Final Evaluation Of Flight Service Automation System Model 2 Design and Modification Test

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16. Abstract

An evaluation of selected Flight Service Automation System (FSAS) Model 2 functions was conducted at the Federal Aviation Administration (FAA) Technical Center. Selected weather and flight data messages were extracted from the FSAS Model 2 specifications (FAA-2684, Volume II, Model 2 Software) and programmed into a system designed to simulate the specifications.

Flight Service Station (FSS) specialists from the field, representing every FAA region, were brought to the Technical Center FSS automation laboratory to evaluate the messages. "Canned" experiments were conducted in two phases; initial evaluation in September 1980 and a modification test in June 1981. The evaluation took place in a laboratory which closely emulated the actual operation of a Model 2 Automated Flight Service Station. Three principle operating positions were established — Preflight, Inflight, and En Route Flight Advisory Service (EFAS) — which used keyboard entry and computer-driven cathode ray tubes to display the Model 2 messages for evaluation.

Statistical analysis of data from both tests determined that the messages were essentially satisfactory. Test results led to a major recommendation to implement the messages according to the specifications but with minor changes. Test results indicated a strong preference for a graphical display of the tabular data in many of the messages which led to a recommendation to develop a system to integrate graphics with the tabular displays (primarily in route type messages). These graphics would be in addition to standard weather graphics used in pilot weather briefings.

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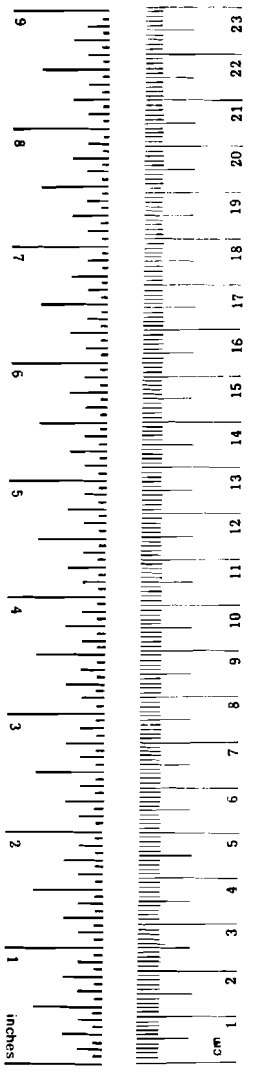
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

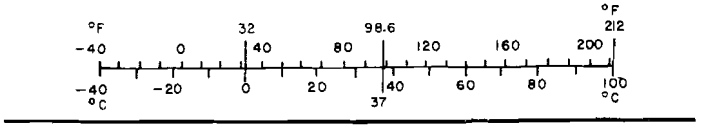
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		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	qwarts	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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EXECUTIVE SUMMARY

This report discusses the results of the modification test of the Flight Service Automation System (FSAS) Model 2 Software, conducted at the Federal Aviation Administration (FAA) Technical Center, Atlantic City, New Jersey, in June and July 1981. The initial test, conducted in September and October 1980, revealed some areas in which improvements to certain message types could be made. These improvements were suggested by the 24 flight service station (FSS) specialists who participated in the testing. The followup modification test was to evaluate the changes made to some of the messages, as recommended by the field specialists. Summaries of the major findings of both tests, as they relate to the messages tested, are provided in a succinct format in tables 7 and 8 (pages 19 and 20).

Before implementation of a National FSS Automation Program, the FAA Systems Research and Development Service (SRDS) wanted an early indication of the operational effectiveness of certain functions of the proposed Model 2 system. To this end, certain weather and flight data messages were selected from the design specifications (FAA-E-2684, Vol. II, Model 2 Software) and programmed into an operating system conforming as close as possible to the specifications. Testing was performed in the Flight Service Station Engineering and Development laboratory set up to emulate an automated Model 2 FSS. Results from the initial test, including comments and recommendations from the field specialists, are contained in a separate informal report. These results became the basis for modifying some of the messages for retesting. The same specialists returned for the modification test, conducted under identical conditions, and the results are contained in this report. Following is a summary of the major findings from both evaluations.

The majority of reponses recorded on the questionnaires and during interviews with the specialists were favorable, with the rate of concurrence high among the three levels of flight service. A major problem, as revealed in the first evaluation, centered around messages whose format included a mask. (A mask is a visual image of a preprogrammed form designed to receive flight data information from the specialist which is provided by the pilot. Separate masks are used to file and amend flight plans; for direction finding purposes, filing pilot reports, and for logging information received from an aircraft contact. Illustrations of masks can be found in appendix E.) Many specialists disliked having to select from several different masks during an air-to-ground contact. This was necessary when flight plan filing and pilot report (PIREP) filing were involved with a briefing. Problems arose when more than one aircraft called at the same time and the specialist found it very awkward switching masks while trying to record intervening contacts. Based on the specialists recommendations, a "universal mask" was developed for retesting which combined several functions including position reporting, PIREP filing, flight monitoring, message routing and flight plan activation and cancellation. The universal mask was rated satisfactory overall but opinions were still varied as to what fields or functions should be included in the mask.

During the initial evaluation, specialists were reluctant to do away completely with paper and pencil, especially at the Inflight position. During the modification test, this tendency to write information down markedly decreased as noted by personnel monitoring the test.

Many of the specialists felt that some of the detailed route weather messages contained excessive information, such as long Flight Data Center (FDC), Notices to Airmen (NOTAM's) and Military Training Route (MTR) activity outside their geographic area of familiarity. For the modification test, lengthy FDC NOTAM's could be accessed separately, and MTR activity was abridged somewhat. These changes were rated favorably by the specialists.

In the initial test, all specialists felt that the first entry should be the aircraft identification and not the message type. They also felt that the aircraft identification should be continuously displayed on the Cathode Ray Tube (CRT) throughout a transaction, and basic information relative to a flight, such as the altitude, aircraft type, etc., should be continuously displayed until the contact is terminated. This suggestion was incorporated into the second test and proved to be one of the most successful modifications recommended.

All specialists preferred over-and-under CRT displays versus side-by-side.

All specialists thought the development of a graphic display associated with the Direction-Finder (MDF) message, and tested during the modification test, was a very useful tool in working an aircraft orientation problem.

A strong preference was evident for a flight plan mask in the same format as that presently in use. A different format was tried in the modification test and met with an unfavorable evaluation. (See appendix E).

A strong preference for a graphic display of much of the tabular data was reported by the specialists, especially in route type messages. PIREP summaries, radar reports, and MTR activity were the types of data mentioned most frequently in suggestions for incorporation into graphic displays to improve comprehension of the weather situation associated with a particular route of flight.

The limitation of the operating system, which precluded full dynamic testing of some messages, accounted for some of the specialists' comments regarding needed changes or additions to some messages.

The messages constructed according to the design specifications and tested in the initial evaluation were found to be satisfactory overall for operational use. The messages modified according to the specialists suggestions, and retested in the modification test, were also found to be satisfactory overall for operational use.

Since the messages were determined to be essentially satisfactory, it is recommended to proceed with implementation of the system including adoption of the messages according to specification, but consider modifying the messages where minor problems have been identified using the recommendations in the message analysis section. These modifications could be incorporated into the system well before full operational implementation is realized.

It is also recommended to pursue the further development of graphics to enhance the effectiveness and efficiency of the whole system by integrating the graphics with more of the various messages; specifically, to develop graphics, such as those tested in the Graphic Route Display (FRT) message and to develop displays of PIREP summaries and other weather phenomena using symbols adaptable to and integrated with graphic route displays of proposed flights. This could be an important aid to the specialists' comprehension of the weather situation as it relates to a planned flight, since it seems evident that briefing distances will become longer with implementation and consolidation of the automated facilities.

INTRODUCTION

PURPOSE.

The purpose of this report is to document the results of the modification test of the Flight Service Automation System (FSAS) Software. The test was conducted to allow several Flight Service Station (FSS) specialists from the field evaluate changes to selected weather messages and flight data messages as contained in the FSAS Specifications, Vol. II, Model 2 Software, FAA-E-2684. These changes to the messages were based on the results of the initial test of the specifications conducted in the fall of 1980.

BACKGROUND.

The Federal Aviation Administration (FAA) is in the process of developing and implementing a National Flight Service Station Automation Program designed to meet the increasing demand for services to the general aviation community while holding down cost. To satisfy these requirements, hardware and software specifications have been developed for a proposed system to be implemented in stages termed Model 1, Model 2, and Model 3. To procure an early indication of the effectiveness of the system, a test of selected Model 2 functions was conducted in September of 1980. Flight Service Station (FSS) specialists were brought to the FAA Technical Center, Atlantic City, New Jersey, and participated in an evaluation of selected weather and flight data messages in a simulated operational environment. As realistic a simulation as possible was performed on the Preflight, Inflight, and En Route Flight Advisory Service (EFAS) positions. The specialists could perform weather briefings and flight data processing functions. All message processing was simulated, and all requests for briefings and flight plan filing followed predetermined scripts. Based on recommendations and ideas submitted by the specialists after test completion, some of the messages were modified and reevaluated in a modification test in June and July 1981. The conditions of the initial test were duplicated as closely as possible, and the same specialists who participated in the first evaluation were brought back for the modification test, with the exception of two who were unable to return.

The primary emphasis of this report is on the modification test, but results and analysis are compared with the initial test as well. The summary and recommendations reflect the entire project effort.

EQUIPMENT DESCRIPTION.

The simulation was conducted on the same system as the initial evaluation, built around an Interdata 8/32 computer with 512 megabytes of RAM (figure 1). Major peripherals included a 256M byte disc, magnetic tape, line printers, and a number of terminals for time sharing. The computer drives up to three Genisco graphic generators. Each generator controls two black and white standard resolution displays, and interacts with a keyboard (figure 2). Each position, Inflight, Preflight, and EFAS, had a single keyboard and two Cathode Ray Tube (CRT) displays, one for tabular data, the other for weather graphics (figure 3). The operator had the option of displaying weather graphics on both screens, whereas tabular data were limited to one screen. Several graphics products could be overlayed on either screen.

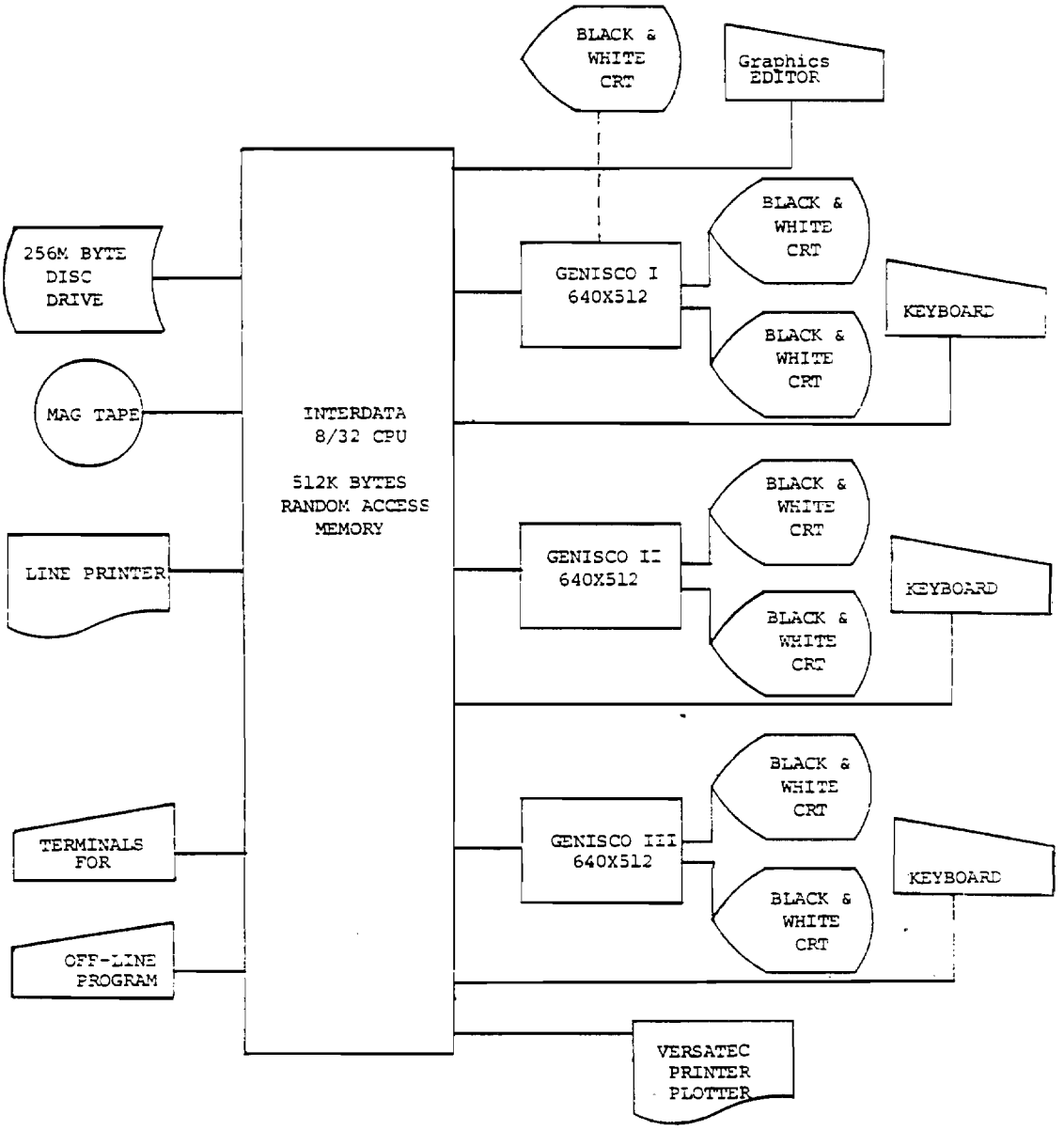
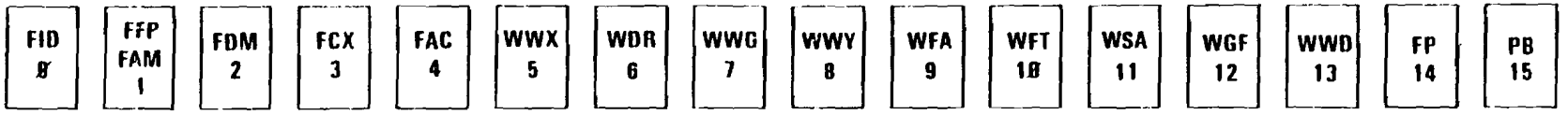


FIGURE 1. SYSTEM OVERVIEW



FUNCTION SWITCH ARRAY (DETAIL)

LEGEND
- 0 Aircraft Ident
- 1 Flight Plan and Amend FP
- 2 Departure Message
- 3 Cancel Flight Plan
- 4 Aircraft Contact
- 5 Multiple Weather Message
- 6 Radar
- 7 Graphics
- 8 PIREP entry
- 9 Area Forecast
- 10 Terminal Forecast
- 11 Surface Observations
- 12 Winds Aloft
- 13 Detailed Weather
- 14 Forward Page
- 15 Back Page

