Type of Power Plant)	$\frac{\theta+\theta\eta\phi}{\theta\phi+\theta\eta} = \frac{(e+\psi+\theta\eta\phi+\theta\phi+\theta\eta+\theta)+(e+\psi+\theta\eta\phi)}{(e+\psi+\theta\eta\phi+\theta\phi)+(e+\psi+\theta\eta\phi+\theta\eta)} = \frac{2e+2\psi+2\theta\eta\phi+\theta\phi+\theta\eta+\theta}{2e+2\psi+2\theta\eta\phi+\theta\phi+\theta\eta}$	
π	(No. Times Basic PATWAS)	$\frac{\pi+\pi\eta\phi}{\pi\phi+\pi\eta} = \frac{(e+\psi+\pi\eta\phi+\pi\phi+\pi\eta+\pi)+(e+\psi+\pi\eta\phi)}{(e+\psi+\pi\eta\phi+\pi\phi)+(e+\psi+\pi\eta\phi+\pi\eta)} = \frac{2e+2\psi+2\pi\eta\phi+\pi\phi+\pi\eta+\pi}{2e+2\psi+2\pi\eta\phi+\pi\phi+\pi\eta}$	
λ	(No. Times Trial PATWAS)	$\frac{\lambda+\lambda\eta\phi}{\lambda\phi+\lambda\eta} = \frac{(e+\psi+\lambda\eta\phi+\lambda\phi+\lambda\eta+\lambda)+(e+\psi+\lambda\eta\phi)}{(e+\psi+\lambda\eta\phi+\lambda\phi)+(e+\psi+\lambda\eta\phi+\lambda\eta)} = \frac{2e+2\psi+2\lambda\eta\phi+\lambda\phi+\lambda\eta+\lambda}{2e+2\psi+2\lambda\eta\phi+\lambda\phi+\lambda\eta}$	
ϕ	(Samples)	$\frac{\phi}{\eta\phi} = \frac{e+\psi+\eta\phi+\phi}{e+\psi+\eta\phi}$ (Not a Quasi F Ratio)	
ψ	(Subjects Within Cells)	(No Test Possible)	

[1] Symbology simplified and adapted from Winer

TABLE 19. SUMMARY OF MULTIVARIATE TEST RESULTS

Classification	Assessment		Levels of Statistical Significance	
	Absolute Judgement (Question 8) Trial PATWAS More Highly Rated By	Comparative Judgement (Question 10) Trial PATWAS Favored By	Absolute (Question 8)	Comparative (Question 10)
1. No. Engines	-(1)	Single	-(1)	P<.0016
2. Total Flying Time	<400 hours	-(1)	P<.0001(2)	-(1)
3. Annual Flying Time	>51 hours	-(1)	P<.0001	-(1)
4. Power Plant	Piston	Piston	P<.1065	P<.0116
5. Basic PATWAS Use	>21 Contacts	>21 Contacts	P<.0001	P<.0032
6. Trial PATWAS Use	>11 Contacts	>11 Contacts	P<.0001	P<.0001
7. IFR or VFR Capability	VFR	IFR	P<.0001	P<.1048
8. GADO Affiliation	Teterboro	Teterboro	P<.0001	P<.1705

1. Signifies "Not Statistically Significant at the .25 Probability Level". The differences observed could have occurred by chance more than 25 times in 100 repetitions of the experiment.

2. Notation for this and other statistically significant values indicates that a difference as large as or larger than the one observed would be expected to occur by chance less than one time in 10,000 repetitions (or whatever other value is indicated) of the experiment.

separate but related scores dealing with a single phenomenon. Thus, it is uniquely suited to the analysis of the PATWAS questionnaire data. Finn points out that "...the analysis of a single summary measure--for example, a total of average score--will result in the loss of the information conveyed by the individual scales. Statistical analysis of each of a series of measures separately will result in redundancy, which, in turn, will threaten the validity of the interpretations drawn from the data. Use of the appropriate multivariate model will allow the researcher to retain the multiple scores and to treat them simultaneously, giving appropriate consideration to the correlations among them." (Underline added.)

This powerful technique revealed numerous statistically significant differences between the levels of the classification parameters. All pilot classifications indicated their satisfaction with the trial PATWAS. Only one seemed to require any action as discussed below.

POSSIBLE TELEPHONE PROBLEMS IN THE TETERBORO AREA. The multivariate analysis of question 8 produced a highly statistically significant (a difference as large as or larger than the one observed would be expected to occur by chance less than one time in 10,000 repetitions of the experiment) difference in responses from the Teterboro and Farmingdale areas. Pilots affiliated with the Farmingdale GADO were found to favor the trial PATWAS much more than those affiliated with Teterboro.

An examination of the individual questions contributing to this difference revealed that pilots affiliated with the Farmingdale GADO felt much more strongly than those affiliated with the Teterboro GADO that "The Recorded Message Was Obtained Promptly After Dialing" (Questionnaire item 8M).

Figure 33 plots the relative strength of effect differences between the two GADO affiliates for the five parameters upon which opinions differed most significantly. The magnitude of the difference is forcefully illustrated by the steep positive slope of the curve labeled "10" (i.e., promptness of connection) relative to the other parameters whose differences are also highly statistically significant. In terms of scale values, Teterboro produced a value of 3.40, while Farmingdale rated this parameter at about 3.85.

The five most distinguishing characteristics are ranked in figure 33, with the most discriminating one shown first. Figure 34 shows a similar effect for the items in question 10. Again, a higher rating is given to the stimulus "Connected Promptly to Recorded Message" (item 10J), and the difference is the most significant of the items in the group. The difference is not as large here (3.25 versus 3.32), but this points to the possibility that Teterboro pilots also had difficulty reaching the basic PATWAS.

CHI-SQUARE TESTS.

Advantages of Chi-Square. The superior analytic properties of the multivariate analysis of variance enabled placing primary reliance upon it for the final analysis of questionnaire items 8 and 10. However, chi-square test leads were also conducted at earlier stages, since their relative simplicity:

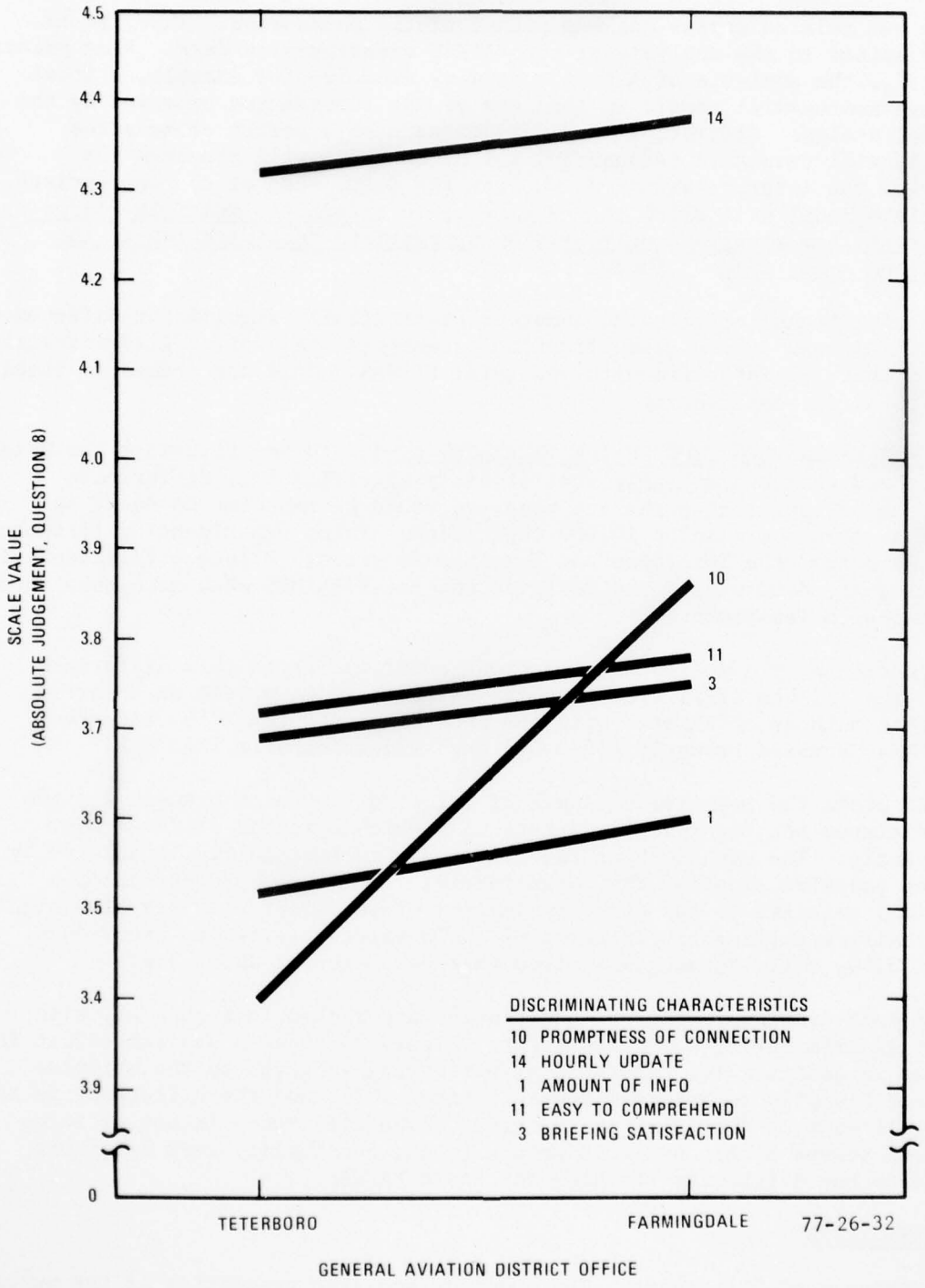


FIGURE 33. TRIAL PATWAS RATED HIGHER BY FARMINGDALE GADO AFFILIATES (QUESTION 8)

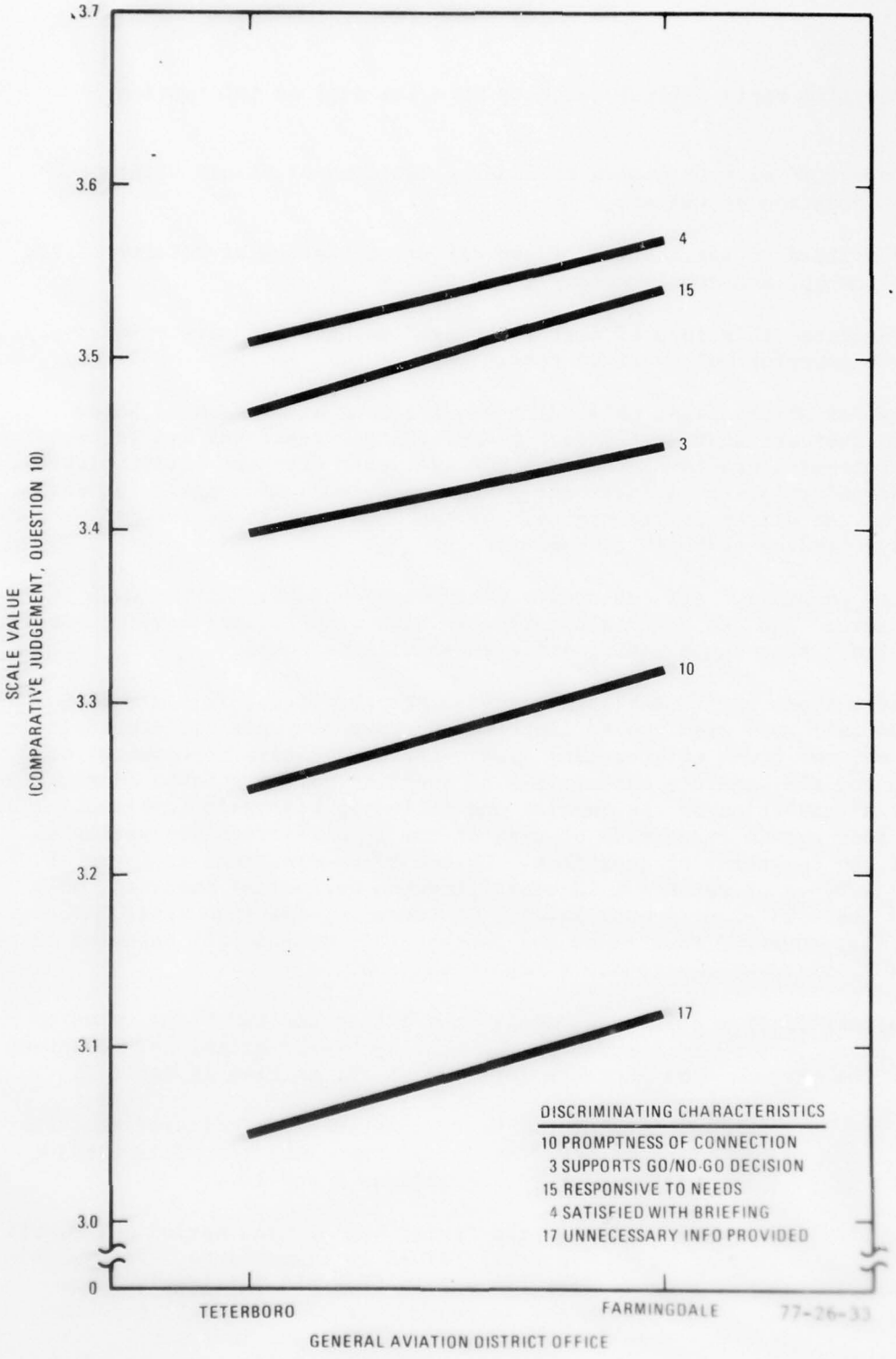


FIGURE 34. TRIAL PATWAS RATED HIGHER BY FARMINGDALE GADO AFFILIATES (QUESTION 10)

AD-A047 247 NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER ATL--ETC F/G 4/2
NEW YORK CITY PILOTS AUTOMATIC TELEPHONE WEATHER ANSWERING SERV--ETC(U)
OCT 77 F STAIANO, E SHOCHET

UNCLASSIFIED FAA-NA-77-26 FAA-RD-77-80-VOL-1 NL

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1. Provided rapid initial insights into the data as information developed,

2. Permitted an examination of finer gradations of values within each of the classification parameters,

3. Permitted an examination of the different classes of returns (i.e., initial, follow-up, and supplementary), and

4. Permitted this form of test to be used earlier and more extensively than the more powerful multivariate test.

The results of the final chi-square examinations are presented below primarily to indicate what statistical relationships were found and to reveal certain differential gradients that are not available from the multivariate results. Secondarily, it is instructive for future work to compare the results obtained from the different techniques. As the data will show, the two methods do not always produce compatible results.

Material Examined. All chi-square tests were conducted at the 0.25 level of significance. The use of this numerically high significance level makes it extremely likely that any existing differences will be found.

The three types of primary questionnaire returns (i.e., initial, follow-up, and supplemental) were examined to identify subgroup response differentials to each of the two forms of questions (i.e., the comparative assessments of question 10 and the absolute assessments of question 8). A further examination was made of a tabulation of the initial and follow-up responses combined. Thus, there were four examinations made of each of the 10 classification variables for each of the two forms of questions. Of the 80 combinations (2 forms of questions x 4 types of returns x 10 classification variables) analyzed, only 10 exceeded the 0.25 significance level. Of these 10, one (the trial PATWAS listening time) appeared four times and another (VFR versus IFR) appeared three times. The complete tabulation is given in table 20.

The balance of this discussion deals only with these two items, plus two others that appeared in the analysis of the combined initial and follow-up responses. The presentation accounts for nine of the entries in table 21.

Trial PATWAS Listening Frequency. Users consistently indicated that the more they listen to the trial PATWAS, the better they like it. This finding appeared strongly in the analysis of both questions 8 and 10.

Figure 35 shows a marked rise in the "trial better than basic" curve, with increases in the number of times the trial PATWAS is listened to. Forty-seven percent of those listening up to five times felt that the trial PATWAS was better than the basic. The percentage increased steadily until 61 percent of those who listened more than 40 times rendered the same judgement. There is a marked decrease in the percentages of those indicating "no significant difference" and "basic better than trial."

TABLE 20. SUMMARY OF CHI-SQUARE TEST RESULTS

CLASSIFICATION	ABSOLUTE (QUESTION 8)				COMPARATIVE (QUESTION 10)			
	COMBINED[1]	INITIAL	FOLLOW-UP	SUPPLEMENTAL	COMBINED[1]	INITIAL	FOLLOW-UP	SUPPLEMENTAL
1. LICENSE/RATING	-[2]	-	-	-	-	-	-	-
2. NO. ENGINES	-	-	-	-	-	-	-	-
3. TOTAL FLYING TIME	-	-	-	-	-	-	-	-
4. ANNUAL FLYING TIME	.10<p<.20	-	-	-	-	-	-	-
5. COUNTY OF RESIDENCE	-	-	-	-	-	-	-	-
6. POWER PLANT	-	-	-	-	-	-	-	.20<p<.25
7. BASIC PATWAS USE	-	-	-	-	-	-	-	-
8. TRIAL PATWAS USE	p<<<.001[3]	-	p<<<.001	-	p<.001	p=.05	-	-
9. IFR OR VFR CAPABILITY	-	-	-	-	.025<p<.05	.025<p<.05	-	.10<p<.20
10. GADO AFFILIATION	.05<p<.10	-	-	-	-	-	-	-

1. Combines "Initial" and "Follow-Up."

2. Signifies "Not Statistically Significant at the .25 Probability Level." The differences observed could have occurred by chance more than 25 times in 100 repetitions of the experiment.