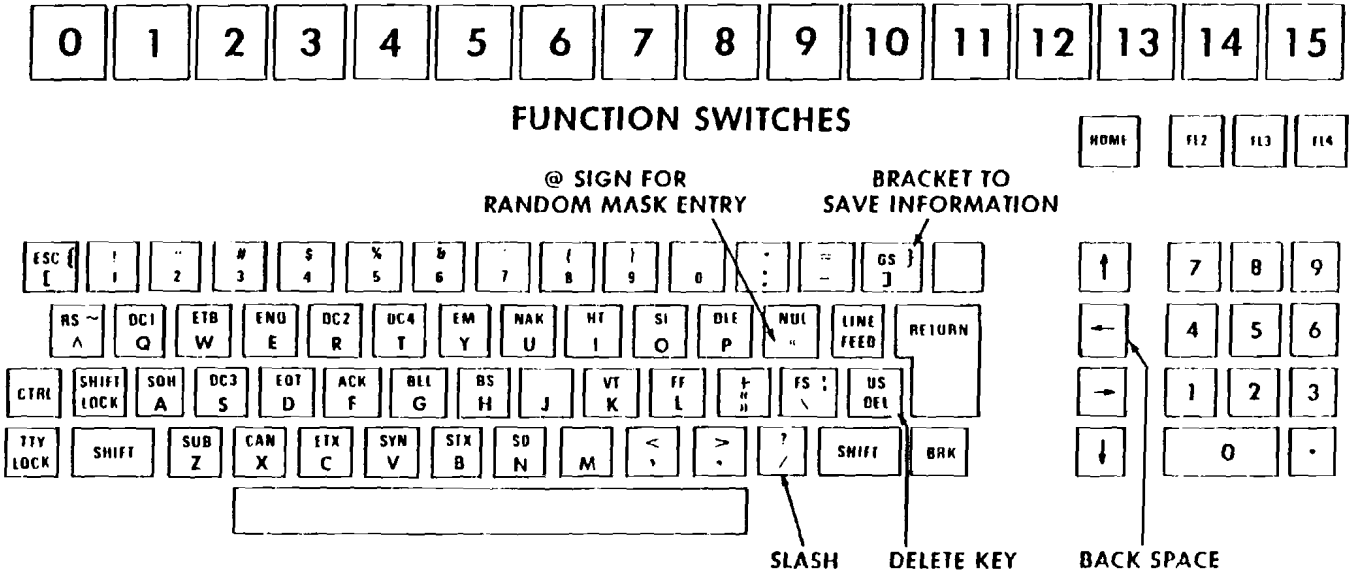


FIGURE 2. GENISCO KEYBOARD

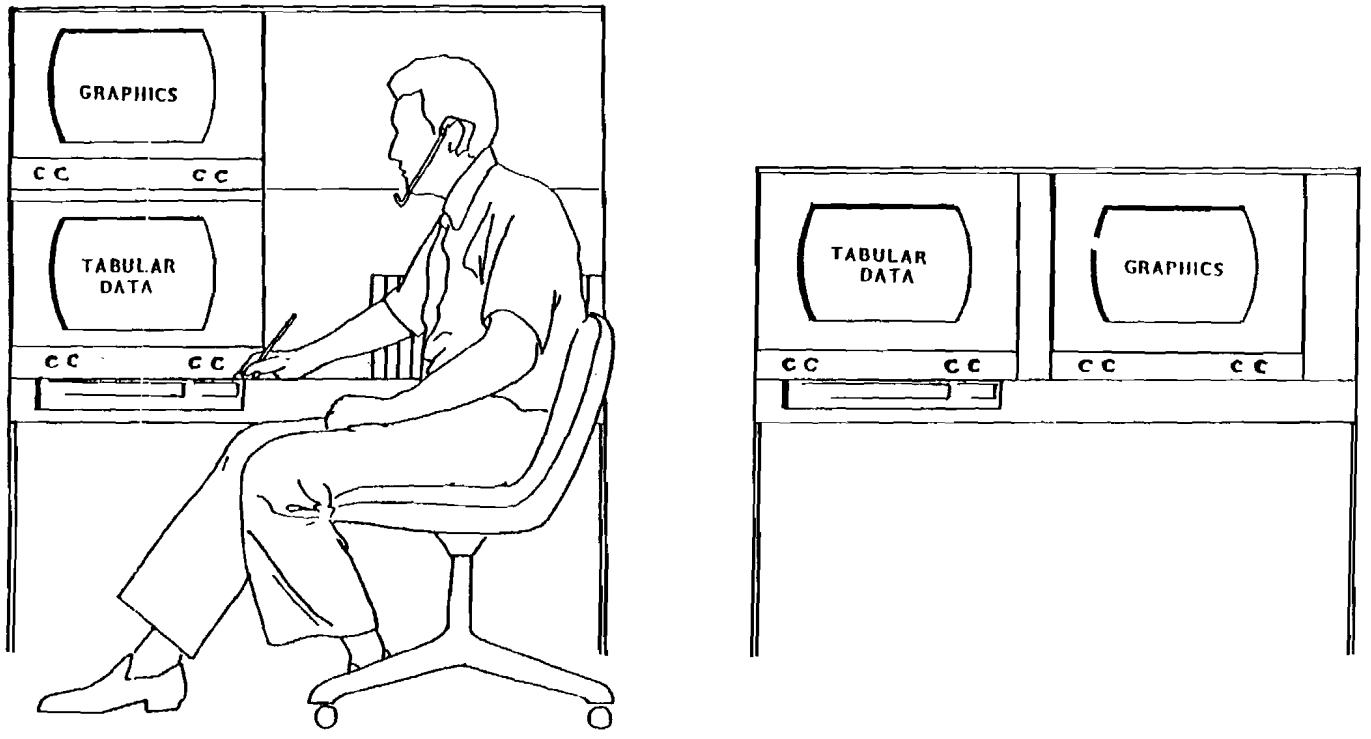


FIGURE 3. SPECIALISTS OPERATING POSITIONS

POSITION DESCRIPTIONS.

Each operating position contained two CRT displays, a keyboard, and a phone with headset. EFAS and Inflight position phones were specially modified to simulate air-to-ground operation. Simulator pilots, located in an adjacent room, generated requests for information following the format of specially prepared scenarios.

During Preflight testing, a pilot would call and request information on local weather or en route weather relative to a proposed flight. The specialist used keyboard input to request information prestored in the data base. The "pilot" might request to file or amend a flight plan, depending on the scenario.

At Inflight, communication equipment was modified to simulate radio operation, and prepared scripts were used to request en route weather briefings; updates on weather; filing, amending, canceling, and activating flight plans; changes in route of flight and corresponding weather requirements; position reporting; Pilot Weather Report (PIREP) handling; and emergency assistance service. Modified Direction Finding (DF) procedures and display were evaluated at this position.

EFAS pilot/specialist transactions were similar to Inflight, using prepared scripts and simulated radio equipment. The EFAS specialist was engaged in providing near real-time weather information to airborne pilots; i.e., PIREP dissemination and entry, and updating other weather information.

MODIFICATION TEST AND EVALUATION

SELECTION OF TEST SUBJECTS AND TEST FORMAT.

Test subjects were full performance level Flight Service Station (FSS) specialists from field facilities. The same specialists who participated in the initial evaluation returned to the Technical Center for this evaluation. Only two were unable to return. Every FAA region including Alaska and Pacific was represented, with a good cross section from the three levels of flight service. Completely manual operations were represented, as well as semiautomated and automated facilities including Aviation Weather and Notices to Airmen Systems (Atlanta, Indianapolis and Macon, GA) and a Meteorological and Aeronautical Presentation Subsystem facility (Leesburg).

A written test guide was presented to each specialist upon arrival. It contained a description of the changes made since the previous evaluation, and directions for keyboard use. One-half day was devoted to hands-on training, and 1 1/2 days for actual evaluation of message content on position. Each specialist completed the evaluation by filling out a questionnaire.

The same weather situation used in the initial evaluation was utilized for the modification test. The main data base was based on 4 consecutive hours of weather and Notices to Airmen (NOTAM) information from Service A. Digitized weather radar was available for use, automatically programmed to update over the 4-hour period. Standard weather graphics were prepared by copying the information from facsimile

charts corresponding to the other weather data. These charts were entered into the system utilizing the graphics editing tablet. The number of graphics overlays possible was unlimited, but specialists were advised to limit overlays to three products as called for by the specifications.

The major limitation of the test system, which was lack of flexibility in requesting certain weather or flight data information, was due to programming constraints which limited full dynamic testing of all situations. Therefore, it became necessary to select portions of the weather data that was collected and incorporate it into specially prepared scenarios. As long as the scenario was used, requested information was available. For example, a request for a full route briefing would contain complete information and be displayed as a route corridor as required by the specifications for a route corridor. If a specialist requested information outside the route corridor other than what had been built around the scenario, no data were available. To help overcome this limitation, weather for all stations within a 300-mile radius of the point of departure (usually Atlantic City) was programmed for retrieval on a random access basis. A specialist could request surface reports, terminal forecasts, winds aloft, pilot reports, and NOTAM's singly or in combination. All other data beyond 300 miles were usually confined to that information contained in route corridors, and limited to canned data. This limitation was taken into consideration during test preparation, and the full range of scenarios used were constructed with enough variety to exercise many different situations. By the time testing was completed, it was hoped the specialists had exercised enough message types involving various scenarios to have given them a good "feel" for the Model 2 messages tested.

The test ran at a saturation level to emulate a busy FSS. As with the first evaluation, the specialist would respond to requests from the simulation pilots. The specialist entered a message type by hitting the function key for Aircraft Ident (AI), entering this data along with additional information such as location, altitude, etc. If the wrong entry format was used, an error message would appear and the specialist re-entered the corrected data.

Depending on the script, the pilot asked for more information or filed a flight plan. The most important messages could be entered by function key; all could be typed in.

Some changes were made to the function key array, along with changes to the method of extracting weather and flight data information. With the exception of the PIREP entry mask, all mask displays were altered in response to the specialists comments from the initial test. (A mask is a visual image of a preprogrammed form designed to receive flight data information from the specialist which is provided by the pilot. Separate masks are used to file flight plans and amend flight plans, for direction finding purposes, filing pilot reports, and for logging information received from an aircraft contact. Illustrations of masks can be found in appendix E.)

New graphics products were added, almost doubling that which was available in initial testing. Increased versatility resulted from a major change to the multiple weather (WWX) message, wherein different types and combinations of weather data could be called up.

The messages were divided into three major categories:

(1) Flight Data Messages

(2) Weather Information, including

(a) Tabular weather
(b) Graphics products
(c) Digitized weather radar

(3) Direction Finding Message (MDF)

The messages were:

(1) FLIGHT DATA	(2) WEATHER	(3) DIRECTION FINDING MESSAGE
*FFP (Flight Plan)	*WWY (PIREP Entry)	
*FAC (Aircraft Contact)	*WSA (Surface Observation)	
*FCX (Cancellation)	*WWD (Detailed Weather)	
FAM (Amend Flight Plan)	*WFA (Area Forecast)	
FDM (Departure)	*WFT (Terminal Forecast)	
FSU (Special Use Areas/ Routes)	*WGF (Grid Winds)	
	*WSM (Weather Summary)	
FED (Encode/Decode)	WWX (Multiple Weather)	
FRR (Preferred Route)	WUA (Pirep Request)	
FCF (Air Traffic Systems Command Center)	WNO (NOTAM Request)	
FRT (Graphic Route Display)	WWL (Local Weather)	
	WFX (Prognostic Map Discussion)	
	WWT (Weather Trend)	
	WWS (Sigmets)	
	WWA (Airmets)	
	WSD (Radar Summary)	
	WAL (Alternate Weather)	
	*WWG (Graphics)	
	*WDR (Radar)	

*Denotes function key assigned.
Two new messages are underlined.

In addition to the above, an AI function key was assigned to initially enter the aircraft identification at the start of a contact.

A major change in the operation of the system was the introduction of field displays at the top of the screen. This was termed the BASIC DATA BLOCK, and consisted of the following:

AI

FR RT

AE TM TS TP ZS

The field identifiers are:

AI Aircraft Identification

FR Type Flight Rules

RT Route of Flight (Departure point/Destination can be entered alone)

AE Requested Altitude

TM Proposed Departure Time

TS True Airspeed or Mach Number

TP Aircraft Type

ZS Zone Size (To select route width or circular zone size)

The Basic Data Block was entered once and remained on the screen for continuous reference until the pilot contact was terminated. The block was designed to contain data necessary to provide background information to conduct a satisfactory briefing. It also satisfied the requirement for entry of most information needed to process the vast majority of weather and flight data messages, especially route requested data. The aircraft identification is mandatory and is always entered first. The remaining fields are optional, and are entered depending on the briefing requirements. An altitude or aircraft type, for example, may not be necessary while the route of flight would be required for any type of route informaton. The specialist then selects the weather using function keys or typed entry, and the weather is displayed under the data block. Regardless of how many separate requests for data are made, the data block remains at the top for reference, but the individual fields can be changed at any time using the random access feature.

Two lines at the bottom of the screen were reserved for a preview area to check accuracy before entering data into the Basic Data Block, or before entering weather or flight data requests. Data block fields can be entered at the beginning of the transaction by filling in a single field (previewed at the bottom) and hitting the entry key. The data enters the proper space and the next field is automatically ready for entry. A faster way to enter data is by typing all fields, separating them with a slash (field delimiter), and finally hitting the entry key once. A

double slash will leave any field blank. A third method is using the random access key for every field. Again, the fields can be entered singly, or several at once (lined up randomly) with a single, final strike of the entry key. Finally, a combination of random entry mixed with slashes can be used for the most versatile method of entering data.

During a transaction, the flight plan mask or any other mask could be displayed. This would wipe out any weather data that was displayed (or another mask). The Basic Data Block and its information was retained, and, in the case of a flight plan, only the fields needed to complete the remainder of the flight plan appeared under the data block. The method of entering data into the masks was the same as entering data into the data block, and the specialist could skip back and forth between them. The Aircraft Contact (FAC) and Direction Finding (MDF) mask worked on the same principle.

The current field identifier on the mask was easily noted, since it was the brightest on the screen. Out-of-sequence entry could be accomplished by the random entry feature.

Use of the random access involved typing the @ sign, followed by the appropriate field identifier, and the information for that field.

The major problems with the Model 2 capabilities evaluated in the initial test centered on two areas: (1) messages whose formats included a mask and (2) lack of retention of aircraft ident and basic information necessary for briefing.

The messages whose formats included a mask are:

FFP (Flight Plan)	MDF (Direction Finding)
WWY (PIREP try)	FAC (Aircraft Contact)

The problem involved having to use too many separate masks during a single transaction, especially air to ground contacts. An attempt was made to construct a more or less universal mask out of the Aircraft Contact message by combining several functions. The new FAC message had provision for progress reports, special flight monitoring, PIREP filing, flight plan activation and cancellation, and automatic routing features for certain data.

The multiple weather request, a well-liked feature based on the initial evaluation, was made more flexible so that a greater number of weather messages could be requested simultaneously.

The Encode/Decode was improved so that it could be used while the specialist was completing mask information or briefing from tabular data, and not lose this information when encode/decode data was displayed.

Specific information regarding changes to the system, and specific message are included in appendix D in outline format.

DATA COLLECTION — SUBJECTIVE MEASURES.

The following method and technique was used to obtain subjective data from the FSS specialists participating in the evaluation. Questionnaires were designed to elicit the specialists' comments concerning the Inflight, Preflight, and EFAS positions; weather messages, graphics, and flight data messages were also evaluated with space provided for additional comments. The specialists were asked to evaluate the options available in each message, the format of data on the CRT, the sequence of data as it appeared, data content, and mask displays, where applicable. They were given a choice of adequate/not adequate, satisfactory/unsatisfactory, or sufficient/insufficient in rating each aspect. Sample questionnaires can be found in appendix D. The questionnaires were administered at the end of the 3-day training and evaluation period. Each specialist was given ample time to answer all questions and make comments.

The procedures used for obtaining subjective data from each of the subject specialists were standardized. These procedures are described below.

1. The subject specialists were briefed on the purpose and objectives of the evaluation, and the flight service tasks each would be asked to accomplish. The briefing was accomplished with the aid of a "test guide," (appendix C) which provided instructions on data retrieval. Any questions that arose were clarified for the specialists. The point stressed at this time was that the test was not designed to evaluate the subjects' briefing ability, but rather the idea was to allow specialists to reevaluate some Model 2 functional capabilities.

2. The specialists were given the opportunity to become familiar with the lab area, the sim "pilots" who would call requesting information, personnel monitoring the test, and finally, the three positions with keyboard and CRT configuration.

3. The subject specialists had the opportunity to evaluate each of the three positions, Preflight, Inflight, and EFAS, during the next 2 days of the evaluation. Direction-finding procedures were also evaluated.

4. Questionnaires were administered to the specialists at the completion of the test. Ample time was allowed for the subject to thoroughly evaluate the aspects of the Model 2 capabilities provided during the test.

DATA ANALYSIS.

The specialists' responses to each of the questions were, where possible, quantified and presented in a table which shows N = number of responses in a category, and percent of specialists making that response. A nonparametric binomial test of probability with Yates correction for continuity was used to statistically categorize data. (Yates correction is used when a small sample size is used.) Our test results consisted of classes of response; i.e., Adequate/Inadequate, Yes/No, etc. For such cases, all of the observations fall into either one or the other of the classifications. For any comparison of two classes, the proportion of cases in one class is P, and the proportion in the other is 1-P, or Q. The formula used was:

$$Z = \frac{X \pm .5 - NP}{\sqrt{NPQ}}$$

The significance of an obtained Z may be determined by reference to an appropriate statistical table. Calculated Z values and the probability associated with that score (Zp) were found for each level, and for all levels combined. Since we do not predict the direction of responses favorable or unfavorable, a two-tailed test is used. If the value of (Zp) is less than .05, the significance of the result goes beyond the likelihood of chance, and is, therefore, noteworthy. Likewise, a (Zp) greater than .05 indicates the difference in the distribution of response can be attributed to chance variation or, in other words, there is no significantly different number of favorable responses versus unfavorable.

RESULTS AND INTERPRETATION.

To evaluate the significance of the responses on the questionnaire, a binomial test with Yates correction for continuity was used. The Z scores were calculated for each weather and flight data message evaluated, for each level separately, and for all levels combined. Responses to the Inflight, Preflight, and EFAS questions were also subjected to the same statistical test. Results for the questionnaire data are shown in tables 1 through 4. Tables 5 and 6 show the results of the questionnaire dealing with the overall capabilities and improvements made since the last evaluation in September and October 1980. These are broken down into the three levels of flight service, and combined. Number of responses in each category, and the percentage of scores that number represents is tabulated.

In table 1 through 6, a plus (+) in the column entitled "sig." indicates that the result is significant; a minus (-) in the column means no significance is shown at the $\alpha = 0.05$ level.

In table 1, results are given to the questions dealing with the three positions, Inflight, Preflight and EFAS. The sample size for level 1 is N=5. In order to achieve signficance, all five responses must be in one category. For level 2, N=6 and again, all responses must be in one category for significance. For level 3, with a sample size of N=11, at least ten responses are needed for statistical significance. It can be seen from table 1 that a significant number of specialists for every level of flight service felt that the message types available were sufficient for briefing with the exception of level 3 at the Inflight position. Two responses may be a chance finding, hence not significant. However, with all levels combined, the findings indicate that the specialists were, for the most part, satisfied, and this represents a significant finding.

Tables 2 and 3 show the results of the weather and flight data evaluation, except those messages with masks. These are shown in table 4. The same distribution of responses is necessary to achieve significance. That is, for level 1 and level 2, all responses must be in the same category, and for level 3, 10 must be in one category. With all levels combined, as shown in table 4, at least 17 responses are needed to achieve significance. It can be seen that all specialists felt that the message content, sequence, options, and format was acceptable for their briefing purposes. However, when the three levels are broken down (table 2), factors emerge that makes it necessary to look at the specialists' comments for an explanation. For example, the pilot report request shows, in the column entitled "OPTIONS," that one specialist from a level 1 facility felt that an insufficient number of options were available for this message.

TABLE 1. RESULTS OF SPECIALIST EVALUATION QUESTIONNAIRE

1. Do you feel that the type of messages available to you, and the information contained in them, was complete enough to allow you to satisfactorily perform your duties at the INFLIGHT position?

	Sufficient		Not Sufficient		Sig.
	N	%	N	%	
Level 1	5	100	-	-	+
2	6	100	-	-	+
3	9	82	2	18	-
ALL	20	91	2	9	+

2. At the PREFLIGHT position?

Level 1	5	100	-	-	+
2	6	100	-	-	+
3	10	91	1	9	+
ALL	21	95	1	5	+

3. At the EFAS position?

Level 1	5	100	-	-	+
2	6	100	-	-	+
3	10	91	1	9	+
ALL	21	95	1	5	+

Note: + Sig. at 0.05 level
- No. Sig.

TABLE 2. RESULTS OF SPECIALIST EVALUATION QUESTIONNAIRE — ALL LEVELS

Weather Messages		Sequence					Format					Options					Contents				
		Ade		N.Ade		Sig	Sat		Unsat		Sig	Suff		N.Suff		Sig	Ade		Not Ade		Sig
		N	%	N	%		N	%	N	%		N	%	N	%		N	%	N	%	
Weather Summary	1	5	100	-		+	5	100	-		+	5	100	-		+	5	100	-		+
	2	6	100	-		+	6	100	-		+	6	100	-		+	6	100	-		+
	3	11	100	-		+	11	100	-		+	11	100	-		+	11	100	-		+
Pilot Rep. Req.	1	5	100	-		+	5	100	-		+	4	80	1	20	-	5	100	-		-
	2	6	100	-		+	6	100	-		+	6	100	-		+	6	100	-		+
	3	11	100	-		+	11	100	-		+	11	100	-		+	11	100	-		+
NOTAMS	1	5	100	-		+	5	100	-		+	5	100	-		+	5	100	-		+
	2	6	100	-		+	6	100	-		+	6	100	-		+	6	100	-		+
	3	11	100	-		+	11	100	-		+	11	100	-		+	11	100	-		+
Detailed Weather	1	4	80	1	20	-	5	100	-		+	5	100	-		+	5	100	-		-
	2	6	100	-		+	6	100	-		+	6	100	-		+	6	100	-		+
	3	11	100	-		+	11	100	-		+	11	100	-		+	11	100	-		+
Alter-nate Wx Min.	1	4	80	1	20	-	4	80	1	20	-	4	80	1	20	-	4	80	1	20	-
	2	6	100	-		+	6	100	-		+	6	100	-		+	6	100	-		+
	3	11	100	-		+	11	100	-		+	11	100	-		+	11	100	-		+
Grid Winds Forecast	1	5	100	-		+	4	80	1	20	-	5	100	-		+	5	100	-		+
	2	6	100	-		+	5	83	1	17	-	5	83	1	17	-	6	100	-		+
	3	11	100	-		+	10	91	1	9	+	11	100	-		+	11	100	-		+
*ATC Sys Com. Center	1	5	100	-		+	5	100	-		+	5	100	-		+	5	100	-		+
	2	5	100	-		+	5	100	-		+	5	100	-		+	5	100	-		+
	3	9	100	-		+	9	100	-		+	9	100	-		+	9	100	-		+
Spec.Use Areas/ Routes	1	5	100	-		+	5	100	-		+	5	100	-		+	5	100	-		+
	2	6	100	-		+	6	100	-		+	6	100	-		+	6	100	-		+
	3	11	100	-		+	11	100	-		+	11	100	-		+	11	100	-		+
Graphic Route Display	1	5	100	-		+	5	100	-		+	5	100	-		+	5	100	-		+
	2	5	100	-		-	5	100	-		+	5	100	-		+	5	100	-		+
	3	10	91	1	9	+	11	100	-		+	11	100	-		+	10	91	1	9	-
Weather Trend	1	5	100	-		+	5	100	-		+	5	100	-		+	5	100	-		+
	2	6	100	-		+	6	100	-		+	6	100	-		+	6	100	-		+
	3	11	100	-		+	11	100	-		+	11	100	-		+	11	100	-		+
Local Weather	1	5	100	-		+	5	100	-		+	5	100	-		+	5	100	-		+
	2	6	100	-		+	6	100	-		+	6	100	-		+	6	100	-		+
	3	10	91	1	9	+	10	91	1	9	+	10	91	1	9	+	10	91	1	9	-

Note: + Sig. at 0.05 level
- No Sig.
* Not all specialists evaluated this.

TABLE 3. RESULTS OF SPECIALIST EVALUATION QUESTIONNAIRE — ALL LEVELS COMBINED

Weather Mess	Seq.					Format					Options					Content				
	Ade		N.Ade		Sig	Sat.		UnSat		Sig	Suff		N.Suff		Sig	Ade		N.Ade		Sig
	N	%	N	%		N	%	N	%		N	%	N	%		N	%	N	%	
Weather Summary	22	100	-		+	22	100	-		+	22	100	-		+	22	100	-		+
Pilot Rep. Req.	22	100	-		+	22	100	-		+	21	95	1	5	+	22	100	-		+
NOTAMS	22	100	-		+	22	100	-		+	21	100	-		+	22	100	-		+
Detailed Weather	21	95	1	5	+	22	100	-		+	22	100	-		+	22	100	-		+
Alternate Wx Min.	21	95	1	5	+	21	95	1	5	+	21	95	1	5	+	21	95	1	5	+
Grid Winds	22	100	-		+	19	86	3	14	+	21	95	1	5	+	22	100	-		+
*ATC Sep. Com. Center	19	100	-		+	19	100	-		+	19	100	-		+	19	100	-		+
Spec. Use Areas/Routes	22	100	-		+	22	100	-		+	22	100	-		+	22	100	-		+
Graphic Route Display	21	95	1	5	+	22	100	-		+	22	100	-		+	21	95	1	5	+
Weather Trend	22	100	-		+	22	100	-		+	22	100	-		+	22	100	-		+
Local Weather	21	95	1	5	+	21	95	1	5	+	21	95	1	5	+	21	95	1	5	+

Note: + Sig at 0.05 level
- No Sig.
* All spec. did not evaluate this

Again, regarding the detailed weather message, a level 1 specialist found the sequence of information unsatisfactory. The specialists were encouraged to make comments about each message, especially when they found an aspect unsatisfactory for some reason. All of the comments are summarized and presented in the next section. The specialists' comments are perhaps the most valuable part of the evaluation, not only for the explanation they offer for questionnaire responses, but for the suggestions they provide for improvements to the system.

Table 4 shows the messages whose format included a mask. Results of all levels, separately and combined are shown. During the last evaluation, the masks proved to be a major target area requiring improvement. Although many improvements are made, and commented on by the specialists, there still seemed to be some disparity in the results. Again, a review of specialists' comments points to specific areas where difficulty was encountered.

Tables 5 and 6 summarize the remaining questionnaire results; those that deal with the system as a whole or with certain screen configurations. The sample size for each level is shown, and percentage of responses in each category given. On the first question, regarding weather graphics, most of the specialists felt that they were very useful as a briefing aid. No specialist felt that they were not useful.

Regarding the screen configuration, opinion was unanimous for the over/under setup.

The Basic Data Block was considered useful by specialists, but improvements were suggested. Some still feel that the method of data entry will not serve a busy station.

Seventy-seven percent of the specialists rated the model 2 capabilities they evaluated as "very good." Twenty-three percent felt that the capabilities were "average," and no specialists found that they were unable to brief effectively.

Opinion was almost equally divided on the ease of answering pilot queries. Fifty-nine percent of the specialists said that the modified system was much easier to use based on improvements made since the initial evaluation, and forty-one percent said there was not much difference. None of the specialists said they were unable to retrieve data in a timely fashion.

When asked to comment on the method of inputing data/weather requests, the majority (64 percent) felt that it as much easier, and 32 percent felt that the system was about the same. One specialist, representing a level 3 facility, felt that the present method was not convenient at all.

Finally, regarding the formats available for the Winds Aloft Message, the majority of the specialists stated a preference for the format represented by medium level winds. A noteworthy number (18 percent) liked neither format.

TABLE 4. RESULTS OF SPECIALIST EVALUATION QUESTIONNAIRE — ALL LEVELS AND ALL LEVELS COMBINED (MESSAGES WITH MASKS)

Message	Type	Sequence					Format					Options					Content					Masks				
		Ade		N.Ade		Sig	Sat		Unsat		Sig	Suff		N.Suff		Sig	Ade		N.Ade		Sig	Sat		Unsat		Sig
		N	%	N	%		N	%	N	%		N	%	N	%		N	%	N	%		N	%	N	%	
Flight	1	3	60	2	40	-	5	100	-		+	4	80	1	20	-	5	100	-		+	3	60	2	40	-
Plan	2	6	100	-		+	6	100	-		+	5	83	1	17	-	5	83	1	17	-	5	83	1	17	-
	3	7	64	4	36	-	9	82	2	18	-	10	91	1	9	+	9	82	2	82	-	9	82	2	18	-
All		16	73	6	27	-	20	91	2	9	+	19	86	3	14	+	19	86	3	14	+	17	77	5	23	+
Aircraft	1	4	80	1	20	-	5	100	-		+	4	80	1	20	-	4	80	1	20	-	4	80	1	20	-
Contact	2	6	100	-		+	6	100	-		+	6	100	-		+	5	83	1	17	-	4	66	2	34	-
	3	8	73	3	27	-	9	82	2	18	-	9	82	2	18	-	9	82	2	18	-	9	82	2	18	-
All		18	82	4	18	+	20	91	2	9	+	19	86	3	14	+	18	82	4	18	+	17	77	5	23	+
Direction	1	4	80	1	20	-	4	80	1	20	-	4	80	1	20	-	4	80	1	20	-	4	80	1	20	-
Finder	2	6	100	-		+	6	100	-		+	5	83	1	17	-	5	83	1	17	-	6	100	-		+
	3	10	91	1	9	+	10	91	1	9	+	10	91	1	9	+	10	91	1	9	+	9	82	2	18	-
All		20	91	2	9	+	20	91	2	9	+	19	86	3	14	+	19	86	3	14	+	19	86	3	14	-

TABLE 5. RESULTS OF EVALUATION QUESTIONNAIRE — ALL LEVELS AND ALL LEVELS COMBINED

Question	Level	Response					
		Very Useful		Useful, but...		Not Useful	
		N	%	N	%	N	%
Rate	1	5	100	-	-	-	-
weather graphics with	2	5	83	1	17	-	-
overlay capabilities	3	9	82	2	18	-	-
	All	19	86	3	14	-	-
		Side by Side		Over/Under		Neither	
Which screen	1	-	-	5	100	-	-
configuration do	2	-	-	6	100	-	-
you prefer?	3	-	-	11	100	-	-
	All	-	-	22	100	-	-
		Very Useful		Useful, but...		Not Useful	
Rate the "basic	1	3	60	2	40	-	-
data block"	2	5	83	1	17	-	-
	3	8	73	3	27	-	-
	All	16	73	6	27	-	-
		Very Good		Average		Not Able to Brief	
Rate the overall	1	5	100	-	-	-	-
Model 2 capabilities	2	5	83	1	17	-	-
you evaluated	3	7	73	4	27	-	-
	All	17	77	5	23	-	-
		Much Easier		Not Much Diff.		Very Diff to Get Data	
Rate overall ease	1	4	80	1	20	-	-
of answering pilot	2	4	67	2	33	-	-
queries based on	3	5	45	6	55	-	-
improve. since last evaluation	All	13	59	9	41	-	-
		Much Easier		About the Same		Not Convenient	
Rate method of	1	4	80	1	20	-	-
inputting data/	2	6	100	-	-	-	-
weather requests	3	4	36	6	55	1	9
	All	14	64	7	32	1	4

See appendix for complete questionnaire.

TABLE 6. WINDS ALOFT MESSAGE

To the question:

Please comment on the two formats available during testing for the Winds Aloft Message.

	Medium		Low		Neither Format	
	N	%	N	%	N	%
Level 1	34	80	1	20	-	-
Level 2	4	66	1	17	1	17
Level 3	7	64	1	9	3	27
All	15	68	1	14	4	18

MESSAGE ANALYSIS, CONCLUSIONS, AND RECOMMENDATIONS

This section contains a discussion and analysis of the messages tested, and conclusions produced as a result of an analysis of written comments, interviews, questionnaires, and oral discussions with the specialists. A general overview of the results of both the initial and modification tests are found in tables 7 and 8, summarizing the major findings for each message.

The first group of messages are those which were modified, based primarily on the specialists recommendations from the initial evaluation. Discussion and analysis center on the modified messages evaluated during the modification test, with reference to the initial testing of the message for comparison. The conclusions combine the analysis and results of both the initial and the modification test so that the conclusions in this report can be a basis for determining what changes, if any, are recommended.

The second group of messages are those which were found to be satisfactory "as is" in the initial test, but with an indication to pursue some ideas for improvements. A decision was made not to make and test any modifications due to some impracticality based on either operational unfeasibility or programming constraints of the limited system. A brief analysis of each message is followed by conclusions and recommendations.

TABLE 7. FLIGHT DATA MESSAGES — SUMMARY OF MESSAGES TESTED DURING INITIAL AND MODIFICATION TEST PERIODS

Message Type	Result	Recommendation	Result(Modification)	Final Recommendation
FFP (Flight Plan)	Mask concept accepted and well-liked but more flexibility is needed	Test FFP trying new methods of field entry; develop & test a multipurpose mask incorporating functions of other masks	FFP as provided by spec. is acceptable	Data field alignment preferred by specialists should correspond as closely as possible to FAA form 7233-1.
FAC (Aircraft Contact)	Both masks (progress and monitor) be combined on 1 display; also more flexibility in handling multiple & repeated contacts	Retest FAC using modified mask	Combined FAC with PIREP mask and added FCX, FDM functions rated satisfactory overall	Improvements are still needed i.e. a means to enter data for more than one aircraft at a time
WWY (PIREP Entry)	Method of entering PIREPS not flexible enough	Develop mask for flexibility and speedy input of data	PIREP mask incorporated into FAC mask; the capability for a separate WWY also retained	PIREP mask could be integrated into FAC to save work switching displays; also develop a more practical display of position reporting data
MDF (Direction-Finder)	Improvement over present methods; add a graphic display of local area including VOR's airports, terrain features	Retest MDF with field changes to mask & graphics display	Graphic display of the local area with weather overlays showing aircrafts position superimposed was the most popular feature	Include data fields added for modification test; addition of the graphic display of local area with weather overlays
FCF (ATC System Command Center)	Satisfactory	More dynamic test situations	Satisfactory	Retain with additional option of displaying all ATCSCC messages in effect throughout the country
FSU (Special Use/ Areas, Routes)	Graphic display of MTR/MOA info was requested	Retest FSU with a graphic display of routes/areas	FRT was developed for mod test; detail limited to local AFSS area	Incorporate FRT into the FSAS specification
FRR (Preferred Route Request)	Satisfactory	Add graphic display to the FRT graphic route display	FRT developed for mod test; also when FRR was called up, other data on screen was not lost	Incorporate FRT into the FSAS specification
FAM (Amend Flight Plan)	Concern over interfacility processing of amendment messages	Test FAM to exercise all correction options and simulate interfacility message processing	*	*
FDM (Departure Message)	Satisfactory (within limited test situation)	Test using more dynamic test situations	*	*
FCX (Cancellation/ Close)	Satisfactory (within limited test situation)	Test using more dynamic test situations	*	*
FED (Encode/ Decode)	Satisfactory	Assistance in using the FED like a list of state identifiers	*	*
FRT (Graphic Route Request)			New message added for modification test and rated satisfactory	Incorporate FRT into the FSAS specification

* Indicates messages were not modified and therefore not re-evaluated; operating system precluded the use of a more dynamic test situation

TABLE 8. WEATHER MESSAGES — SUMMARY OF MESSAGES TESTED DURING INITIAL AND MODIFICATION TEST PERIODS

Message Type	Result	Recommendation	Result(Modification)	Final Recommendation
WSM (Weather Summary)	Similar to WWD so its value is reduced	Reduce some of the data	Good feature but still too much information	Further reduce weather data so WSM is more of a true summary; omit FDC NOTAMS and detailed military training activity outside AFSS
WNO (Notice To Airmen)	Amount of information is excessive	Develop alternate method of displaying NOTAMS; FDC NOTAMS should be available as an option	Satisfactory	Display full FDC NOTAMS as an option only
WGF (Grid Winds Forecast)	Lack method for complete display of high altitude similar to low altitude display	Explore method to display high altitude winds	Satisfactory	Display medium and high altitude winds as an option when the WPNA parameter is applied. also use simpler display format
WWT (Weather Trend)	Satisfactory & very popular	Include synopsis from the area forecast	Satisfactory	Include specially developed synopsis
WWD (Detailed Weather)	Excessive data in military training activity, NOTAMS, flow control	Improve display by streamlining message; also use route of flight in relation to fixes & weather reporting points	Message was streamlined	Further streamlining by adding a synopsis as well as abbreviating SA's, FT's, etc.
WWX (Multiple Weather Selection)	Satisfactory	More options should be available	Greater number of combinations of message types were made available	Excellent briefing tool
WWL (Local Weather)	Comments were divided	Retest the WWL to provide a comparison between WWL & WWD using a zone option on WWD	Satisfactory but still very similar to the WWD	Retain WWL
WSD (Radar Report)	Acceptable, but needs a graphic display of info to aid interpretation	Test WSD by displaying it with a graphic display of weather radar	*	*
WFT (Terminal Forecasts)	Satisfactory, however	Test an option to display only FT's meeting criteria for IFR alternate minimums	*	*
WFA (Area Weather	Too much info especially in bad weather	Test using an abbreviated format	*	*
WFX (Prognostic Map Discussion)	Satisfactory	Retain as is	**	**
WSO (Severe Weather Outlook)	Satisfactory	Retain as is	**	**
WWS (Sigmets, WWA (Airmets)	Satisfactory, necessity for both is well documented	Retest WWS & WWA to allow both to be called up together	**	**
WSA (Surface Observations)	Satisfactory	Retain as is	**	**
WUA (Pilot Report Request)	Satisfactory, but graphic PIREP is desired	Develop graphic PIREP Display	*	*
WAL (Alternate Weather)			New message added during mod test; very useful	Develop a similar message for the Model 2 System

* Messages were not modified and therefore not reevaluated

** Recommendation was to "retain as is"; therefore messages were not specifically reevaluated.

MESSAGES RETESTED.

FLIGHT PLAN. The major change to the Flight Plan (FFP) message included the use of two blocks of information to complete a flight plan. The Basic Data Block was first used to insert preliminary information at the start of a pilot contact. At this time, enough information should have been available to conduct a detailed briefing, if desired. The rest of the flight plan mask could then be called up by entering "FFP." This changed the format of the first part of the flight plan through item 8 (based on FAA Form 7233-1). Items 9 through 16 were unchanged, and constituted the second half of the mask.