3. Indicates that a difference as large as or larger than the one observed would be expected to occur by chance very much less than one time in 1000 repetitions of the experiment.

TABLE 21. COMPARISON OF RESULTS OBTAINED BY MULTIVARIATE AND CHI-SQUARE TESTS

Parameter	Type of Question			
	Absolute (Question 8)		Comparative (Question 10)	
	X^2	MV	X^2	MV
1. License/Rating	NS[1]	NT[2]	NS	NT
2. No. Engines	NS	NS	NS	SINGLE
3. Total Flying Time	NS	< 400 hours[3]	NS	NS
4. Annual Flying Time	Low	> 51 hours	NS	NS
5. County of Residence	NS	NT	NS	NT
6. Power Plant	NS	PISTON	NS	PISTON
7. Basic PATWAS Use	NS	>21 Contacts	NS	>21 Contacts
8. Trial PATWAS Use	HI	>11 Contacts	HIGH	>11 Contacts
9. VFR vs IFR	NS	VFR	IFR	IFR
10. GADO	FARMINGDALE	TETERBORO	NS	TETERBORO

1. NS = Not statistically significant at the .25 level
2. NT = Not Tested
3. This and similar notations identify the group favoring Trial PATWAS the most

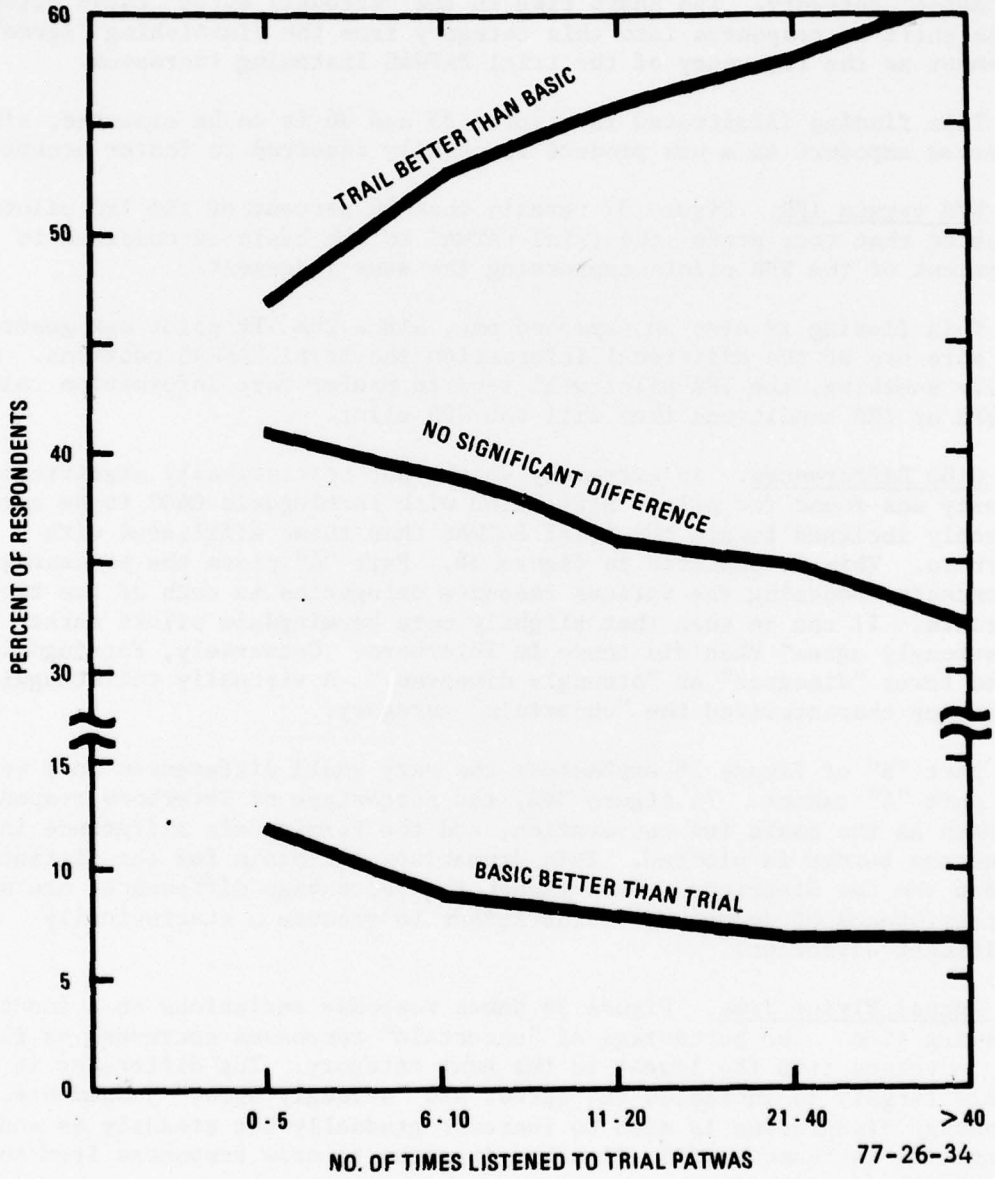


FIGURE 35. FREQUENT USERS PREFER TRIAL PATWAS

As shown in figure 36, the percentage indicating "uncertain" falls sharply as listening frequency increases from 0-5 to 6-10. Those who were initially "uncertain" have moved largely into the "agree" category, as the rise in that curve signifies. Toward the higher end of the frequency of listening continuum there is a decline in the percentage of those endorsing the "agree" category. The sharp rise in the "strongly agree" curve attests to the shift of responses into this category from the diminishing "agree" judgement as the frequency of the trial PATWAS listening increases.

This finding illustrated in figures 35 and 36 is to be expected, since increased exposure to a new product is usually required to foster acceptance.

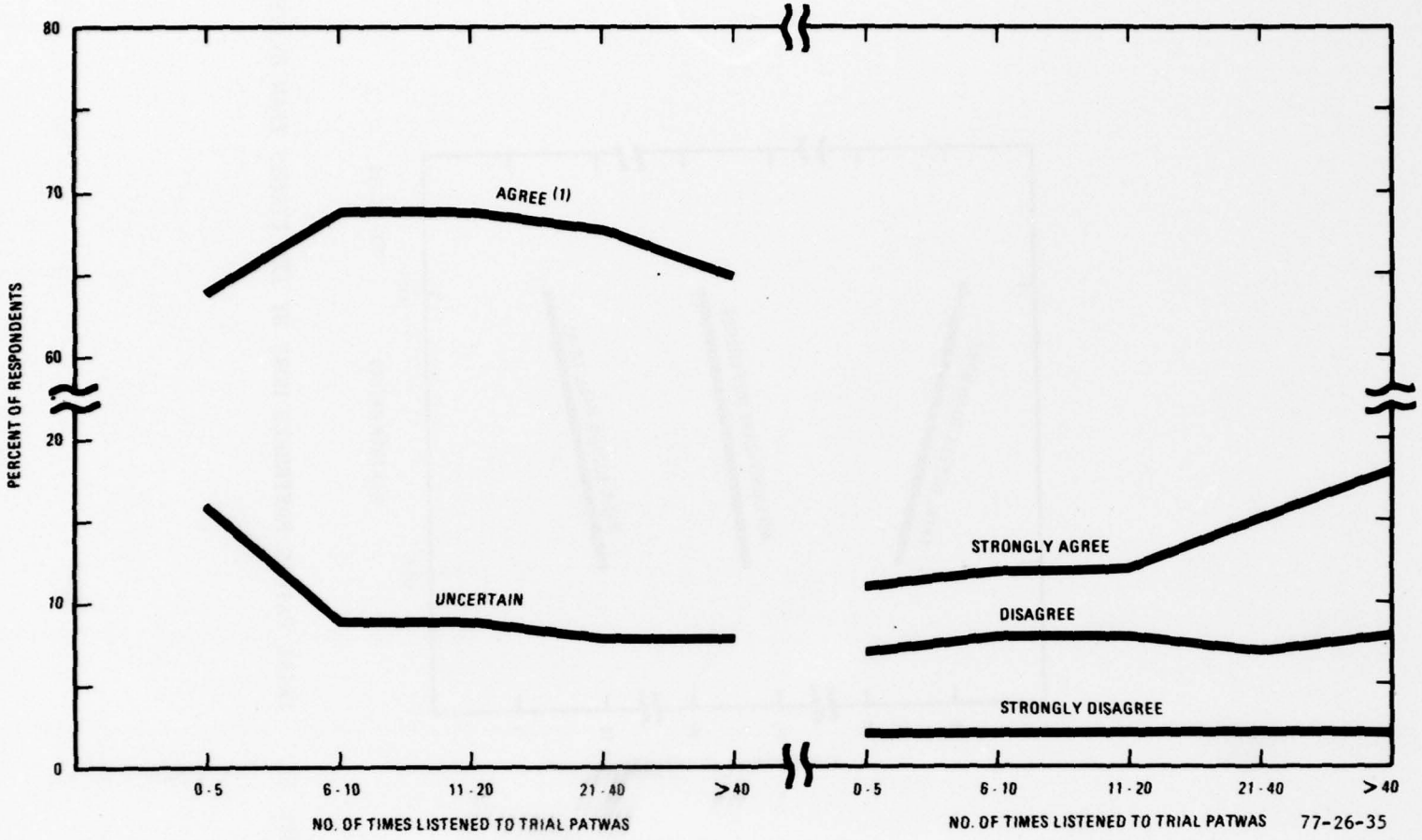
VFR versus IFR. Figure 37 reveals that 56 percent of the IFR pilots indicated that they prefer the trial PATWAS to the basic as compared to 52 percent of the VFR pilots expressing the same judgement.