Of 22 written comments, 11 specialists did not like the changes made to the data fields. This was the most serious problem encountered with the mask. Nine stated a preference for the format presently in use in the field. Two did not like the sequence, but did not specify any preference. When filing flight plans, the "pilots" gave the information in sequence, as outlined on the flight plan form 7233-1. This caused the first 8 items on the plan to be out of sequence when filling in the Basic Data Block, thus generating comments from some that they did not like the sequence, preferring the present format as used in the field. However, in everyday operation, pilots often give flight plan information out of sequence when the standard form is not available. The new format, in effect, gave them a realistic test of field conditions, since they were now required to utilize the random access feature to enter the first group of data.

Nevertheless, a considerable number of specialists were not happy with the change in format since half the written comments concentrated on this area. By contrast, the initial evaluation, which followed the specification design around a format as used in the field today, produced only 3 negative comments out of 32 specifically on data field arrangement.

The FFP Mask had the benefit of a more flexible method for data field input (see Basic Data Block description; check further when single spaced). This helped satisfy the need for more flexibility in entering data as voiced in the initial evaluation.

As in the original test, scenarios consisted of simple flight plan filing. No attempt was made to simulate error generation or message correction.

Other suggestions included substituting numbers for two-letter field identifier and rearrangement of some of the data fields. One specialist felt the domestic and International Civil Aviation Organization (ICAO) flight plans might be combined in one format. Two specialists thought vertical field alignment might be easier to work with.

Conclusion. It is concluded that the FFP Message, as provided by the specifications, is acceptable.

Recommendation. Data field alignment preferred by the specialists should correspond as close as possible to FAA Form 7233-1 (Flight Plan).

FAC AIRCRAFT CONTACT. The format of the Aircraft Contact (FAC) message was substantially changed from the previous test to accommodate most of the specialists' suggestions and to explore new ideas resulting from observations of Technical Center personnel.

The new design of the FAC message centered on these specific areas of need as indicated in initial testing: (1) Need to make specific mask information more operationally relevant. (2) Need to speed entry of data onto mask. (3) Need to consolidate information from other masks into the FAC mask to eliminate the necessity of switching masks continually while engaged in a pilot transaction.

Modification design efforts centered on these objectives, and the result was called the "Universal Mask."

The specifications call for Progress Report, Flight Monitoring, and other functions combined in one mask. Because of programming constraints in the initial test, employed two separate masks were employed, one each for Progress Report and Flight Monitoring. To use them in the initial test, the specialists entered FAC but nothing was displayed until they selected either "P" for Progress Report or "M" for Flight Monitoring. A disadvantage of separate masks was the specialist having to determine what the pilot's intentions were before selecting either P or M. Some specialists found two separate masks undesirable during this initial test, and the new mask developed for the modification test more closely resembled the concept in the specifications, with several changes as follows:.

1. Data Blocks for Position Reporting

Data blocks for position reporting were altered in response to comments that pilots rarely give position reports in the format of an IFR position report as in the specifications. Specialists felt this rendered the format inappropriate for daily operations, and comments suggested a more appropriate format be developed. Since flight monitoring involves position reporting, these functions were combined along with provisions for remarks. The Basic Data Block supplied most of the routine information required during a contact.

2. Display of Subsequent Contact Data

A problem that surfaced during initial testing was a lack of display of previously recorded data during a later contact with the same aircraft. The method tested consisted of providing the mask with several lines in which to enter subsequent data, with previously entered information displayed each time the mask was recalled for the same aircraft. This was not tested dynamically, in that subsequent aircraft contacts were not employed to best illustrate its use, due to programming constraints. A single contact was used to test the concept. Lack of more dynamic testing may have given a somewhat unclear picture of the full function of this feature as indicated by written comments, as, "Aircraft contact mask fields R1, R2, R3, F2, F3 not useful. A remarks field would better serve the purpose." Since the R fields were set up for remarks, the need for them was still evident from the same specialists comments, while it is equally evident that the R function was not fully understood. Two out of 14 comments indicated confusion as to use of the R-remarks function. A third comment indicated that the R-field function was not used, and a fourth suggested combining R-remarks with F-fix/time data under one section.

3. PIREP Data

Provisions for entering PIREP data was added immediately after the basic contact data. The idea was to eliminate having to call up the separate PIREP mask and to retain all contact information for continuous reference. There were several verbal comments from the specialists that this concept was a "good idea," but the only written comment received was a recommendation from a level II specialist to omit PIREP data.

In the PIREP mask (WWY), message display as a separate message was retained and was available for use.

4. Statistical Data Block

This was relocated on the mask display but otherwise unchanged. No comments were received on this.

5. Processing Instruction Block

This was a new feature added to enable specialists to select what processing or internal routing was necessary on mask information. An "X" was placed after any one of the fields, and a single final keystroke entry selected data from the mask to be processed and routed automatically. For example, if an X was entered after WY, the PIREP will be transmitted on the circuit, as well as routed internally to all local operating positions. Selecting the "FM" results in the selection of the flight monitoring option, and causes the contact to automatically "time out" after 10 minutes. That information is still available for recall at the position to resume monitoring function of that flight. When called up, previous data are displayed, new fix/time information can be entered under field F2, new remarks under field R2, and changes to any other data blocks can be made including updated PIREP entry. After the contact the specialist can again check FM to recall the contact in 10 minutes, repeating the process as often as necessary. Omitting the FM block entry terminates the monitoring function and the contact is routinely archived.

The 14 written comments recorded by the specialists on the FAC message were varied. It was difficult for one specialist to use, but he felt it was mostly attributable to being unfamiliar with local identifiers rather than the concept. One specialist wanted the Basic Data Block omitted; another the PIREP mask, and another suggested no mask at all, saying "it is too cumbersome" with no elaboration. Most comments were suggestions for improving the modified mask. The FAC received the most "inadequate" or "unsatisfactory" questionnaire responses after the FFP Flight Plan Mask. The greatest number of unsatisfactory marks were for sequence of data and mask display.

The modified FAC mask contained a large number of options which, it was hoped, would help the specialist by eliminating the need to constantly change the mask display during a contact, a disadvantage evident in the first test. Problems with its use seemed to be confusion in using the various fields which could be attributable in part to limitations to full dynamic testing.

Conclusion. The FAC message as originally tested under Model 2 specifications is satisfactory but needs improvemment to be used effectively in the field. The FAC as tested with modifications to improve its effectiveness was rated satisfactory overall, but improvements are still needed.

Recommendation. It is recommended that a means to enter data for more than one aircraft at a time be provided to solve the problem of simultaneous aircraft contacts which occur regularly. While one aircraft is being worked, limited preliminary data for additional aircraft could be recorded for reference on the same page.

A method should be provided to produce a display of previous aircraft contact data, updated chronologically, for reference during subsequent contacts with the same aircraft. Sufficient space should be provided on the mask to display these data.

Some work can be saved by integrating the Cancellation/Close (FCX) and Departure Message (FDM) functions into the Aircraft Contact (FAC) display. The FCX and FDM messages should still be retained for separate use.

The PIREP mask could be integrated into the FAC mask to save work switching displays and filling in a separate PIREP mask, but the separate WWY PIREP Entry mask should still be retained.

A more practical display of position reporting data should be developed. The full IFR position reporting format is not compatible with the vast majority of routine contacts the specialist processes.

The first item of information to be entered on the FAC mask should be the aircraft identification.

SPECIAL USE AREAS/ROUTES. The Special Use Areas/Routes (FSU) message was modified to incorporate ideas proposed by the specialists in the initial test. The main problem was lack of detailed knowledge of area/route location outside the specialists' geographic area of familiarity. The most difficulty centered on military training activity which the specialists are most often concerned with. Messages were very detailed as to specific entry and exit times of aircraft, but this information, as well as any other data was considered superfluous since the specialists had no way of telling where the route/area was located. They were unable to effectively integrate the information into a briefing. The route could have been just outside their Flight Service area or half-way across the country.

During initial testing and the modification test, some specialists questioned the usefulness of "detailed" military training activity taking place, several hours away in many cases, when the effective times are often changed due to cancellations or revisions brought about by weather or other operational reasons. A pilot briefed on the scheduled activity of a particular route may find the activity cancelled or replaced by another, and he would have no knowledge of the change before he reaches the area.

With these considerations in mind, the FSU messages were modified so that detailed activity was displayed as before within a 100-mile radius of the departure FSS. This is the area of prime responsibility as presently outlined in the Flight Service Handbook, 7110.10, Para 167, Conduct of Preflight Briefing. The display

was shortened for activity outside this radius. The route or area identifying number was listed along with the three-letter identifier of the responsible FSS and its associated radio frequency. The idea was to persuade the pilots to contact the FSS en route as they approach the area of the airspace restriction to procure more timely information directly from specialists most familiar with the training route activity.

Based on comments received during initial testing, a graphic display was considered but not developed for testing at this time. During modification testing two written comments were received from level 2 specialists, both suggesting a graphic display be developed and patterned on the newly tested Graphic Route Display (FRT) message. Overall, the modified FSU message was satisfactorily rated for sequence, format, options, and content.

Conclusion. The FSU message was found to be satisfactory and useful, but beyond the specialists' area of responsibility, the information was of dubious value in the course of a briefing.

Recommendation. A display similar to the Graphic Route Display (FRT) message would be a desirable improvement. The display would have to be of sufficient scale to present enough detail and at the same time provide a satisfactory geographic orientation to be of effective use.

AIR TRAFFIC SYSTEMS COMMAND CENTER. The Air Traffic Systems Command Center (FCF) message was rated satisfactory overall in initial testing, and no suggestions for changes were received. During the initial test, the option to display all Air Traffic Control System Command Center (ATCSCC) messages in effect throughout the country by entering FCF alone was not tested. It was explained to the specialists that the option is planned for use but was not available for testing.

This option was made available for modification testing, and all specialists rated the FCF satisfactory overall, although it was not rated by two level 3 and one level 2 specialist. The only written comment received was from a level 3 specialist who thought the FCF message should be accessed via the NOTAM key.

Conclusion. The FCF message is satisfactory and a very useful briefing tool.

Recommendation. It is recommended that the FCF message be retained in its present format.

GRAPHIC ROUTE DISPLAY. The Graphic Route Display (FRT) is a new message type created out of a need expressed by the specialists for a depiction of the proposed route across state boundaries. Whenever a full route (or departure/destination fix) was entered, the proposed flight could be displayed on the full U.S. map background on the graphic display. The presentation consisted of parallel lines superimposed on the map corresponding to the route width selected and illuminated brighter than the background map. The briefer could overlay any graphic weather product in any combination onto this display, thereby providing a graphic display of various weather phenomena in direct relation to the pilots intended flight. The background map contained state outlines as a geographic aid to specialists briefing in unfamiliar territory. Several ideas to improve the route display were suggested, including possible display of location identifiers or weather reporting points along the route. The map, in its present scale, would be unsatisfactory for this purpose; a larger scale would be necessary to accommodate large quantities of

identifiers. A zoom feature in this area might also be helpful. Another idea was to highlight segments of the route to coincide with the tabular data displayed on the other screen. This would be useful in pinpointing weather reports beyond the specialists' area of geographic familiarity.

Conclusion. The FRT was not only satisfactory but proved to be a very promising tool. A graphic display of the proposed route of flight aided the specialist in geographic orientation and was especially useful when used in conjunction with graphic weather overlays.

Recommendation. It is recommended that the FRT message be incorporated into the FSAS specifications.

DETAILED WEATHER. The Detailed Weather Message was reevalauted with two modifications. Flight Data Center (FDC) NOTAM data were deleted except for NOTAM number and associated location identifier. If the specialist needed to check the details of an FDC NOTAM, it could be requested by typing "FDC," after which complete information was displayed. Military training routes and special use airspace were also modified much like the modified FSU message. Detailed information was displayed for the local 100-mile radius and data outside that area were tabulated according to the airspace title, followed by the controlling AFSS and associated radio frequency. These modifications were in response to initial comments that too much information was displayed in the WWD, FDC NOTAM's, and military training activity in particular.

Eight written comments were received. Two specialists would like to see a synopsis; four stated a need for less information, especially for high altitude flights. Both high and low altitude flights were exercised, with some SA's (surface observations) and FT's (terminal forecast) eliminated from the high level route as per specifications. It is probable with the volume of information presented that the difference was not easily discernible. This was verified by comments received from the specialists after testing.

Overall, the WWD message as modified was rated satisfactory for sequence, format, options, and content.

Conclusion. The detailed weather message is satisfactory but some data is excessive; specifically, full FDC NOTAM and Military Training Route information.

Recommendation. It is recommendated that further streamlining through addition of a synopsis be accomplished, as well as combining or summarizing other material; such as, SA's, FT's, and winds aloft.

GRID WINDS FORECAST (WGF). The winds aloft as displayed according to specification in the initial test were rated satisfactory, but the specialists needed a display of high altitude winds when the Wind Processing Normal Altitude (WPNA) parameter was applied. When looking into a method of including high altitude winds, perhaps as an option, it was evident that a very limited display of wind data would be available on a page at any one time due to the format called for in the specifications. The problem was the heading line under which the wind columns were lined up. The length of the header severely limited the number of columns that could be placed on a page. To retest the WGF message, two different winds aloft displays were prepared for evaluation. One group of scenarios tested low level winds in a format similar to the winds aloft forecast presently in use in the field. The second format presented medium level winds according to Model 2 specifications. (See figure 4.)

	3000			6000			9000			12000		
	W DIR	SPD	TMP	W DIR	SPD	TMP	W DIR	SPD	TMP	W DIR	SPD	TMP
AGC	230	21		240	36	+00	230	49	-04	230	60	-00
	15000			18000								
	W DIR	SPD	TMP	W DIR	SPD	TMP						
	230	70	-13	230	81	-17						

	3000			6000			9000			12000		
	W DIR	SPD	TMP	W DIR	SPD	TMP	W DIR	SPD	TMP	W DIR	SPD	TMP
PSB				240	38	+01	240	50	-03	230	62	-07
	15000			18000								
	W DIR	SPD	TMP	W DIR	SPD	TMP						
	230	72	-12	240	38	+01						

LOW ALTITUDE WINDS - MODEL 2

	21000	24000	27000	30000	33000	36000	39000
ENO	2583-21	7507-32	7515-35	7423-39	7432-51	7516-52	2780-55

	21000	24000	27000	30000	33000	36000	39000
ACY	2681-20	2694-31	7600-31	7610-35	7435-50	7516-52	2788-56

MEDIUM ALTITUDE WINDS - SIMILAR TO PRESENT

FIGURE 4. WINDS ALOFT DISPLAY

In addition to the standard questionnaire by which all messages were evaluated, the WGF contained a separate question asking the specialists to state a preference for the low level winds (Model 2), medium winds (near present format), or no preference. After viewing both formats, the majority preferred the present format over the Model 2 format. Those who rejected the Model 2 format stated the unsuitability of the header line for two reasons. Specialists felt that it was more difficult to interpret the wind information overall since the display was more confusing, and they felt it was unnecessary to "spell out" (the heading line) what was very obvious to them. The Model 2 format was preferred by 4 specialists, the present format by 14, and neither format by 4. The WGF message was rated satisfactory overall for sequence, format, options, and content. Only three rated the format unsatisfactory on the questionnaire.

Conclusion. The WGF message is satisfactory.

Recommendation. Provision should be made to display medium and high altitude winds as an option when the WPNA parameter is applied. A more simplified display format, such as that which is presently in use, might improve efficiency and accuracy.

WEATHER SUMMARY. The Weather Summary message was modified in the same way as the Detailed Weather (WWD) by deleting FDC Notam data except for NOTAM number and associated location identifier. If the specialist wanted to look up an FDC NOTAM, they requested it by typing and entering "FDC," after which complete NOTAM information was displayed.

Military training routes and special use airspace were modified similar to the modified FSU message. Detailed information was displayed for the local 100-mile radius and data outside their area listed by the airspace title, followed by the controlling AFSS and associated radio frequency. These modifications were in response to initial test comments that too much information was displayed, FDC NOTAM and military training activity in particular. Only three written comments were received on the WSM message and these indicate that too much information is included to call WSM a summary. However, the message was judged satisfactory overall regarding sequence, format, options, and content.

Conclusion. The WSM message is a good feature but contains too much information and is too similar to the WWD message to be called a summary. This was indicated by written and oral comments during both evaluations.

Recommendation. Specialists would prefer the omission of FDC NOTAM's and the elimination of detailed military training activity outside their AFSS area of responsibility. A method of further reducing weather data is also desired so that the WSM messages can be more of a true summary.

NOTICES TO AIRMEN. The only change to the Notices to Airmen (WNO) message tested was omitting the FDC NOTAM's, making them available as an option. This was in response to a large number of requests from the initial evaluation. In the modification test of the WNO display, FDC NOTAM's were identified by the letters FDC followed by the number and the three-letter identifier. To review the complete NOTAM, the specialist entered "FDC" and all the appropriate FDC NOTAM's were displayed in full.

It was intended that FDC NOTAM's could also be called up independently by entering appropriate preliminary data the same as any other weather message, which would, in effect, create a new message type. However, all testing surrounded the use of displaying FDC data as an option of the WNO message.

Three written comments were received. One suggested omitting FDC NOTAM's, another said to retain them, and a third questioned the necessity of the WNO message since NOTAM's are presently appended to the SA reports.

The WNO message, retested with this change, was rated satisfactory for sequence, format, options, and content.

Conclusion. The WNO message is satisfactory.

Recommendation. It is recommended that displaying full FDC NOTAM data as an option could be a desirable modification to the message.

LOCAL WEATHER. During initial testing, written comments received on the Local Weather (WWL) message indicated it was a "great idea," "good for local pilot briefings," but also a "duplicate feature" that "could be eliminated." It was considered that the WWL message might have appeared too similar to the Detailed Weather (WWD) message during initial testing. The initial and modification test used a route format only, to test the WWD message. For the modification test, several WWD messages were especially prepared using a circular zone size format with the intent to provide a better basis for comparison with the WWL message which used a similar zone size format.

After the second test, written comments from specialists indicated that the WWL duplicated other messages "I don't know how useful this feature is, same information on FT, FA, and SA;" "Not needed with all other information available." Two comments suggested improvements: "Omit FDC Notams;" "Please add winds aloft information."

No serious problems were found in the evaluation of the WWL message. Sequence, format, option, and content were rated satisfactory.

Conclusion. The WWL message is useful and satisfactory.

Recommendation. It is recommended that the WWL message be retained in its present format.

WEATHER TREND. The initial test proved the Weather Trend (WWT) message satisfactory and popular, with one specialist requesting the addition of a synopsis. This proved to be a complicated task considering all the possible combinations of fixes and/or routes that could be called up, since the synopsis would have to cover conditions (forecast and actual) at each station displayed. The vast amount of station combinations that could be called up preclude the possibility of preparing a synopsis in advance to cover all the combinations. A possible solution would be to include the portion of the Area Forecast (WFA) message within which any of the selected stations fall. This is the main body of the WFA message, and would often result, in several sections, in more than one WFA message being displayed. This becomes very complicated, and would still not constitute a complete synopsis since the portion of the WFA describing frontal position and movement would have to be included and related to the main message content.

Conclusion. The WWT message is a valuable and popular briefing tool.

Recommendation. It is recommended that a synopsis be included in the WWT message. Inclusion of a synopsis is desirable but perhaps impractical considering the incompatability of combining a synoptic analysis which covers large areas with frequently changing conditions, and with individual stations resulting in many possible combinations of route structures. However, use of the synopsis from the WFA or a specially developed synopsis based on the Area Forecast should be considered.

ALTERNATE WEATHER. The Alternate Weather (WAL) is a new message developed in response to specialists' recommendations from the initial evaluation. The message is designed to display any terminal forecast meeting a legal IFR alternate minimum of 800 feet and 2 miles visibility for nonprecision approaches, and 600 feet and 2 miles for precision approaches. It was felt that a message of this type would eliminate the need to search through all the FT's which is very time consuming but necessary during periods of widespread low ceilings and visibilities.

The WAL message was favorably accepted by the specialists. A suggestion for improvement, voiced by several specialists, was to expand the content of the message to include Surface Analysis reports. Thirteen written comments were received and all but one was favorable. Only one specialist stated that the message was not useful since "not all pilots have the same minimums." This comment refers to the practice many pilots have of establishing "personal" minimum weather conditions below which they may elect to discontinue a flight. These personal standards may vary considerably and are traditionally based on training, individual experience levels, recency of flight, etc. However, the WAL message was intended to satisfy Federal Aviation Regulations (FAR) requirements, which are regulatory by nature and standard for all qualified instrument rated pilots.

Conclusion. The WAL message was found to be a very useful message by the specialists.

Recommendation. Consideration should be given to develop a similar type message for future use in the FSAS Model 2 system.

DIRECTION FINDING. The Direction Finding (MDF) message was tested using the same protocol and scenarios as in the original test. Combinations of single and multiple VOR radials were employed to provide cross references to establish aircraft position from initial testing. The MDF message shared the distinction, along with the FFP and FAC messages, of evoking the greatest number of written comments and ideas. Based on the specialists responses, the following changes were incorporated into the MDF message retesting:

1. Basic Data Block was again added as in other messages.

2. Information fields added to work emergency.

   (a) Minimum information block

   (b) Supplemental information block

3. Multiple remarks section.

4. Time-to-station field added.

5. Weather display for selected airports.

6. Graphic display of local area showing airports, towns, NAVAIDS, etc.

7. Option display of SA's and PIREP's as an overlay on local map.

8. Option for display of minimum altitudes/restricted areas on local map.

9. Aircraft position superimposed on map with course line to airport.

One of the main complaints from the specialists during initial testing was lack of provision to enter background information such as aircraft type, fuel remaining, etc. The specifications called for entry of aircraft identification, followed by data to immediately solve a problem; i.e., bearing or radial entry, airport of intended landing, fix, and airspeed. What many of the specialists considered lacking at this point was data fields necessary to have firm control of the emergency situation. More information was needed not only to immediately work a problem, but additional information for search and rescue activity, should it be required.

Basic Data Block. This supplied much basic information including altitude, type aircraft, transponder data, speed, and departure/destination information in the route of flight section.

Minimum Information Block. This expands on the Basic Data Block and provides space to record:

EM - Nature of the emergency and pilots intentions

FB - Fuel remaining in time

WX - Weather as reported by the pilot

BC - Transponder Beacon Code in use, or assigned code if furnished

R1 - Remarks section

F1 - Fix/time data (ETA at next intended fix/landmark)

Space is provided for additional remarks and updated fix data as the contact progresses.

Supplemental Information. This section contains supplemental information considered necessary for effective emergency services management, and includes the following:

IR - Pilot capability to fly IFR

LP - Time and place of last known position

HH - heading since last known position

DD - Intended final destination

AD - Alternate

SR - NAVAID signals received

NE - Onboard NAVAID equipment capability

LM - Visible landmarks

CR - Color of aircraft

NB - Number of people aboard

EQ - Emergency equipment on board

The next section provides entry of data necessary to provide a computer-generated solution:

SB - DF bearing data

VR - VOR radials

SA - Airport/fix for intended steer

When all required fields were entered, a single keystroke displayed the solution. Position and heading to steer were displayed according to specification in tabular format. In addition, time-to-station was displayed when airspeed was entered.

Airspeed was one of the elements available for entry as an option according to the specifications; however, no provision was made for time-to-station in the solution. Since heading to fly is part of the solution, the use of computer-stored winds aloft information for problem solution is implied. No provision for altitude entry could be found in the specification, but this field was included as part of the Basic Data Block during modification testing.

A new feature tested was the display of a complete weather sequence report (SA) as part of the solution. The SA now appeared immediately after the aircraft location and recommended heading. This worked whenever field SA — Selected Airport was filled in, and that airport was an official weather reporting point with current weather available. An alternative might have been to list all SA's within the local area, but the single SA concept was the only method tested.

When the MDF message was activated, a map display of the local area could be called up for simultaneous viewing on the second screen. The map contained geographic landmarks; rivers, cities, highways, VORTAC locations with three-letter identifiers and airports. An overlay with minimum safe altitudes and restricted airspace was available. A second overlay provided sequence weather observations (SA's) for all stations on the map, along with PIREP's; all geographically situated where the reports occurred.

When a lost aircraft solution was displayed on the tabular screen, a simultaneous display of aircraft position was portrayed graphically on the local map, consisting of a small aircraft symbol representing the actual computed position. A course line also appeared, leading from the aircraft position to the point of intended landing if the point was entered in the SA field of the tabular block below.

Eleven written comments were received, evenly divided between the three levels of the specialists. This compares with 31 comments received during initial testing. Most of the comments were positive, and two negative comments were also received. A level 1 specialist did not see much improvement over present methods in the field and wanted to see a Doppler System used. A level 2 specialist said, "Still don't believe it will work as I now know and use DF" but did not elaborate. During initial testing, some skepticism surrounded operational methods and effectiveness of the Model 2 system as presented using close-in DF approaches.

When developing a modified MDF mask for testing, Technical Center specialists appreciated the great number of possible combinations of data fields and their organization on the mask. The resultant mask that was developed reflected a concensus based on the operational experience of project personnel.

The most popular aspect of the MDF message was the graphics display, although this was not reflected in the written comments.

Questionnaire results were satisfactory overall in each area: sequence, format, option, content, and mask, with an occasional unsatisfactory indication about evenly divided among the categories for each flight service level. The greatest number of unsatisfactory marks (4) were for the mask display.

Conclusion. The concept of computer processing of inputs which produce a display of aircraft position is well accepted. Specialists liked the data fields that were added to record necessary information during an emergency. The addition of a graphic display of the local area, with weather overlays, upon which the aircraft's position was superimposed, was the most popular aspect of the evaluation as observed by the test team.

Recommendation. It is recommended that the data fields incorporated during the modification test be added to the DF message, as well as the addition of a graphic display of the local area with weather overlays.

MESSAGES NOT REEVALUATED.

FLIGHT PLAN AMENDMENT. The Flight Plan Amendment (FAM) message was initially tested using flight plans previously filed with the FFP message. There was concern over amendments to multiroute military flights and flight plans on file outside the AFSS area of responsibility.

Conclusion. The FAM message was found satisfactory, but needs to be tested under more dynamic conditions than were available.

Recommendation. Test the FAM message under more dynamic conditions than were available to insure its usefulness.

FLIGHT PLAN CANCELLATION. The Flight Plan Cancellation (FCX) original test exercised the entry of departure points, destination, and different times to demonstrate various options. Problems, such as generation of rejection messages; etc., were not attempted.

Conclusion. The FCX message was satisfactory from the standpoint of the limited testing done, but needs to be retested under more dynamic conditions.

Recommendation. The FCX message should be tested under more dynamic conditions.

DEPARTURE MESSAGE. Testing of the Departure Message (FDM) involved simple flight plan activations with various departure times and destinations involved. Complex problems, such as generation of rejection messages for problem resolution were not attempted.

Conclusion. The FDM message was satisfactory from the standpoint of the limited testing.

Recommendation. Test the FDM message under more dynamic conditions than were available so it could be evaluated in complex situations.

ENCODE/DECODE. While no change was made to the Encode/Decode (FED) message for retesting, a system change enabled the data called up by the FED to be displayed without erasing the other data on the screen. The FED message was very popular, but the specialists expressed concern over trying to determine the proper spelling of unfamiliar identifiers. They felt a graphic display or some handy reference tool might be needed to check spelling before entering locations.

Conclusion. The FED message was satisfactory and very popular.

Recommendation. Some assistance with identifiers would be handy, such as a graphic display of two-letter state identifiers.

PREFERRED ROUTE REQUEST. The Preferred Route Request (FRR) message was tested by having a specialist request a route in the middle of a flight plan filing scenario. There was a drawback in initial testing where the flight plan and route could not be displayed on the CRT simultaneously. The modification test eliminated this problem, but the message was not retested since there was still no way to incorporate the route into the flight plan automatically as called for in the specifications.

Conclusion. Retain the FRR message in present format.

Recommendation. It is recommended that the FRR message be retained in its present format.

SEVERE WEATHER OUTLOOK. There was confusion about the Severe Weather (WSO) message since it is more familiarly known as the Convective Outlook or AC. There was little comment or discussion otherwise during the initial evaluation.

Conclusion. The WSO message was rated satisfactory overall except for the confusion created by its name, Severe Weather Outlook.

Recommendation. It is recommended that the message title be changed to WAC to avoid confusion.

PROGNOSTIC MAP DISCUSSION. The specialists were initially confused as to what the Prognostic Map Discussion (WFX) was since they were used to seeing it at the bottom panel to the 36- and 48-hour prog chart. Some of the terminology in the chart was unfamiliar to some specialists, specifically in reference to vorticity and the LFM model. Formal training on these areas has only recently been introduced at the FAA Academy, and this only for EFAS specialists. Comments from specialists indicate the map discussion is used in the field.

Conclusion. The WFX message was rated satisfactory in all aspects.

Recommendation. It is recommended that the WFX message be retained in its present format.

TERMINAL FORECAST. Many specialists liked the idea of displaying only unexpired portions of the Terminal Forecast (FT). However, the unexpired material provides a trend which is not otherwise available. The WWT message can only access unexpired FT's. One specialist suggested providing capability to call up all FT's that meet legal IFR alternate minimums (ceilings/visibilities 800/2, 600/2). It is very time consuming to scan all FT's to pick out this criteria during busy periods of bad weather. This suggestion directly influenced the development of the separate WAL message, which was designed for this purpose and evaluated during modification testing.

Conclusion. The WFT message was rated satisfactory overall.

Recommendation. It is recommended that the WFT message be retained in its present format.

RADAR SUMMARY MESSAGE. Comments on the Radar Summary Message (WSD) were few and varied. Specialists from the western part of the country had difficulty interpreting the data since they do not receive tabular summaries of radar reports. Weather detection radars are sparse in the west so precipitation echoes are periodically traced manually off Air Route Traffic Control Center (ARTCC) radar scopes. This information is eventually reproduced on the Radar Summary Facsimile Chart normally distributed to all FSS's in the country with access to the National Facsimile Network (NAFAX) circuit.

Some comments suggested that the radar summary might lose some of its importance where digitized weather radar displays provide sufficient coverage and interpretive data. Two comments referred to a need for the digital plot which comes off the teletype. This plot locates precipitation by intensity in numerical values from zero to nine. One specialist said "radar graphics are sufficient, no need for radar summaries except for plotting purposes; don't like method of plotting coordinates; prefer terrain reference." Another said "radar summaries should be keyed to display the radar graphic with the same key." Another said "unnecessary with live radar and radar summary chart and GOES."

The WSD message was rated satisfactory overall in the initial test. Center personnel were unable to develop a workable graphic display of tabular radar summary reports.

Conclusion. The WSD message is acceptable.

Recommendation. It is recommended that the WSD message be retained in its present format.

AREA FORECAST. During the initial evaluation, it was found that the Area Forecast (WFA) message used alone was an important briefing tool and was especially useful during preduty briefing. One drawback, however, was the large amount of material that had to be assimilated and correctly interpreted by the specialist when the message was used in conjunction with other weather messages. Several specialists stated that smaller portions of the WFA should be displayed especially when the area forecast is used with route briefings. For example, a scenario from Atlantic City to Los Angeles contained six lengthy area forecasts along with other required data as part of a detailed weather briefing. It was exasperating for the specialist to convey all the information. While this may be an extreme example, the nature of the future system makes it a realistic one. This message was not specifically tested again, since an abbreviated format was not developed in time for the modification test period.

Conclusion. The WFA message is satisfactory. It was especially useful for preduty briefings, and a necessary option in conjunction with route briefings.

Recommendation. It is recommended that the WFA message be retained and a means to condense some of the material used in route briefings be considered.

SURFACE OBSERVATIONS. The Surface Observations (WSA) message received one comment from a specialist who would like to see the present format retained, but stated that this preference was due to familiarity with the present format. The WSA message was rated satisfactory overall.

Conclusion. The WSA message was rated satisfactory.

Recommendation. It is recommended that the WSA be retained in its present format.

SIGMETS AND AIRMETS. These are combined because the messages are so similar and specialists often referred to "SIGMETS and AIRMETS" collectively, even when commenting on just one of them. Written comments suggested combining the two for display. Two additional comments suggested appending them to the WFA or incorporating them into the body of the WFA.

The necessity for SIGMETS/AIRMETS is well documented, and they were used regularly during briefing. No modification was made to either the WWS or the WWA message. Both messages rated satisfactory overall during initial testing.

Conclusion. The WWS and WWA messages are acceptable as they are.

Recommendation. It is recommended that the WWS and WWA messages be retained in their present format.

PIREP REQUEST. Four written comments were received on the initial test, two preferring a graphic display of PIREP's. Comments gathered under a separate Graphics Questionnaire contained five remarks in favor of a graphics display. A

need for requesting only discrete items of information from PIREP's for display (i.e., icing, turbulence) requests were noted by Center personnel, with one specific written request. This option is available in the specifications, but was not tested.

Conclusion. The WUA message was rated satisfactory overall.

Recommendation. Retain the WUA message in its present format and consider a graphic display of PIREP information to facilitate comprehension of weather conditions.

MULTIPLE WEATHER REQUEST. The Multiple Weather Request (WWX) was one of the most popular messages tested. Negative comments during initial testing were the result of programming constraints which limited its use considerably. The message was still rated satisfactory overall. A system improvement developed for the modification test vastly improved the capability of the message type allowing more flexibility in calling up more combinations of messages.

Conclusion. The WWX message is acceptable in its present form.

Recommendation. It is recommended that the WWX message be retained in its present format.

SUMMARY AND RECOMMENDATIONS

The initial evaluation tested the most important operational messages under conditions simulating, as closely as possible, actual operating conditions. The message formats and the processing system developed for the test followed the specifications as rigorously as possible. The main test limitation was on the operating system, which precluded full dynamic testing of the messages. The test was not designed to be an evaluation of the operating system however, only the operational messages.

Statistical analysis determined that the messages were satisfactory. Specialists' comments isolated certain problem areas which needed modification or further evaluation. Most of the comments were varied, covering many different items. As many of the specialists' ideas as possible were incorporated into the messages and reevaluated during the modification test. Changes to the messages were based on specialists' comments, interviews, and observations of Center personnel, and special consideration was given to specifically identified problem areas. Messages without serious problems were not reevaluated. Statistical analysis determined the modified messages to be satisfactory overall.

Specialists' comments and suggestions provided varied information, in addition to the statistical analyses, that indicated particular areas where messages could be improved. Comments regarding data format were concerned with vertical versus horizontal display of data fields, rearrangement of some data fields, inclusion, or elimination of one or two items of weather, etc., More major changes regarding the amount of information available; e.g., produced favorable reactions and were consistent with specialists' initial recommendations. By contrast, the concept of

a universal mask, which seemed an evident way to solve one of the more serious problem areas in the first test, was met with lukewarm enthusiasm during the second test. Some specialists liked the idea, others did not. Often there was disagreement over what should go into the mask.

One reason which would account for this diversity of specialist opinion was the sample population. A wide a range of experience levels and geographic dispersion was represented by the specialists. The test participants came from every section of the United States, including Alaska and Hawaii, with wide variations in total time in FSS work, different activity levels (level 1, 2, and 3 stations), and manual, semiautomated, and fully automated facilities. This diversity was coupled with the human factors aspect of different briefing styles and techniques for accomplishing required tasks in the man-machine relationship.

In some cases, the nature of the changes may have influenced the outcome. Certain changes necessarily involved judgment and unavoidable subjectivity on the part of personnel making these changes after considerable efforts to interpret the specialists' recommendations and find a solution. Persons making the changes drew on considerable operational experience, so that the changes were the result of conscientious interpretation.

The main point is that the messages were satisfactory after both tests, and there was substantial agreement on the definition of certain problem areas. There were many diverse opinions about other minor items. These were often suggestions about the number of letters used as field identifiers in a mask, for example, and may never be resolved to the complete satisfaction of all persons concerned.

The main test objective was to determine suitability of the messages for operational use. The messages tested were determined to be suitable for this use.

A secondary objective was to identify areas or items for specific change. This was done, and the conclusions following each message analysis provide the basis for this. It was originally intended to provide very specific reference to any item where a need for change was identified. The diversity of opinion among the specialists on many of these areas has led to a modification of this objective. It is no longer felt that changes can be that specific or absolute in a substantial proportion of messages.