This finding is also an expected one, since the IFR pilot can generally make more use of the additional information the trial PATWAS contains. Statistically speaking, the IFR pilot will tend to prefer more information relevant to MVFR or IFR conditions than will the VFR pilot.

GADO Differences. An extremely slight but statistically significant tendency was found for pilots affiliated with Farmingdale GADO to be more favorably inclined toward the trial PATWAS than those affiliated with Teterboro. This is depicted in figure 38. Part "A" plots the percentage of respondents endorsing the various response categories in each of the two GADO districts. It can be seen that slightly more Farmingdale pilots marked "agree" or "strongly agree" than did those in Teterboro. Conversely, Farmingdale pilots marked fewer "disagree" or "strongly disagree." A virtually indistinguishable difference characterized the "uncertain" category.

Part "B" of figure 38 emphasizes the very small differences in a way that part "A" cannot. In figure 38B, the percentage of Teterboro responses is taken as the basis for computation, and the Farmingdale difference in percentage points is plotted. This dramatizes the basis for the distinction between the two districts. Even though the percentage differences are small, the consistency of judgement is sufficient to produce a statistically significant difference.

Annual Flying Time. Figure 39 shows response variations as a function of flying time. The percentage of "uncertain" responses decreases as flying time increases from the lowest to the next category. The difference is attributable largely to increases in "agree: and "strongly agree" judgements. The percentage disagreeing is seen to increase gradually but steadily as annual flying time increases until, finally, it seems to draw responses from the two favorable categories.



1. RATINGS ON THE 11 QUESTION 8 ITEMS FOR WHICH "STRONGLY AGREE" FAVORS TRIAL PATWAS.

FIGURE 36. FREQUENT USERS RATE TRIAL PATWAS MORE HIGHLY

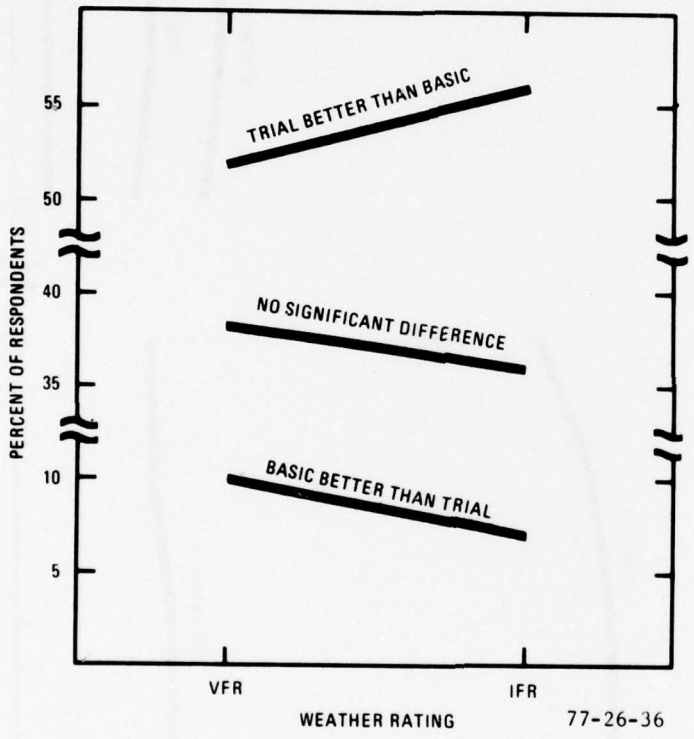
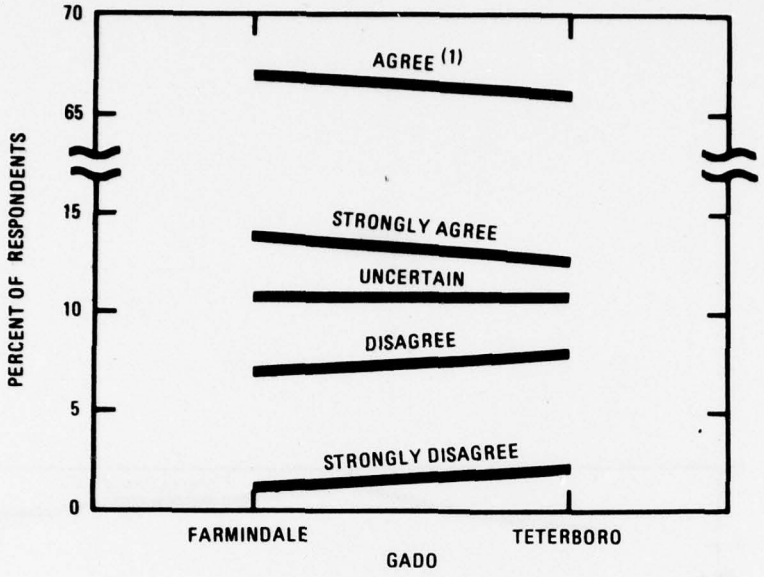
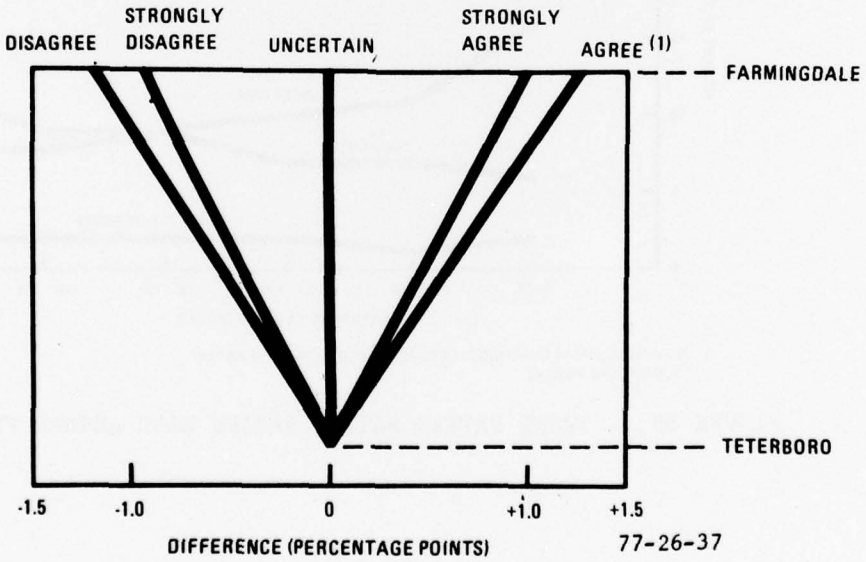