GENERAL RECOMMENDATIONS.

The effectiveness of the messages and any further problems can best be determined through operational use. Since the messages were determined to be essentially satisfactory, proceed with implementation of the system, including adoption of the messages according to specification, but consider modifying the messages where minor problems have been identified using the conclusions and recommendations in the message analysis section. These modifications could be incorporated into the system well before full operational implementation is realized.

Further development of graphics should be pursued with the objective to enhance the effectiveness and efficiency of the whole system by integrating the graphics with more of the various messages. More specifically, develop graphics such as that tested in the FRT message. This would be an important aid to the specialists' comprehension of the weather situation as it directly relates to a planned flight, since it seems evident that briefing distances will become longer with implementation of the automated facilities.

APPENDIX A

SPECIALISTS' COMMENTS

FFP - FLIGHT PLAN MASK

Level I

1. Maybe instead of letters, use numbers. (NON)
2. FP mask should be in normal FP sequence.....FR, ID, TP, TS, DP, PT, AL, RF, ETE, FB, PD, PB, CR. (NON)
3. The Flight Plan and Aircraft Contact Masks are difficult for me to use primarily because I'm conditioned to pen and paper. I believe that the transition to this equipment would be easier if on the FP, the order of fields paralleled the standard form in use now. (NON)
4. I would like the sequence the same as the form now in use. (NON)

Level II

1. Would it not be easier to have one Flight Plan Mask and have that mask displayed as the flight plan form that is in use now. Field one or type of Flight Plan would identify the type Flight Plan, VFR, IFR, ICAO, MVFR, MIFR, etc. The FFP has 20 blocks to fill in. FAA Flight Plan Form 7233-1 only has 16 blocks to fill in, 17 if you add the tie-in station. (AWANS)
2. Flight Plan Mask numbers such as on the Flight Plan Form would be better than letters. (SAS)
3. Have fields verical instead of horizontal. (SAS)
4. Key "Switching" necessary to enter data in basic block and lower mask. (SAS)
5. I am not satisfied with the present material. TP should come before TS when filing FP. Doing too much jumping. FP-CTC, FP. Need improvement. (SAS)
6. Is adequate but don't particularly like sequence. (SAS)
7. Had to use random entry a lot to enter data. (NON)

Level III

1. For multiple FP filing , be able to input several FP's without having to retype all information that stays the same. (SAS)
2. Format should be in order like FP form. (SAS)
3. Should be formatted the same as Pilot's Flight Plan Form. (MAPS)
4. While I had little problems with this mask, vertical field alignment (PIREP mask) made field identifying easier. (SAS)
5. Should be the same sequence as the 7233-1. (SAS)
6. Need two lines for PD and RM. (SAS)
7. Masks should follow the format of the actual form as the transfer of the material is easier from the bottom. Receipt of the information is usually not in the proper order. (SAS)
8. AWANS is more clear and concise. (AWANS)
9. On the flight plan mask, the specialists could serve the pilots faster if the cursor would return to the slant of the format after last item on format is typed. (AWANS)
10. The masks did not follow the Flight Plan Forms and sequence as used today. I feel changing this system would be easier than changing the individuals and center computers that exist today. (SAS)
11. Had to use random access to fill data blocks. This doesn't follow the form field. (SAS)

FAC - AIRCRAFT CONTACT MASK

Level I

1. Mask should read ID/TP/FR/OV. (NON)
2. It might help to add a remarks section for any unusual requests that might be made and not covered by masks or information available in the computer. (NON)
3. Very difficult for me to use but mostly attributable to being unfamiliar with local identifiers rather than the concept. (NON)

Level II

1. Same as the upper part of the FFP mask, could be eliminated. (AWANS)
2. Too much data for aircraft contact. PIREP data omit. (SAS)

Level III

1. This combo mask is nice but WWY, FDM and FCX keys not needed if combined mask is available. (SAS)
2. Aircraft contact mask fields R1, R2, R3, F2, F3 not useful. A remarks field would better serve the purpose. (SAS)
3. Field delemeter "/" is not a good symbol to use. A slash is needed on every aircraft type and equipment entry. Suggest another symbol in the lower type (no use of shift key) be used; is another frequently used symbol on PIREPS so should not be considered for symbol user. (SAS)
4. Mask fields R1, R2, F2, F3 not used in any aircraft contact. (SAS)
5. Could be exactly the same format as the UA with the information being entered into the WX system with the WWY function. (SAS)
6. Why R1-R4 and F1-F4, just put time and remarks or fix under one section, computer can place one under another. (SAS)
7. Aircraft Contact Mask should allow you to start with the AI entry instead of using one mask then call up another mask. (SAS)
8. Do not think we should have the aircraft contact mask, it is too cumbersome. Is mandatory to have flight progress strips. It is not possible to work more than one aircraft at a time using just the computer. (AWANS)
9. I used random access to enter data. Pilots do not follow forms. (SAS)

MDF - DIRECTION FINDING

Level I

1. Very good. (NON)
2. Not much better than what we now have. Need a doppler system. (NON)
3. Seems like the best program in the automated system. (NON)

Level II

1. Mask display very good. (SAS)
2. Entering airport other than DF station to obtain heading to that airport for pilot if he desires a heading or a heading to any other fix he might desire. (SAS)
3. Still don't believe it will work as I now know and use DF. (SAS)

Level III

1. Review the field identifiers for appropriateness. (SAS)
2. Excellent, makes obtaining background information much easier. (SAS)
3. Think this will be an improvement over present system, much faster, I like it. (SAS)
4. This is vast improvement over manual plotting of information. (SAS)
5. Mask fields R1, R2, R3, F1, F2, F3 not needed. A remarks field would be better. (SAS)

FED - ENCODE/DECODE

Level I

1. The Encode/Decode needs the same information as in the ID Book. (SAS)

Level II

1. FED should contain tie-in facility and ARTCC. (SAS)
2. Minimum back ground data required should be at top. You need this information before you can begin emergency assistance. (SAS)

FRT

Level I

1. Could the display also show points of available weather reports. (NON)

Level II

1. Should include overlays of significant weather charts; Weather Depiction Charts, Radar Summary, Weather Warning areas and maybe Fronts. (AWANS)
2. Very helpful. (NON)

Level III

1. Hi-lite information on chart to agree with information on page. Major identifiers on route shown on map. (SAS)

2. Excellent idea. (SAS)
3. Another excellent feature. (SAS)
4. I like this feature - the ability to overlay graphics. (SAS)
5. Helpful in visualizing route. (SAS)

FSU - SPECIAL USE AREA/ROUTES

Level II

1. Might be useful on graphics display perhaps in conjunction with FRT. (SAS)
2. Need very much some indication of location of route or MOA. Perhaps a map similar to the FRT. (SAS)

FCF - ATC SYSTEM COMMAND CENTER

Level III

1. I think this should come under the NOTAM key. (AWANS)

WUA - PILOT REPORT REQUEST

Level I

1. This was a good feature. I liked it. These should come out at the same time as the SA. (NON)

Level II

1. Less in-between information for long distance highflyers. (SAS)

Level III

1. Can programming be included to request type of UA; i.e., icing UA's, TB UA's, etc.? (SAS)
2. Would like ability to call up PIREPS by conditions; i.e., Tops, icing, turbulence, etc., along a route also. (SAS)

WWL - LOCAL WEATHER MESSEAGE

Level I

1. I don't know how useful this feature is, same information on FT, FA, and SA. (NON)

Level II

1. Omit FDC NOTAMS. (SAS)
2. Please add winds aloft information. (SAS)

Level III

1. Not needed with all other information available. (SAS)

WWT - WEATHER TREND

Level II

1. Very useful. (NON)
2. Excellent idea. (SAS)
3. Excellent idea. (SAS)

Level III

1. This is a good feature. The pilots will appreciate also. (SAS)
2. Much better than SAS. (SAS)

WSD - RADAR REPORTS

Level III

1. WSD not needed with radar graphic; too hard to visualize. SD's are being replaced with computer grid format. (SAS)

WAL COMMENTS - ALTERNATE WEATHER

Level I

1. Very good idea (NON)
2. Not all pilots have the same minimums. I don't feel this feature is very useful. (NON)

Level II

1. This is a very good addition. (SAS)
2. Excellent. (SAS)
3. Delete portions of forecast that do not fall into the "PB" time frame. (NON)
4. Saves a lot of time. (NON)

Level III

1. Would prefer to have FT and SA. (SAS)
2. Excellent addition to program. (SAS)
3. Useful briefing tool; numerous requests at sea for this type of data. (SAS)
4. Like this idea. (SAS)
5. The WAL feature is great. I think it would be better if current weather was also displayed. (AWANS)
6. Present weather and WNO should be displayed with WAL information. (AWANS)
7. Can be very useful in the field. This will save time. (SAS)

WSM - Weather Summary

Level II

1. Add synopsis to WSM at the beginning, omit FDC NOTAMS. (SAS)

Level III

1. FDC NOTAMS do not seem to be necessary for an update PB. (SAS)
2. (See WWD, Level III, #2) Too much overlap - WWD/WSM. (SAS)

WNO - Notice to Airmen

Level II

1. Omit FDC NOTAMS. (SAS)

Level III

1. Nice to have, however, is it really necessary to have it when NOTAMS are attached to SA. (SAS)
2. FDC Notams are important. They should be presented with other NOTAMS on the regular WNO format. (AWANS)

WWY - PIREP Entry

Level II

1. PIREP entry mask data was much easier to enter on vertical mask. (WWY) (NON)

Level III

1. The PIREP mask should have recall capability to add to the mask if needed after giving weather data that was requested. (SAS)
2. On the PIREP format, the specialist needs an area to free-format a message. This message can later be edited into the appropriate PIREP format. (AWANS)

WGF - Grid Winds Forecast

Level I

1. We know the format, don't need to spell it out. (NON)
2. Condensed format is much more logical for FSS briefers, but some pilots would welcome expanded FD's for self briefing. (NON)
3. Altitudes on medium level format for every station is redundant. Altitude data only needed at the top of the report. Low level winds, it is not necessary to use headings (WND-DIR SPD TEMP). The wind format is standard. (NON)

Level II

1. The altitude included above each Direction/Speed group is unnecessary and clutters display. Altitudes at top of screen would suffice. The wind can be displayed without all the words to indentify each element. (SAS)
2. The words and letters "W DIR SPD TIME" above each wind element could be eliminated. (AWANS)
3. Prefer old format, 90-390 all together. If system is geared to the FSS specialist, self-briefing terminals can be plain language for pilots; plain language format totally unnecessary for FSS specialist. (SAS)
4. Not all altitudes available. (SAS)
5. Don't believe it is necessary to have "W DIR-SPEED-TEMP stated. (SAS)
6. Don't believe it is necessary to have altitude for each line. (SAS)

Level III

1. Takes up too much room on present format. Just set up like FD. Example:
   3000 6000
   2228 2341 05 (SAS)
2. Too much information given to explain winds; have altitude at top of screen only. (SAS)
3. Current FD as printed is better suited to our needs. (SAS)
4. Will FD1, FD2 and FD3 be available? Sometimes we get requests for winds beyond current valid times. (SAS)
5. I do not need it spelled out as in low altitude format. (SAS)
6. Much extraneous data is shown on both. The data block could be shown at the top and more information could be shown on each page. (SAS)

WWD - DETAILED WEATHER

Level I

1. Less in-between information for long distance high flyers. (NON)
2. Sequencing of WSA and WFT would be better if the order were changed to be departure, en route, destination stations. (NON)

Level II

1. The weather synopsis would be helpful. (SAS)
2. Too many FT's in Detail WX. Not every station is needed especially long route briefings. (SAS)
3. Would still like to see Temporary Flight Restrictions. FDC Notams written out. Only Flight Restrictions. (SAS)
4. Some over kill; too much information/SA's.

Level III

1. Some sort of synopsis would be helpful. (SAS)
2. Quite a bit of overlap with the WSM. Perhaps one could be eliminated. (SAS)

GRAPHICS - COMMENTS

Level I

1. Problem with maps of different scales. Also, some maps simply not compatible; i.e., Surface Analysis and Weather Depiction Charts. (NON)

Level II

1. The graphic "L" used for DF could include VOR frequencies, length of longest runway and field elevation. (AWANS)
2. Would like to see some color coding. (SAS)
3. Graphics very helpful. Gives you a much better feel for the problem. (MDF) (NON)

Level III

1. Using the WX graphics on a CRT brought home the point that I scan the FAX products more than I realized. The fact that I had to call up and/or overlay graphics was time consuming. (SAS)
2. Would like graphics on MTR's at least for local area. (SAS)
3. Would like to see VFR and IFR overlays for digitized radar. (SAS)
4. Prefer one entry for overlays and background map. (SAS)

SYSTEM COMMENTS

Level I

1. I like the system and I have enjoyed working with it. (NON)
2. Data was the same, however, having the A/C stay on the scope made it a lot easier. With practice, I'm sure this would become easier. (NON)
3. Need a clear key so scope would be uncluttered. (NON)
4. I feel this is a great system for Preflight, however, EFAS and IF would get too busy to handle all traffic and do all input while trying to type in all entries. I still feel there must be a better system for FSS. (NON)
5. If basic information at top of screen could be transferred to FP after pilot receives weather, would save time. (NON)
6. Should be able to transfer basic information from A/C CTC to FP if pilot decides to file.
7. I think the order of enroute or forecast data should be departure station, enroute stations then destination stations WX. (NON)

Level II

1. Add edit functions keys for line insert - line delete, character insert - character delete. (AWANS)
2. The reason for average is not being used to the Model 2. With more time, a very good rating would be possible. (SAS)
3. With aircraft data at top of screen made it easier to brief. (SAS)
4. Random entry key very valuable. Would like to see cursor with capability of adding or deleting characters in preview area without affecting other data. (SAS insert character key and delete character key very necessary for time savings.) (SAS)
5. Would like very much to have the capability to clear basic data block of old information with simple clear key. (SAS)
6. Need some sort of acceptance response for UA's and stored FP's, etc. (like FCX response). (SAS)
7. Being from high altitude airport, I like the Density Altitude feature. (SAS)
8. How will we pass clearances? We cannot use the CRT to copy center clearances. Example: C A AF -M etc. V<2330 etc....118.4. (SAS)
9. I would like more flexibility on basic information that is kept at top of screen, such as a remarks section. Ex: FR: RT:....etc. RM: (SAS)

Level III

1. Keys for FDM, FCX and WWY don't seem necessary because FAC key has all three functions. (SAS)
2. Prefer aircraft type right after aircraft I.D. (SAS)
3. Having data block is very helpful. (SAS)
4. Extremely difficult to work the position with only a keyboard as your tool. FSS specialists will have to be really proficient typist just to be marginal input users, especially while performing air-ground work. (SAS)
5. Vertical spacing of field masks made locating fields easier for me. (SAS)

Level III (cont'd)

6. I was particularly pleased that provisions had been made to use the @ to fill random fields; it is my experience that as people become keyboard proficient they will use this option. (SAS)
7. I understand that the ability to clear the screen completely is in the spaces. For the future, this is needed, in my opinion. (SAS)
8. Like the random access key feature. (SAS)
9. The current system is set up to allow for practically every type of briefing requirement with the many specialized requirements. In actual practice it would be best to have fewer formats even though there may be some redundancy in the material presented. It is not practical for the briefer to keep all this specialized material in mind considering the average briefing request. (SAS)
10. I had to use the @ symbol for entry. This made it very useful. No pilot calls in data in order as listed. After the data for pilot planning was entered, the weather data for pilot planning was entered the weather recall was easy. (SAS)
11. Take a look at the mask situation again. See if one mask would suffice. (SAS)
12. I believe the AWANS system offers much more flexibility with less functions. (AWANS)
13. I am still of the opinion you only need one mask for briefing, flight plans, aircraft departures, etc. (AWANS)
14. (Basic information at the top of the screen) relieved me of the necessity of writing down the aircraft I.D. However, the rest of the information had to be put in in random access. This could stand improvement. (SAS)
15. Why must we be made to adapt to the machine? The machine should be adapted to our use. (SAS)

APPENDIX B

CHANGES EFFECTED FOR MODIFICATION TESTING

Message Changes

*FFP (Flight Plan)	- Entry of all data in one line without entering fields. - Random entry of multiple items before entry keystroke.
*FAC (Aircraft Contact)	- Masks combined (P,M). - New IFR position reporting section. - PIREP (WWY) Mask integrated. - New fix/time display. - Routing functions added. - FCX, FDM functions added.
*FSU (Special Use Areas)	- Limited the detail to local AFSS area. - Abbreviated display of data outside AFSS area, (included FSS identifiers, frequencies only).
FED (Encode/Decode)	- When FED called up, other data not lost.
FRR (Preferred Route)	- When FRR called up, other data not lost.
*FCF (ATC Systems Command Center)	- All flow control messages displayed as an option.
**FRT (Route Display)	- Graphic Route Display developed for route messages.
*MDF (Direction Finding)	- Extra fields added to record basic information. - Time-to-station displayed. - Weather sequence report displayed for airport selected. - Graphic display of local area (airports, roads, NAVAIDS). - Graphic overlay for restricted airspace. - Graphic overlay for weather sequences and PIREP's. Aircraft position superimposed on map with course line to airport.
WWY (PIREP Entry)	- Improved method of data input. - Integrated with FAC Mask.
*WWD (Detailed Weather)	- Graphic display of route with weather overlays through FRT Message. - FDC NOTAMS displayed as option.

	- Abbreviated MTR data outside 100 miles but available as option.
*WGF (Grid Winds)	- Two different displays to test preference. - Full display of higher altitudes as an option.
*WSM (Weather Summary)	- Same changes as WWD.
WWX (Multiple Weather)	- Greater number of combinations of message types available.
*WNO (NOTAM Display)	- FDC Notams displayed as option.
**WAL (Alternate Weather)	- Display only FT's meeting legal IFR alternate criteria.

System Changes

Aircraft Identification as first item of entry.

Developed Basic Data Block to facilitate all message processing.

Developed Universal Mask to combine best features of FAC and WWY messages and other items.

Standardized all data entry fields.

Incorporated information from these fields into masks, where appropriate.