FIGURE 37. TRIAL PATWAS PREFERRED MORE BY IFR PILOTS THAN BY VFR



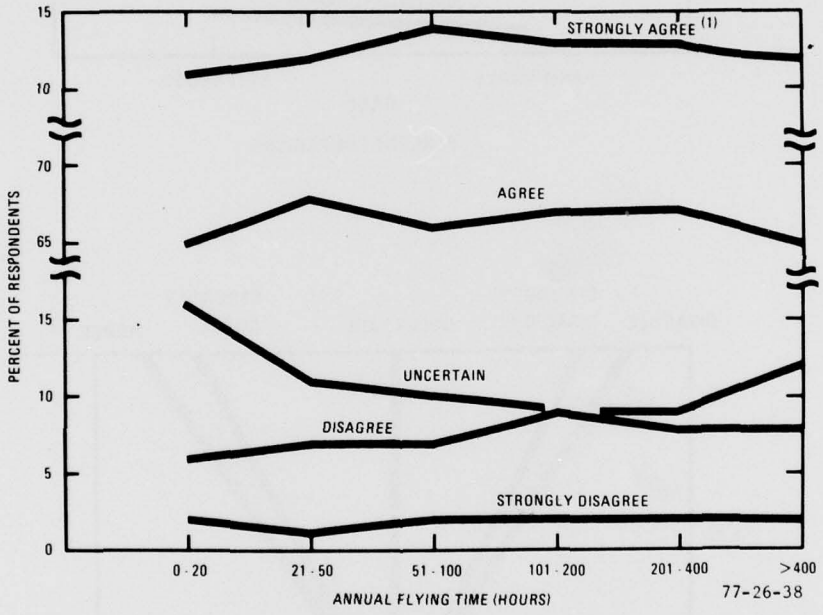
A. PERCENT COMPARISON



B. DIFFERENCE COMPARISON

1. RATINGS ON THE 11 QUESTION 8 ITEMS FOR WHICH "STRONGLY AGREE" FAVORS TRIAL PATWAS.

FIGURE 38. FARMINGDALE GADO RATES TRIAL PATWAS HIGHER THAN TETERBORO



1. RATINGS ON THE 11 QUESTION 8 ITEMS FOR WHICH "STRONGLY AGREE" FAVORS TRIAL PATWAS.

FIGURE 39. TRIAL PATWAS RATING VARIES WITH ANNUAL FLYING TIME

COMPARISON OF MULTIVARIATE AND CHI-SQUARE TEST RESULTS. Table 21 summarizes the results of the chi-square and multivariate analyses of question 8 and question 10.

Table 22 presents two comparisons. The first compares the chi-square results with the multivariate results for each of the two sets of stimuli (i.e., question 8 and question 10). This is an indication of the extent to which the two methods of analysis produced the same result. The second compares the results of question 8 and question 10 for each of the analyses. This is a comparison of the extent to which the different forms of question produced the same answer, regardless of the method of analysis employed.

Three main categories of classification are employed: "agreement," "disagreement," and "one member of the pair not tested." The numbers entered in the body of the table are the parameter identification numbers contained in the left hand column of table 21.

All comparisons producing agreement obviously require no discussion. It is worthy of note, however, that there was agreement in all cases regarding table 21, parameter 8, "number of times trial PATWAS was listened to." This lends even greater weight to the importance of the finding that the more people listen to the trial PATWAS, the more they like it.

TABLE 22. TEST RESULTS COMPARED BY TABULATION OF TABLE 21 PARAMETERS

	X^2 vs MV		Question 8 vs Question 10	
Comparison	Question 8	Question 10	X^2	MV
Agreement	2,(8)	3,4,(8),9	1,2,3,5,6,7,(8)	1,5,6,7,(8),10
Disagreement Significance vs Non-Significance	3,6,7,9	2,6,7,10	4,9,10	2,3,4
Reversal	4,10	-	-	9
One Member Not Tested	1,5	1,5	-	-

SIGNIFICANCE/NONSIGNIFICANCE, CHI-SQUARE VERSUS MULTIVARIATE. There are eight cases of significant/nonsignificant disagreement between chi-square and multivariate tests of question 8 and question 10. It will be noted from an examination of table 21 that there is no case in which chi-square declared significance that the multivariate test did not. All the disagreements are in the other direction, viz., multivariate declares significance when chi-square does not. This type of discrepancy is attributable to the greater power of the parametric test (which the analysis of variance is) as compared with a nonparametric test (which the chi-square is). Siegel (pp. 9 and 19) defines power as "...the probability of rejecting the null hypothesis (of no difference between the values of the parameter(s) being tested) when it is in fact false." In other words, a powerful test will find differences when they do exist. He goes on to point out that "...a parametric test...will be more powerful than any other in rejecting the null hypothesis when it is false."

Significance/Nonsignificance, Questions 8 and 10. There are six cases of significant/nonsignificant disagreement in the question 8 versus question 10 comparisons. Two factors would account for these differences. First, the forms of the questions were different. In one case, an absolute judgement was requested, and in the other, a comparative one was sought. Identical results should not necessarily be expected.

A second factor is that some stimuli were unique to a given form of question. For example, "It is helpful to have the information updated hourly" appeared in question 8, but not in question 10, which made no mention of frequency of updating. Therefore, some discrepancies might be explainable in terms of stimulus differences. The detailed analysis required to confirm this hypothesis has not been conducted.

NONRESPONDENTS. A telephone follow-up was conducted on a random sample of 100 nonrespondents to determine whether or not they held strong opinions about the trial PATWAS that differed from those gleaned from written returns. The results of the telephone follow-up indicate that they do not and that there need be no serious concern about latent adverse opinion.

Sixty-five of the one-hundred people contacted have not used PATWAS and therefore had no basis for completing the questionnaire. Their reasons for not using the system are summarized in table 23. Of the pilots contacted by phone, 35 did give some information concerning the system. The questions asked during the telephone interview are listed below:

1. What license/rating do you hold?

2. Are you licensed to operate a multiengine aircraft?

3 How many flying hours do you have?

4. What type of power plant do you fly most frequently?

5. Have you used the old PATWAS? Estimated number of times.

6. Have you used the new PATWAS? Estimated number of times.

7. What is you general reaction to the trial PATWAS?

8. How would you compare the basic PATWAS with the trial PATWAS? Basic better than trial? No significant difference? Trial better than basic?

9. Did the briefing received from the trial PATWAS make it unnecessary for you to call the Flight Service Station for weather information?

10. If you still had to call the Flight Service Station for weather information, did the briefing received from the trial PATWAS reduce the time on-line with the Flight Service Station? Percentage time reduced?

11. We would appreciate any comments or suggestions you would like to make regarding the trial PATWAS. Thank you.

TABLE 23. REASONS FOR NOT RESPONDING TO THE QUESTIONNAIRE

Reason	Number of Responses
Inactive flying status at present	12
Airline pilots	12
Prefer to call the FSS	7
Military pilots	6
Student pilots (low hours)	5
Living out of state	5
Prefer an in-person weather briefing	3
In college--cannot afford to fly	3
Heard of PATWAS but haven't need	2
Living out of country/or just returned	2
Would like to know more about PATWAS before using	2
Haven't heard of PATWAS	2
List the PATWAS phone number	1
Heard it's a toll call, so never used	1
Eyeball the weather--do local flying only on VFR days	1
Called PATWAS got busy signal--never called again	1
	65*

*Of the 100 calls (the other 35 have used PATWAS)

SUPPLEMENTAL SURVEY.

Question 6 of the supplemental questionnaire asked "Did the briefing received from the trial PATWAS make it unnecessary for you to call the FSS for weather information?" Three response categories were available: "yes," "no," and "uncertain." The responses to this item are given below:

Type of Contact	Percent Yes	No	Uncertain	Total
Pre-Flight	63	34	3	100(1)
In-Flight	67	31	2	100(2)

1. Percentages based on a total of 1,120 responses.
2. Percentages based on a total of 921 responses.

Question 7 of the supplemental questionnaire asked: "If you still had to call the FSS for weather information, did the briefing received from the trial PATWAS reduce the time on line with the FSS?" The estimates are given below:

Type of Contact	Percent No	Percent Yes	Total	Estimated Percent Reduction in Briefing Time
Pre-Flight	13	87	100(1)	51(3)
In-Flight	27	73	100(2)	44(4)

1. Percentages based on a total of 482 responses
2. Percentages based on a total of 320 responses
3. Percentages based on a total of 420 responses
4. Percentages based on a total of 235 responses.

The supplemental survey revealed that 63 percent of the pilot response to question 6 indicated that it was unnecessary to contact the FSS for preflight weather information after listening to the trial PATWAS. Sixty-seven percent of the returns indicated that it was unnecessary to contact the FSS for weather information while in flight, as a result of listening to the trial PATWAS. Question 7 of the supplemental survey asked for an estimate of the percent reduction in FSS contact time for those occasions when it was necessary to call the FSS for weather information. It is significant to note that as a result of listening to the trial PATWAS, the average reduction in FSS weather briefing time was estimated to be 51 percent for pre-flight and 44 percent while in flight.

The supplemental survey also revealed that respondents patently favor the route-oriented briefings provided in the trial PATWAS. As shown in table 24, 96 percent so indicated, while only 4 percent said they did not. This strongly supports a continuation of the route-oriented briefings.

TABLE 24. DISTRIBUTION OF RESPONDENTS PREFERRING SELECTION OF BRIEFING

Datum	No	Yes	Total
Percent	4	96	100
Number	45	1081	1126

The question was asked in the supplemental survey, whether or not the respondent's license/rating had changed since the last report. Ninety-four percent said it had not, while 6 percent said that it had. This indicates marked stability in this respondent characteristic and alleviates potential concern that the response sample was changing significantly during the course of the survey.

CORRELATIONS WITH SUPPLEMENTAL SURVEY.

TYPE OF WEATHER. The supplemental survey asked for an indication of the type of weather that was experienced while airborne. FSS observations of local

weather were made at the same time telephone line count information was gathered. These two types of information are compared in table 25. The line labeled "supplemental survey" gives the percentage distribution of weather actually encountered while the pilots were aloft. The second line shows the distribution of weather type.

TABLE 25. PERCENT DISTRIBUTION OF TYPE OF WEATHER FOR TRIAL PATWAS CONTACT AND FLIGHTS

Information Source	VFR	MVFR	IFR	Total
Supplemental Survey	60	25	15	100(1)
FSS Observation	74	16	10	100(2)

1. Total number of respondents was 1,115.
2. Percentage based on a total of 90,345 observations.

Table 26 shows that only 34 percent of the supplemental survey respondents contacted the local trial PATWAS recording; whereas, the line count revealed 61 percent of all calls to the trial PATWAS going to that recording.

TABLE 26. PERCENT DISTRIBUTION OF TRIAL PATWAS CONTACTS OBTAINED FROM SURVEY AND LINE COUNTS

	PATWAS Recording Contacted			
Information Source	North and East	South and West	Local	Total
Supplemental Survey	39	27	34	100(1)
Line Count	21	18	61	100(2)

1. Total number of respondents was 1,241.
2. Percentages based on 90,345 observations.

CONTACT LENGTH. The telephone recording equipment measured contact time for each of the three trial PATWAS recordings. The average contact time for each of the three recordings is given in table 27, where the times are segregated by type of weather. This information is useful for estimating the number of telephone lines required to serve a given area. Development of such estimates, however, is beyond the scope of this report.

TABLE 27. AVERAGE TRIAL PATWAS MESSAGE LENGTH (MINUTES) CATEGORIZED BY ROUTE AND TYPE OF WEATHER

Route	Type of Weather VFR	MVFR	IFR	OVERALL (Weighted)
Local	4.78	6.34	6.62	5.11
North and East	5.72	6.75	7.17	5.96
South and West	5.52	6.90	7.55	5.84
Overall	5.34	6.66	7.10	5.64

Note: Percentage based on frequencies ranging from 1,231 to 22,009 observations.

TELEPHONE ACTIVITY.

The equipment described in a preceding section measured the number of calls made to each of the three trial PATWAS recordings and the length of the contact for each call. WSO personnel recorded the local weather for selected intervals, and these records were matched with the telephone activity data. The information obtained from this equipment is summarized below.

USE OF SERVICE. Table 28 shows the average number of calls per day broken down by types of weather and segregated by route. This provides an indication of the average telephone line loading requirement experienced during the data-gathering period (i.e., April through October 1976).

TABLE 28. AVERAGE NUMBER OF TRIAL PATWAS CALLS PER DAY

Route	Type of Weather VFR	MVFR	IFR	Average (Weighted)
Local	279	401	592	317
North and East	97	137	176	108
South and West	85	124	194	98
Average	154	221	321	175

Note: Average based on a grand total of 90,345 calls.

Table 29 normalizes the data in table 28 for each of the three routes. The approximately equal numbers in each of the three columns indicate that the three recordings are affected uniformly by variations in the type of weather. As one would expect, the number of calls increase as the weather gets worse.

TABLE 29. PERCENT DISTRIBUTION OF CALLS AS A FUNCTION OF TYPE OF WEATHER

	Type of Weather			
Route	VFR	MVFR	IFR	Total
Local	22	31	47	100
North and East	24	33	43	100
South and West	21	31	48	100

Note: Percentages based on the data in table 27.

Similarly, table 30 highlights the constant relative frequency with which the three recordings are used regardless of type of weather. Here the approximate equality of row entries reveals that the greatest use is made of the local recording, with the balance of the calls being distributed equally between the two routes.

TABLE 30. PERCENT DISTRIBUTION OF CALLS AS A FUNCTION OF ROUTE

	Type of Weather		
Route	VFR	MVFR	IFR
Local	61	61	63
North and East	21	21	19
South and West	18	18	18
Total	100	100	100

Note: Percentages based on the data in table 27.

Table 31 shows how the calls are divided as a function of the time of day for each of the three recordings. Here the numbers in the three columns are essentially equal, indicating that the requests for service vary uniformly as a function of time of day for each of the three recordings.

TABLE 31. PERCENT DISTRIBUTION OF CALLS AS A FUNCTION OF TIME OF DAY

Route	Time of Day 1100Z	1800Z	2300Z	Total
Local	22	47	31	100
North and East	19	53	28	100
South and West	21	49	30	100

Note: Raw percentages based on the following total number of observations: Local 55,053; North and East 18,913; South and West 16,379.

MESSAGE AND CONTACT LENGTH. Table 27 depicts the average trial PATWAS message length as a function of type of recording and type of weather. As expected, message length increases under IFR conditions. Regardless of weather condition, the local message tends to be shorter than the route messages, as can be seen by comparing the three figures in a given column.

Table 32 compares message length and connection. It is seen immediately that the connection time is shorter than the message length, regardless of weather condition. The last line in the table lists the percentage of the message that is listened to (connection time divided by message length with the quotient multiplied by 100). Surprisingly, a larger percentage (68 percent) of the message is listened to during VFR weather than during less favorable conditions (59 and 58 percent, respectively, for MVFR and IFR conditions).

TABLE 32. AVERAGE MESSAGE LENGTH (MINUTES) AND CONNECTION TIME AS A FUNCTION OF WEATHER TYPE

Parameter	Type of Weather VFR	MVFR	IFR	Overall (Weighted)
Message Length	5.34	6.66	7.10	5.64
Connection Time	3.65	3.90	4.13	3.75
Percent of Message Listened to	68	59	58	66

Note: Averages based on a grand total of 51,392 calls.

WEATHER SERVICE OFFICE WORKLOAD.

The WSO workload was another parameter to be assessed during the NYC test. Findings indicate that one person must be available full time to prepare the trial PATWAS recordings. The task becomes a full-time job during MVFR and

IFR weather. During VFR weather, approximately 20 minutes out of every hour are required for the hourly updatings. During MVFR and IFR weather, these updatings are sufficiently extensive when coupled with amendments and other alterations in the material that recording preparation becomes a full-time job.

Table 25 reveals that during the period of observation (April through October 1976), MVFR and IFR weather conditions prevailed 26 percent of the time. This means that the person assigned the PATWAS preparation duty would be available approximately 40 minutes out of every hour for the remaining 74 percent of the time that VFR weather prevailed. It is recognized that this ratio would change during the winter months. Nevertheless, the principle remains.

EQUIPMENT ADEQUACY.

The following equipment items have all functioned adequately, and no further comment is required concerning them:

1. Dedicated, low-speed, request/reply service A teletype line from the Weather Message Switching Center, Kansas City, Missouri, to the WSO at La Guardia.

2. The Hazeltine 2000 keyboard CRT and thermal printer.

3. The voice update/editing recorder units and associated microphone.

The Spotmaster Mini-Series model 305 message composer units developed difficulties in the clutch/drive system that powered selectively the five playback units. Other miscellaneous adjustment requirements became sufficiently troublesome collectively that it became advisable to replace the equipment.

The improved equipment was installed with good results. The primary difficulty with the clutch/drive system was circumvented, since the improved equipment had an independent drive motor and clutch for each of the five cartridges. Moreover, the added presence of a separate failure light calls attention immediately to which one of the five cartridges requires attention on those few occasions that malfunctions occur. After 6 months of experience with the improved equipment, it has also been found that fewer mechanical adjustments were required.