Retained screen display of data when requesting and displaying FRR and FED.

Eliminated interference with other positions when digitized radar display called up.

Improved entry of data fields by allowing entire line to be randomly entered in one operation.

Improved system response time so data displays were nearly instantaneous.

*Denotes messages reevaluated.
**Evaluated for first time.

APPENDIX C

SPECIALISTS TEST GUIDE

Specialist Test Guide
Modification Test
June, July 1981

Welcome back to the modification test phase of the Flight Service Automation System (FSAS) evaluation.

The operation of the keyboard and method of access to weather and flight data messages is very similar to the initial evaluation. However, some changes have been made to the function switch array, some minor changes to exactly what is typed in for weather and flight data information, and changes to the mask displays. New graphics have been added, per suggestions from the previous evaluation and increased versatility has resulted from a major change to the multiple weather message.

You will be asked to evaluate the same types of messages as in the previous test. They are divided into:
(a) Flight Data Messages
(b) Weather Messages
(c) Graphics, Radar, Direction-Finder Messages.

Flight Data
*FFP - Flight Plan
*FAC - Aircraft Contact
*FCX - Cancellation
FAM - Amend FP
FDM - Departure
FSU - Special Use (Areas/Routes)
FED - Encode/Decode
FDC - FDC Notams
FRR - Preferred Route Request

Graphics
WWG - Graphics
WDR - Radar

Miscellaneous
MDF - Direction Finder

Weather
*WWY - PIREP entry
*WSA - Surface Analysis
*WWD - Detailed WX
*WFA - Area Forecast
*WFT - Terminal Forecast
*WGF - Grid Winds
*WSM - Weather Summary
WWX - Multiple Weather
WUA - Pilot Report Request
WNO - NOTAMS
WWL - Local Weather
WFX - Prognostic Map Discussion
WSO - Servere Weather
WWT - Weather Trend
WWS - SIGMETS
WWA - AIRMETS
WSD - Radar Report

A major change in the utilization of the system is information that is displayed on the top and bottom of the screen. The information at the top of the screen is called the BASIC DATA BLOCK and contains the following:

AI___
FR___ RT___
AE___ TM___ TS___ TP___ ZS___

The field identifiers are:

AI - Aircraft Identification
FR - Type of Flight
RT - Route of Flight
AE - Requested Altitude
TM - Departure Time
TS - True Airspeed or Mach Numbers
TP - Type Aircraft
ZS - Zone Size

If you use an incorrect field identifier, you will be given an error message displayed on the screen.

The BASIC DATA BLOCK is entered once and then will remain on the screen for your reference until you terminate the point contact. It is not necessary to enter the aircraft ident each time you want to request data.

In the present system, as long as the BASIC DATA BLOCK is displayed, you just select the information you want (weather, flight plan mask, etc.), hit the return key, and the requested information is displayed under the BASIC DATA BLOCK. This continous display of the BASIC DATA BLOCK is a major change and is the key to the utilization of the (modified) system. The Data Block allows a continuous display of reference information necessary during an aircraft or pilot contact. It provides a means to enter most of the information needed to process weather and flight data messages, especially route requested weather data. When a mask is called up during an aircraft contact or for flight plan filing, the information in the basic block is retained, and only the remaining required information need be entered in the mask below. For example, during a request for weather you might enter a route, altitude, and proposed departure time in the basic block. If a flight plan is to be filed, hit the FFP key and mask appears. Fill in the remaining required information only, since the route, altitude, and time are already filled in above. Change any field any time using random entry feature.

To use the random entry feature, type @, then the appropriate field identifier, the information and hit the return key.
Example: @FR IFR hit return

Changes to Function Switch Array on Genisco Keyboard

Of the 16 function keys, 13 operate as they did in Phase I of the evaluation. The three changes are the 0, 1, and 5 function keys.

Function Key	Before	Now
0	Flight Plan Mask	Aircraft Identification
1	Amend Flight Plan	Flight Plan and Amend Flight Plan (combined)
5	Encode/Decode	Multiple Weather Message (Encode/Decode is now enter via the keyboard)

See Figure 1 for a keyboard detail. Also note the @ and] symbols which are used for random access and storing data respectively.

Mask Information

The following messages utilize a mask format.

FFP - Flight Plan
MDF - Direction-Finder
WWY - PIREPS
FAC - Aircraft Contact

The Basic Data Block contains some of the information that was initially associated with the masks only. For example, altitude, route of flight, and departure time are now part of the Basic Data Block, and do not have to be re-entered on the mask. (The Data Block remains on the screen, regardless of which mask you call up.)

When completing mask information, you can determine the current field identifier by noting that it is the brightest on the screen. Enter the appropriate information, hit the return and you will see the requested location with the next field identifier, brighter and ready to receive the appropriate information. If you want to go to another area on the mask, hit the @ for random field entry and type in the information.

The aircraft contact (FAC) mask now combines several functions. These are progress reports, special flight monitoring, PIREP filing, flight plan activation or cancellation, and automatic routing features.

The WWY (PIREP) mask is still available as a separate mask.

The MDF (Direction-Finder) message has been modified to reflect the following changes. The format and content of the message has been changed, and graphics have been added. You will have the opportunity to view these changes when handling DF "problems" during the evaluation.

Other Features of The Modified System

Three new message types have been added, namely WAL, FDC, and FRT.
WAL - Alternate landing location
FDC - FDC NOTAMS
FRT - Graphic Route Display

Note that the WNO message is intact, listing all the NOTAMS, while the FDC message includes only FDC NOTAMS.

Single Weather Request

When making a single request such as for SA's, several alternatives exist.

Request	
WSA / hit return	SA's along route if you have enterd in the route of flight in the BASIC DATA BLOCK.
WSA / NJ hit return	SA's in NJ.
WSA / ACY MIV hit return	SA's for Atlantic City and Millville
WSA / ACY / hit return	SA's for the zone size (entered in BASIC DATA BLOCK, either Z50 or Z90 mile radius).

Multiple Weather Request

A multiple weather request is now entered as follows:
WWX / WFT WSA WGF etc. (select any of the 18 available subgroups, hit return and get all requested information at one time).

Encode/Decode

The Encode/Decode feature differs as follows: when you are working in a mask and you need to know certain Identication information you just type-in FED (Encode/Decode function). You do not need to enter aircraft ID since, as we have mentioned, it is permanently displayed on the top of the screen in the Basic Data Block. Also, when you now use Encode/Decode you do not wipe out the screen displaying the mask information. The mask information remains displayed while the bottom line on the screen utilizes the Encode/Decode function. The only limitation is the single line feature. This single line will only allow for a maximum of 2 idents displayed at one time, but this is quite sufficient in the vast majority of the Encode/Decode applications.

Summary

The test guide summarizes some of the changes to the system first evaluated last fall. This test guide is intended only to summarize some of the major modifications; hands-on training will allow you to become completely familiar with the system prior to training. If you have any question, do not hesitate to ask any of the personnel monitoring the test.

FUNCTION SWITCH ARRAY (DETAIL)

LEGEND

0 Aircraft Ident
1 Flight Plan and Amend FP
2 Departure Message
3 Cancel Flight Plan
4 Aircraft Contact
5 Multiple Weather Message
6 Radar
7 Graphics
8 PIREP entry
9 Area Forecast
10 Terminal Forecast
11 Surface Observations
12 Winds Aloft
13 Detailed Weather
14 Forward Page
15 Back Page

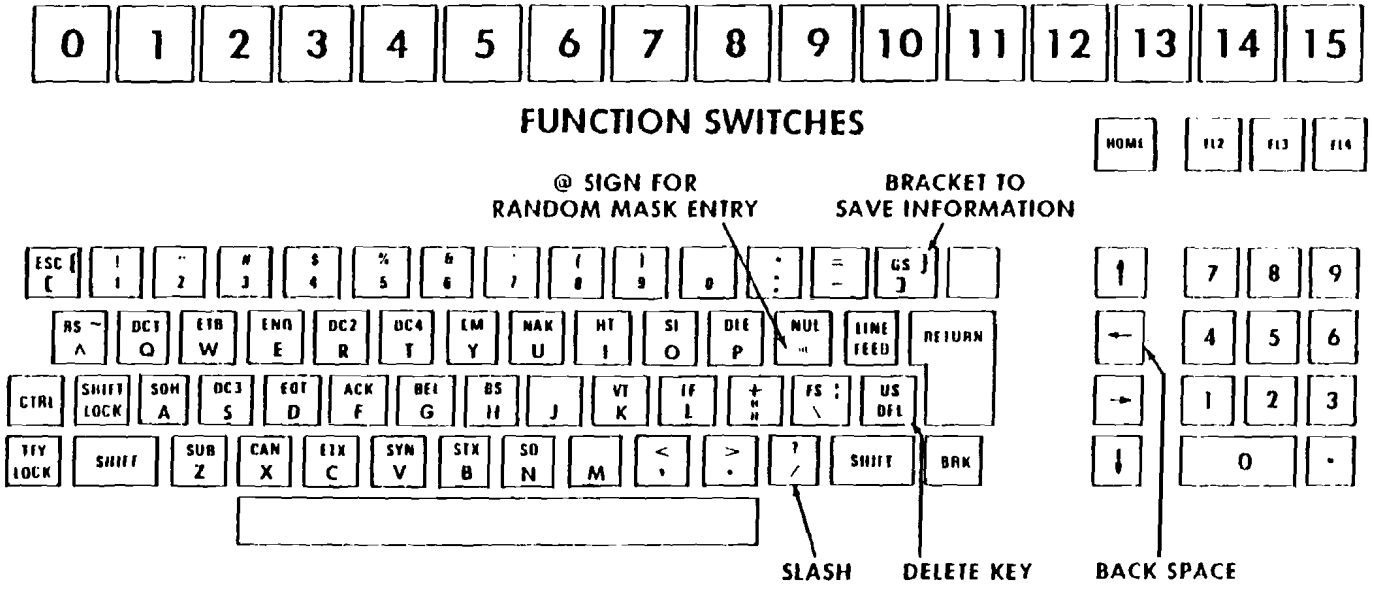


FIGURE C-1. GENISCO KEYBOARD

APPENDIX D

QUESTIONNAIRES

MESSAGES TO BE RATED	SEQUENCE OF DATA		FORMAT OF DATA		OPTIONS		DATA CONTENT		MASK DISPLAY		COMMENTS
	ADEQUATE	NOT ADEQUATE	SATISFACTORY	UNSATISFACTORY	SUFFICIENT	INSUFFICIENT	ADEQUATE	NOT ADEQUATE	SATISFACTORY	UNSATISFACTORY	
WEATHER SUMMARY (WSM)											
PILOT REPORT REQUEST (WUA)											
NOTICE TO AIRMEN (WNO)											
DETAILED WX MESSAGE (WWD)											
ALTERNATE WX MINIMUMS (WAL)											
GRID WINDS FORECAST (WGF)											
FLIGHT PLAN (FPP)											
DIRECTION FINDER (MDF)											
AIRCRAFT CONTACT (FAC)											

MESSAGES TO BE RATED	SEQUENCE OF DATA		FORMAT OF DATA		OPTIONS		DATA CONTENT		COMMENTS
	ADEQUATE	NOT ADEQUATE	SATISFACTORY	UNSATISFACTORY	SUFFICIENT	INSUFFICIENT	ADEQUATE	NOT ADEQUATE	
ATC SYSTEM COMMAND CENTER (FCP)									
SPECIAL USE AREAS/ROUTES (FSU)									
GRAPHIC ROUTE DISPLAY (FRT)									
WEATHER TREND (WWT)									
LOCAL WEATHER (WWL)									

In addition, two distinct formats are available during testing for the Winds Aloft message. Please comment on the formats available.

___(a) I prefer the data format and sequence of information as shown in the medium level winds display.
___(b) I prefer the data format and sequence of information as displayed in the low level winds display
___(c) Neither format is appropriate (explain your answer)

Specialist Evaluation Questionnaire

Level of your Facility_____

Type of Automation, if any_____

How many years of experience do you have as a Flight Service Station Specialist? _____years _____months

___EFAS ___yrs. ___PBR ___yrs.
___GOES ___yrs. ___PBI ___yrs.

Now that you have had the opportunity to re-evaluate some Model 2 functional capabilities, we would appreciate your cooperation in answering the following questions. Remember that your privacy is protected; we are not recording your name on any of our forms. This data will be used for research purposes only.

1. Do you feel that the type of messages available to you, and the information contained in them, were complete enough to allow you to satisfactorily perform your duties at the Inflight position?

___(a) The message types were sufficient
___(b) The message types were not sufficient (explain why)

2. ...At the Preflight position?

___(a) The message types were sufficient
___(b) The message types were not sufficient (explain why)

3. ...At the EFAS position?

___(a) The message types were sufficient
___(b) The message types were not sufficient (explain why)

4. In general, how would you rate the weather graphics with overlay capabilities?

___(a) Very useful
___(b) Useful, but some improvements needed
___(c) Not useful as is (explain)

5. Two screen display configurations were available for your use with the graphics. They were the side by side screens, or the over/under set-up. Which do you prefer?

___(a) The side by side configuration
___(b) The over/under configuration
___(c) Neither (explain)

6. Basic aircraft contact information is retained at the top of the screen, while you are able to retrieve requested weather information. In general, how would you rate this feature?

___(a) Very useful
___(b) Useful, but improvements are necessary
___(c) Not useful in the present format (explain)

7. How would you rate your ability to effectively brief a pilot using the Model 2 capabilities you evaluated?

___(a) Very good
___(b) Average
___(c) Not able to brief effectively (explain)

8. Evaluate the overall ease of answering pilot queries, based on improvements made to the system since your last evaluation.

___(a) Much easier, convenient to use
___(b) Not much difference
___(c) Very difficult to retrieve data in a timely fashion

9. The method of inputing basic aircraft information, and making a request for weather information has been streamlined. Can you comment on this?

___(a) Much easier, convenient to record basic data and make requests.
___(b) Recording basic data and making requests is about the same
___(c) Not convenient to use at all (explain)

10. Is there anything you want to add or comment on?

In addition, two distinct formats are available during testing for the Winds Aloft message. Please comment on the formats available.

___(a) I prefer the data format and sequence of information as shown in the medium level winds display.
___(b) I prefer the data format and sequence of information as displayed in the low level winds display.
___(c) Neither format is appropriate. (Explain your answer.)

APPENDIX E

EXAMPLES OF MASK DISPLAYS

FLIGHT PLAN FIELD IDENTIFIERS

FIELD IDENTIFIER	EXPLANATION
MX	Message type
AI	Aircraft identification
FR	Type of flight
AT	Number and type of aircraft
EQ	Communications equipment and transponder
BC	Beacon Code
TS	True airspeed or Mach number
DD	Departure time
AE	Requested altitude
RT	Route of flight
AD	Destination
TE	ETE
RM	Remarks
FB	Fuel on board
NB	Number of persons on board
AA	Alternate destination
PD	Pilot data
CR	Color of aircraft
OP	Output routing
CP	Closure point
TA	Estimated time of arrivals

PIREP TEXT ELEMENT INDICATORS

/OV	Location of Phenomena (position, time, altitude)
/TP	Type Aircraft
/SK	Sky Condition (cloud cover, base, tops)
/TA	Outside Temperature
/WV	Wind Velocity
/TB	Turbulence (intensity, altitude)
/IC	Icing (intensity, type, altitude)
/RE	Remarks

BRIEFING CHECKLIST

1) Adverse Conditions
2) VFR Flight not Recommended
3) NOTAM Information
4) Synopsis
5) Current Weather
6) Enroute Forecast
7) Destination Forecast
8) Winds Aloft
9) NOTAMS:
   - NOTAM (L)
   - NOTAM (D)
   - FDC NOTAMS
10) Flow Control
11) Requested Information
12) PIREPS
13) Closing Statement