SEASONAL VARIATIONS. Figure 40 shows the expected increase in number of requests served as the number of itinerant departures increases. (Each data point is the average of the 3 years of data prior to activation of trial PATWAS.) The poorer weather months are at the lower left-hand portion of the plot, and the better weather months are at the upper right-hand portion.

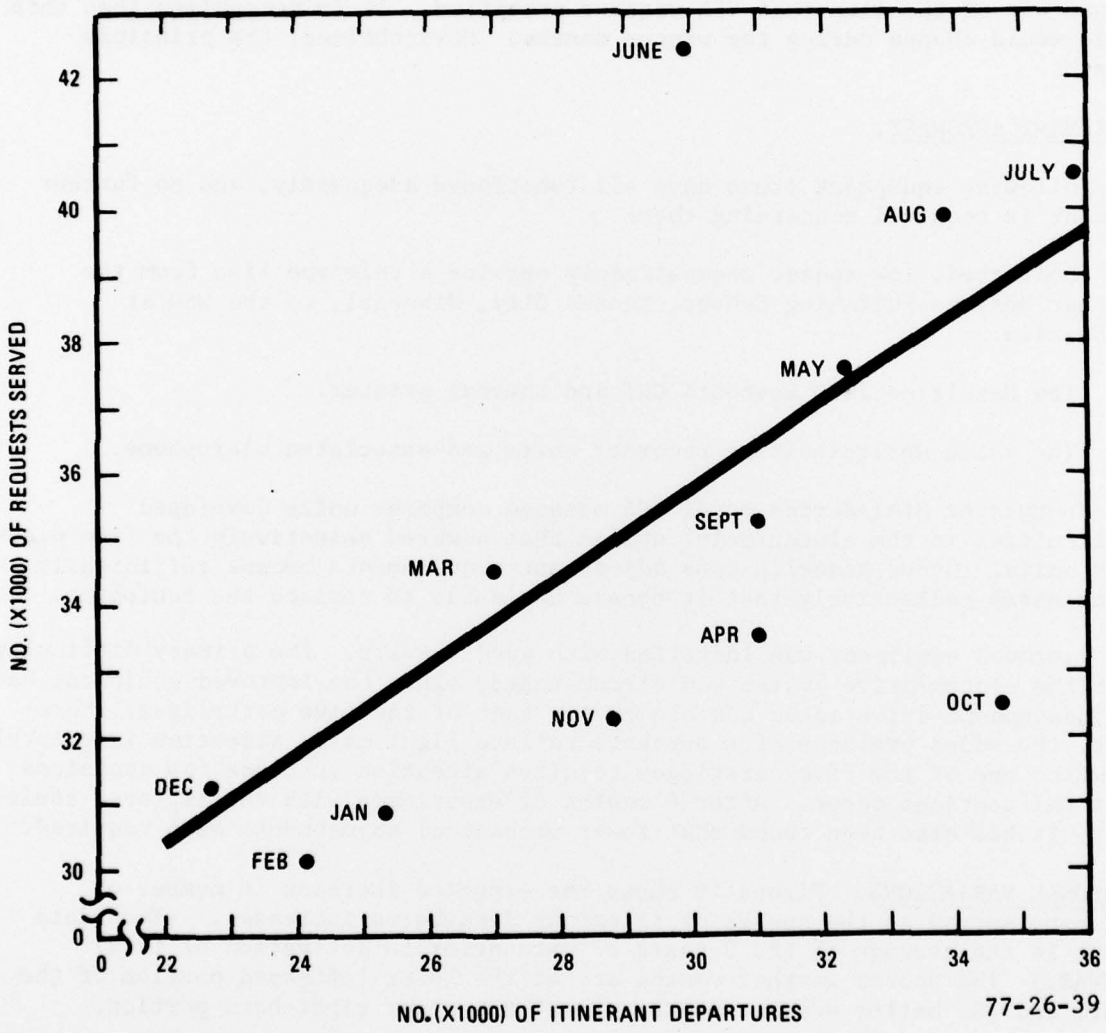


FIGURE 40. POSITIVE EFFECT OF SEASON ON RELATIONSHIP BETWEEN DEPARTURES AND REQUESTS SERVED

COMPARISON OF RESULTS WITH EXPECTATIONS

INITIAL EXPECTATIONS.

The project test plan contained two figures that are relevant to the present discussion. One is test plan figure 3 that presented a possible detailed schedule. The other is test plan figure 4 that presented changes that were expected in various system parameters as a function of schedule events. Those portions of both figures that pertain to the present discussion are shown in figure 41.

The left-hand portion, "A," is labeled "Initial Hypothesis." The schedule events are shown in the lower portion of this segment. Activity alphanumerics are nonsequential and selected to match those employed in the test plan. This facilitates a cross reference to the initial document. The relative magnitudes of the various parameters are shown in the upper left-hand segment. Three values are shown there: calls to the basic PATWAS, curiosity and exploratory calls to the trial PATWAS, and legitimate calls to the trial PATWAS.

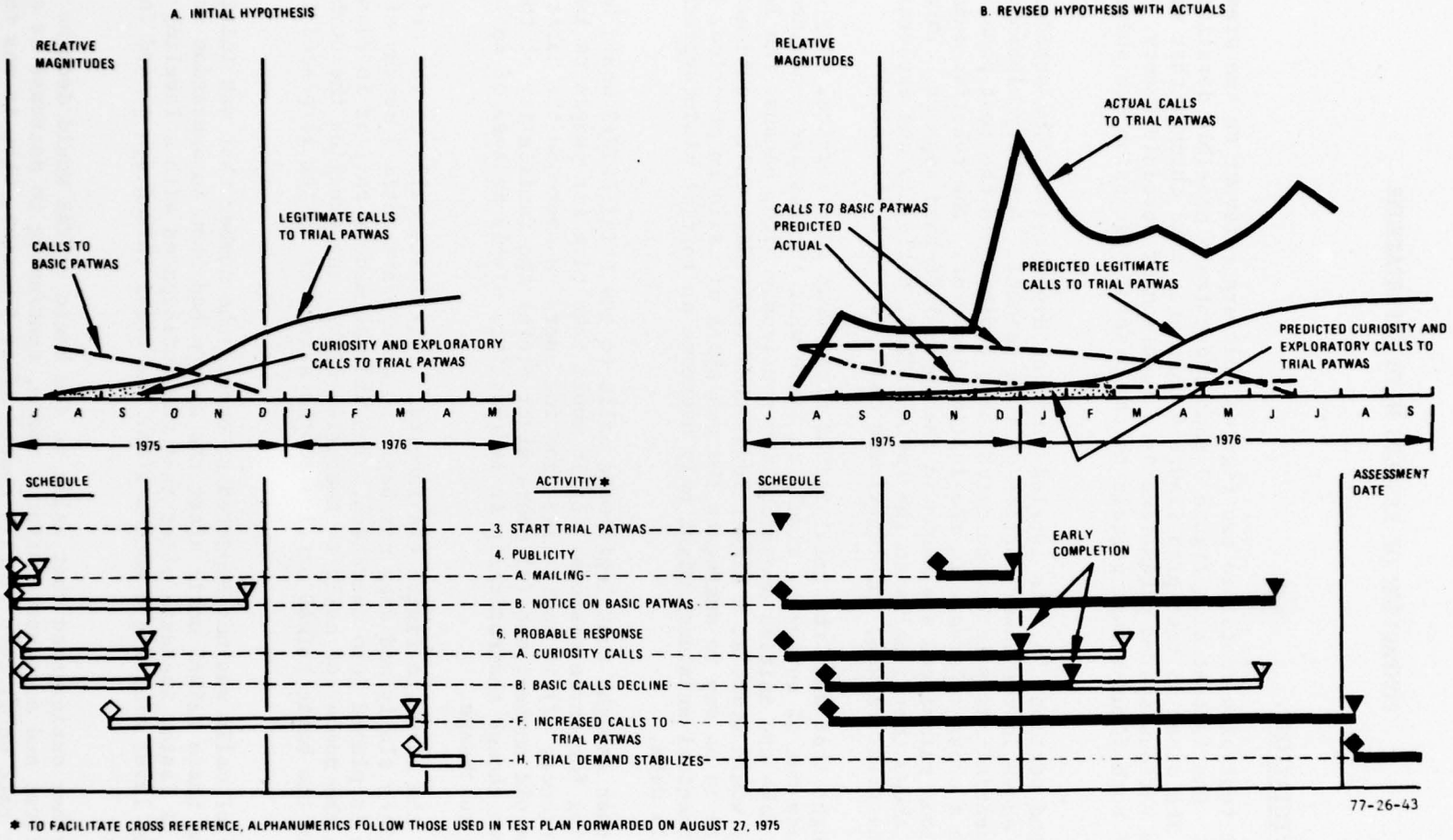
It was thought that when the trial PATWAS first went into service, many calls would be made out of curiosity simply to learn what the message contained. This would make the initial acceptability spuriously high, because the level of activity would start at a higher level than legitimate calls could maintain. There is no way to segregate the two types of calls in practice, but their hypothetical existence might help overcome an initial misinterpretation of the early data.

It was further thought that legitimate calls to the trial PATWAS would be slow in developing for three reasons: (1) It would take time for people to learn of its existence; (2) it would take time for users to overcome the habit of calling the old number; and (3) users might prefer the familiarity of the basic PATWAS, even though theoretically it is inferior, simply because of an inherent resistance to change.

Therefore, the curve in figure 41A labeled, "legitimate calls to the trial PATWAS," rises slowly and does not begin to accelerate until 3 months after the system is placed into operation. The initial modest rate of increase results in the number of calls to the trial PATWAS not equaling the number of calls to the basic PATWAS until 3 months after the system is placed into operation.

The number of calls was not expected to exceed the number that was initially made to the basic PATWAS until after the system had been in operation for 4 months. A faster increase after that was anticipated with a leveling off at a higher level starting 6 months after the trial PATWAS was placed in operation.

It was further anticipated that calls to the basic PATWAS would decline gradually at first and accelerate after 1 month, continuing to decrease at an increasing rate until they finally ceased after 5 months, when it was thought the basic PATWAS message might be terminated in favor of the trial PATWAS.



* TO FACILITATE CROSS REFERENCE, ALPHANUMERICS FOLLOW THOSE USED IN TEST PLAN FORWARDED ON AUGUST 27, 1975

FIGURE 41. HYPOTHESIZED AND ACTUAL PATWAS ACTIVITY LEVELS

It was expected that the publicity mailing to all pilots in the two GADO districts would have a greater effect on the increased use of trial PATWAS than would the announcement on the basic PATWAS message.

REVISED EXPECTATIONS.

The right-hand, "B" portion of figure 41 ("Revised Hypothesis with Actuals") depicts expectations that were altered when a schedule change resulted in an increase in the interval between activation of the trial PATWAS and release of the publicity mailing. Since it was expected that the mailing would have a greater effect on use of trial PATWAS than the announcement on basic PATWAS, the various events listed in the center column labeled "activity" were stretched to cover a greater time span. This revision is shown in the lower right-hand portion of figure 40.

The publicity mailing during the months of November and December is shown occurring later with respect to the activation of the trial PATWAS than was anticipated initially. The other events begin at the same time, but are stretched out longer to account for the presumed delayed effect on the parameters accruing from the later mailing of the flyers. The line labeled "Assessment Date" identifies the point in time at which the acceptability assessment is made. Filled symbols and lines indicate past time. Open symbols and lines indicate future time.

To match this schedule change, the changes in the relative magnitudes of the three hypothesized parameters are also stretched. This has the effect of reducing the slopes of the curves, since changes of the same relative magnitudes are now taking place over longer periods of time. The labels on these three hypothesized curves are the same as in the left side of figure 41, except that the term "predicted" precedes them. This addition was made to distinguish the hypothesized curves from the ones depicting observed data that are also plotted in the right side of figure 41.

Three curves depicting observed data are plotted in figure 41B. The two most important ones are plotted in heavy black lines. The solid black line at the left side is labeled "actual calls to trial PATWAS." This shows that the actual calls made to the trial PATWAS are strikingly higher than anticipated initially.

Even granting that the two systems are not segregated, the total number of calls is over three times greater than expected. This is presumed to be due to the publicity mailing that was made during the months of November andd December and completed just before the year-end holiday season. Thus, it appears that the mailing did indeed have the predicted much greater impact than the recorded announcement. However, the magnitude of the impact was much larger than was expected.

Calls to the basic PATWAS are also seen to be declining at a rate greater than anticipated. This is shown by the lines labeled "calls to basic PATWAS, actual."

The ordinate in figure 41B is labeled "relative magnitude," since initially there was no basis for assigning specific values to it. While this convention is retained, the "actual" curves are drawn to a scale that was selected to accommodate the hypothesized curves.

It appeared from the leveling of the trial PATWAS actuals during the months of October and November that the system was establishing its acceptance 7 months earlier than had been anticipated by the revised schedule and at about the level that had been expected. Confirmation of this tentative conclusion was prevented by the rise in the curve during the month of December. Although the level receded, it seems to have established itself at a new and higher level as shown in the months February through July.

CONCLUSIONS

The following major conclusions have been drawn from the New York City PATWAS experiment:

1. The trial PATWAS produced a substantial decrease in the number and length of FSS person-to-person briefings.

2. Route briefings were very popular with the users, and any national design should incorporate route-oriented PATWAS recordings.

3. The general aviation public expressed satisfaction with all aspects of the trial PATWAS.

4. The trial PATWAS was responsible for disseminating an unprecedented amount of weather information for preflight planning to general aviation pilots in the NYC metropolitan area. The automatic text preparation capability and the Hazeltine 2000 Request/Reply Terminal Subsystem proved to be extremely effective in both performance and manpower savings.

5. Large numbers of users expressed the desire to reach PATWAS through a toll-free telephone number. Requests for toll-free access constituted the most frequent comment received from the respondents to the questionnaire. Seventy-nine percent of the pilots who requested toll-free access to PATWAS resided in the counties outside the toll-free areas. The largest number of requests came from Suffolk County, New York, which is outside the toll-free area.

6. In our opinion, continual improvements to PATWAS will provide better service to the flying public and have a positive effect on flying safety and comfort.

7. The trial PATWAS is superior to the basic PATWAS for flight planning.

8. During non-VFR weather, it was necessary to commit the services of one person full time to the preparation of trial PATWAS recordings.

9. The trial PATWAS information-gathering, recording, and playback equipment worked efficiently.

10. The "barge-in" connection was acceptable to the users (i.e., connection to the message at some point other than the beginning). However, from an operational standpoint, the "barge-in" connection tends to increase the line hold time and therefore is not cost effective. It should be noted that the users have not been exposed to an alternative connection as the basic PATWAS also provides the "barge-in" connection.

11. The speech and recording techniques of the speakers on both the basic and trial PATWAS recordings could be improved.

12. The full potential of PATWAS for disseminating weather information has not been realized as yet.

RECOMMENDATIONS

The following recommendations are divided into two groups: those that can be achieved through operational changes and those that have research and development implications.

OPERATIONAL.

1. Eliminate the basic NYC PATWAS and replace it with the improved trial PATWAS on a permanent basis.

2. Provide an expanded toll-free access for NYC PATWAS to include ISP FSS area.

3. Provide periodic publicity for the improved PATWAS.

4. Make the following changes to the NYC PATWAS message:

   a. Provide local time in addition to Greenwich mean time.
   b. Provide information on cloud tops when feasible.

5. The speaker assigned to record aviation weather briefings on PATWAS should be screened for articulation and pronunciation problems prior to selection. He must be able to speak clearly, distinctly, and in a well modulated manner at a rate between 100 and 120 words per minute. He must be able to control his delivery for articulatory error, loudness, and rate. Deficiencies in any of these areas will adversely influence the quality of the communication. A quality control system should be established to help ensure adequate speech proficiency. Additional training in the preparation of mass-dissemination recordings should be made available to maintain speech proficiency.

RESEARCH AND DEVELOPMENT.

1. To fully exploit the far-reaching potential of PATWAS as an aid to flight planning, a system with the following enlarged capability is needed:

   a. Noninterrupting fast-time updating of weather information.
   b. Multiple message storage.
   c. Accessing message at beginning.
   d. Multiple message availability on any telephone line.
   e. One telephone number access.
   f. Automatic message composition.
   g. Centralized message composition.
   h. User selection of specific message segments.

The existing PATWAS system, utilizing cartridge tapes and magnetic drums, can be improved by changes in message content and format and by furnishing more telephone lines, as evidenced by the NYC PATWAS experiment. These improvements, although important, are nevertheless narrowly limited in scope and thus do not provide any far-reaching benefits for FSS modernization. On the other hand, a national mass-dissemination system based on digital technology has the potential of reaching, in our opinion, more aviation users with better products and at no increase in personnel.

2. Develop a national system design for improving the mass dissemination of aviation weather information.

3. Give the pilot the option of filing a flight plan through PATWAS. This would provide one-call service.

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