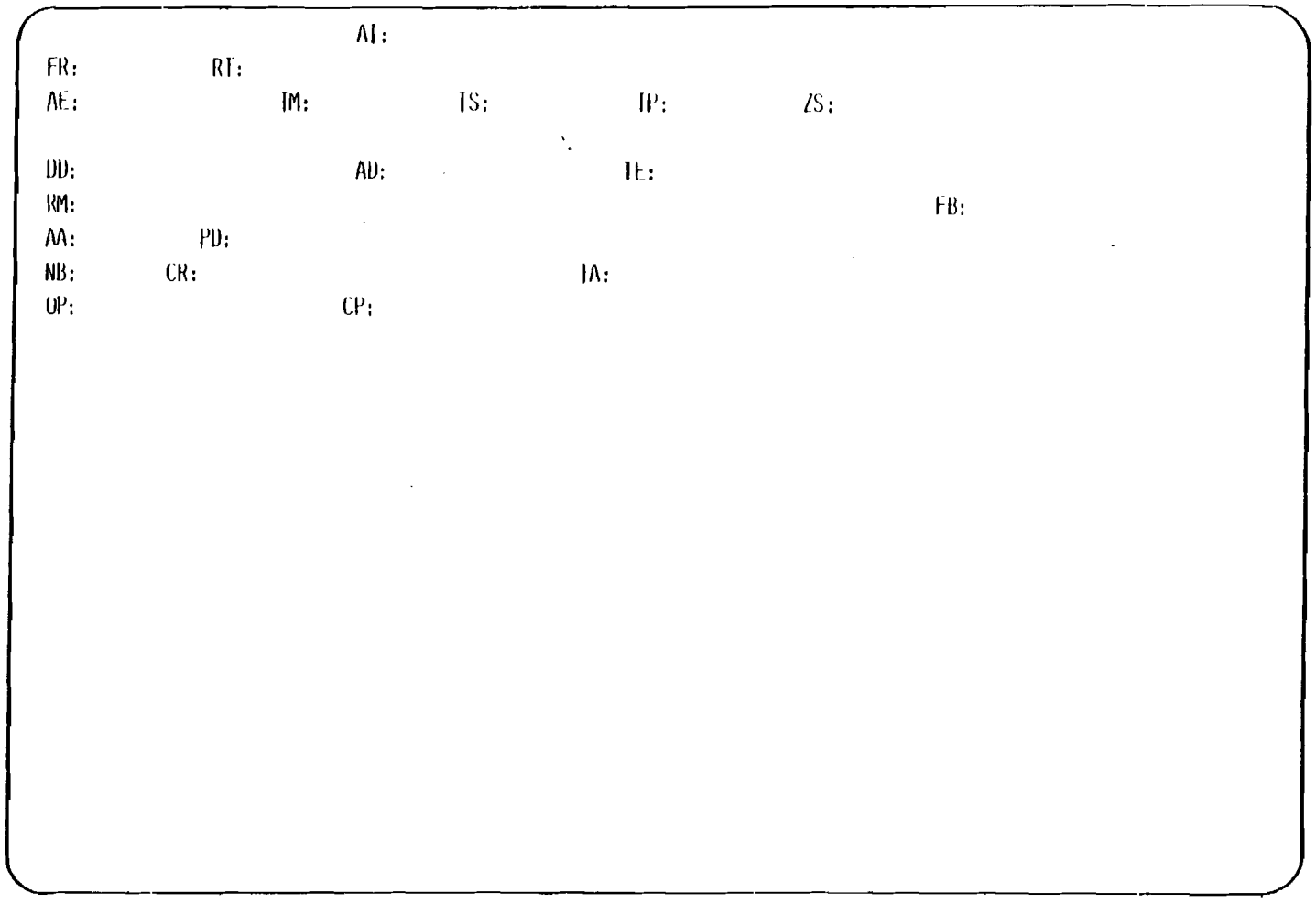


FIGURE 1. FLIGHT PLAN

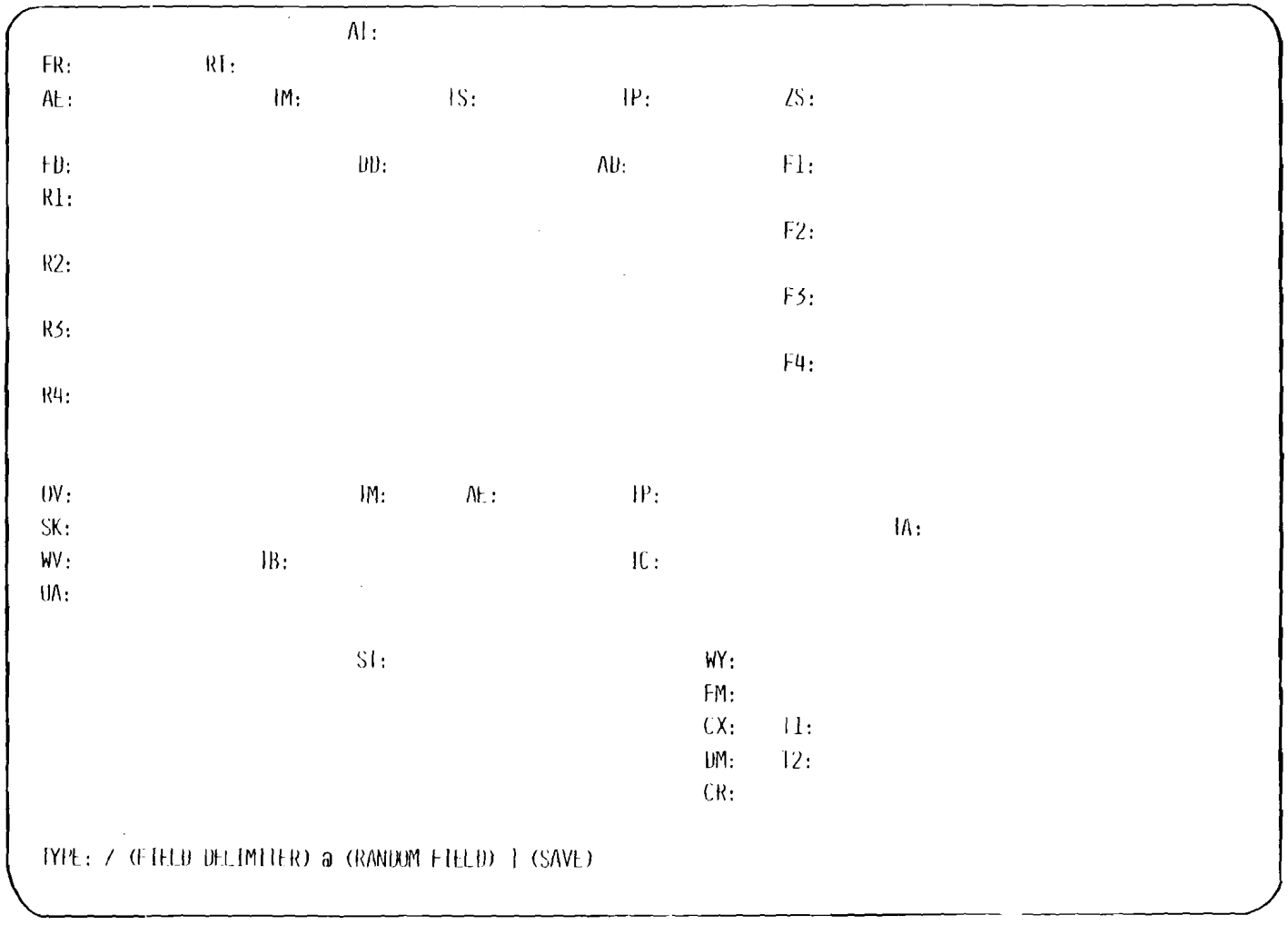


FIGURE 2. AIRCRAFT CONTACT

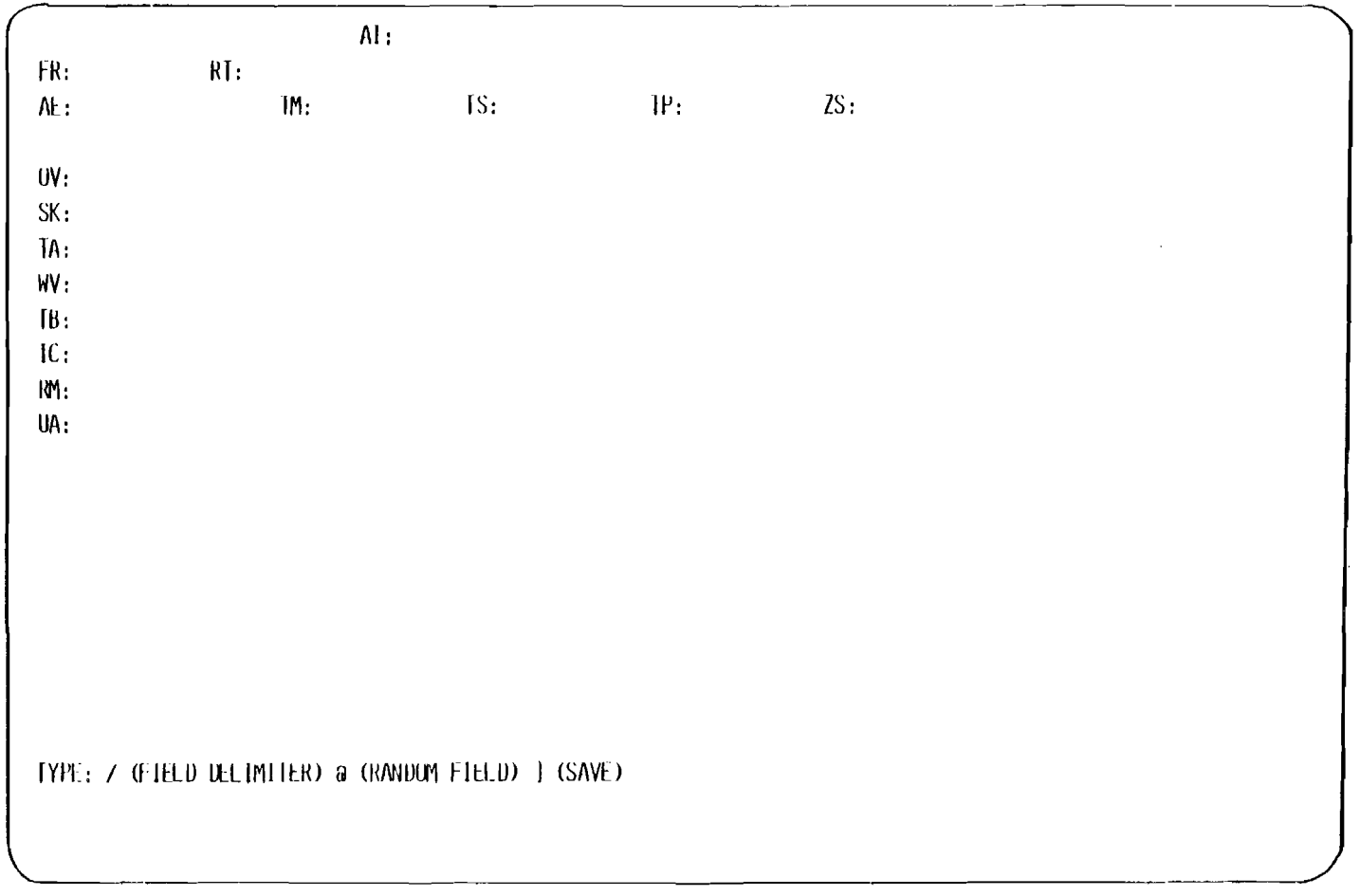


FIGURE 3. PIREP ENTRY

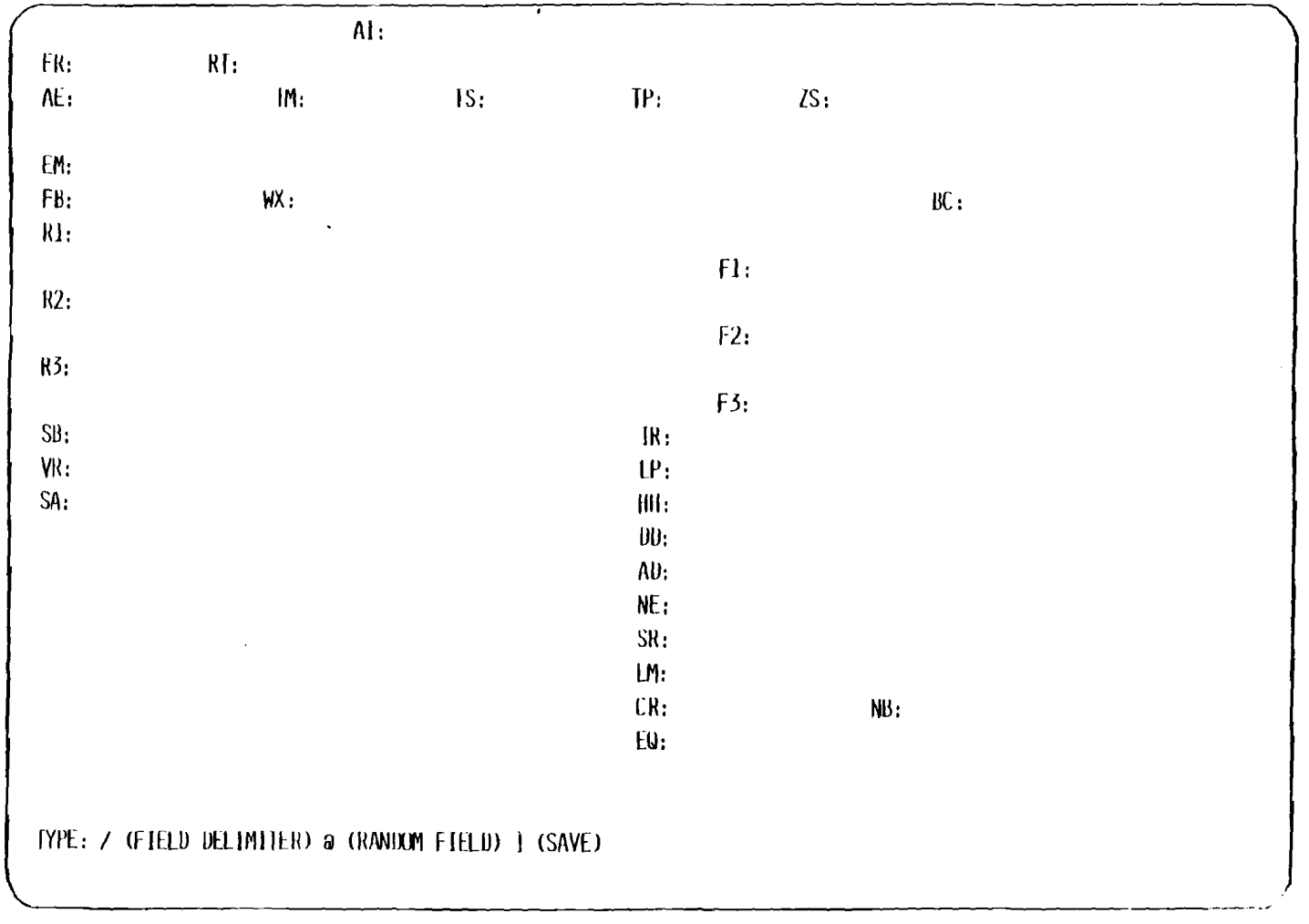


FIGURE 4. DIRECTION FINDING

APPENDIX F

LIST OF GRAPHICS PRODUCTS AVAILABLE

LIST OF GRAPHICS PRODUCTS AVAILABLE DURING TESTING

1 - 18Z SURFACE ANALYSIS - ISOBARS, FRONTS

2 - 18Z SURFACE ANALYSIS - ISOBARS ONLY

3 - 18Z SURFACE ANALYSIS - FRONTS ONLY

4 - 00Z 36 HR. SFC. PROG.

5 - 48 HR. SFC. PROG.

6 - 15Z HIGH LEVEL SIG WX PROG.

7 - 1935Z RADAR SUMMARY

8 - 18Z 500MB HTS.

9 - 18Z 500MB TEMP/DP

A - 18Z 12 HR. SFC. PROG.

B - FREEZING LEVEL

C - 21Z WX DEPICTION

D - 18Z 12 HR. SIG WX PROG.

E - 06Z 24 HR. SIG WX PROG.

F - 500MB VORTICITY

G - 19Z WX DEPICTION

H - 21Z SFC. ANALYSIS - FRONTS, ISOBARS

I - 21Z WX DEPICTION

J - 2035Z RADAR SUMMARY

APPENDIX G

DIRECTION FINDING GRAPHICS

LIST OF GRAPHICS ILLUSTRATIONS

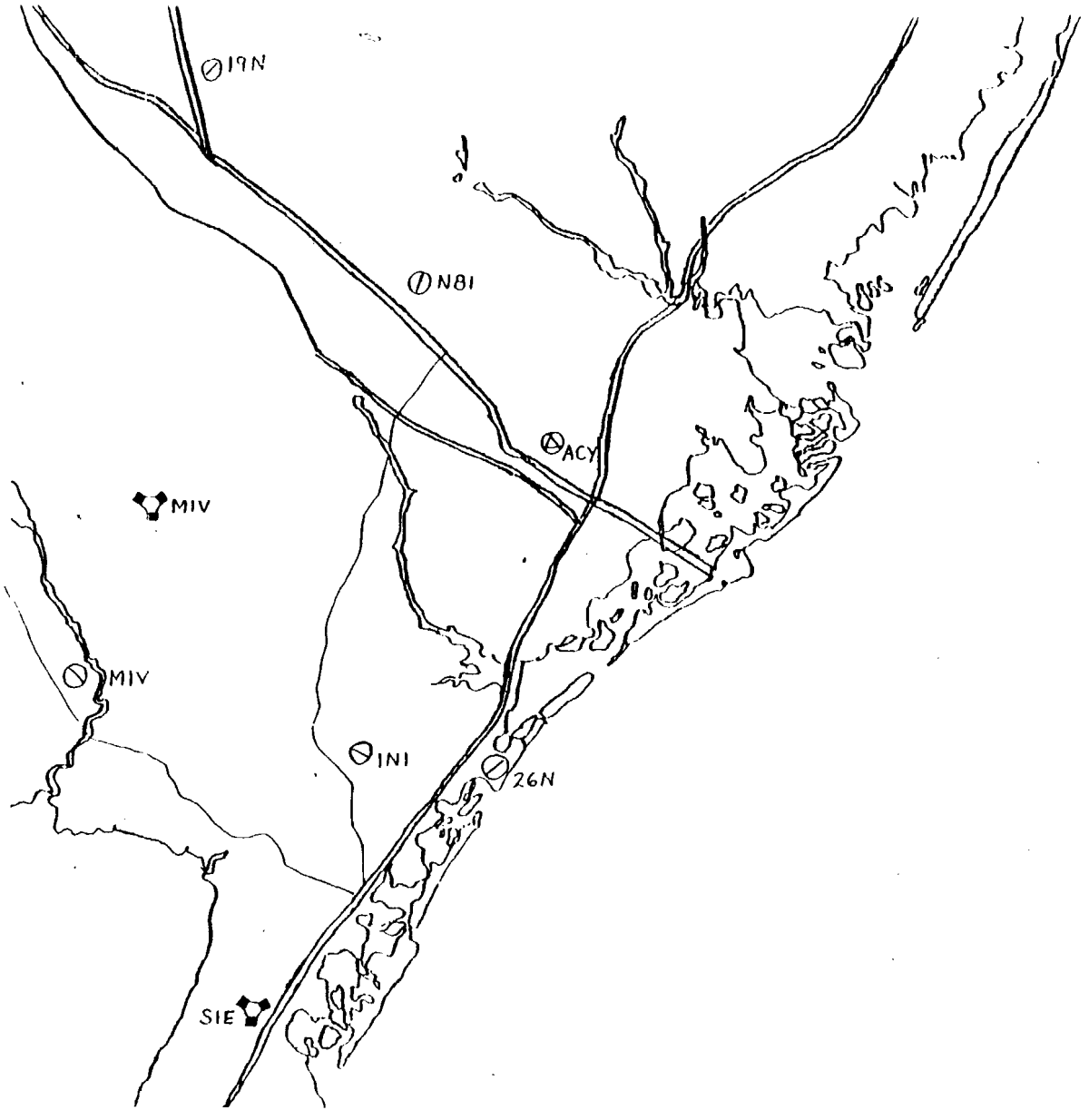


FIGURE G-1. LOCAL BACKGROUND MAP

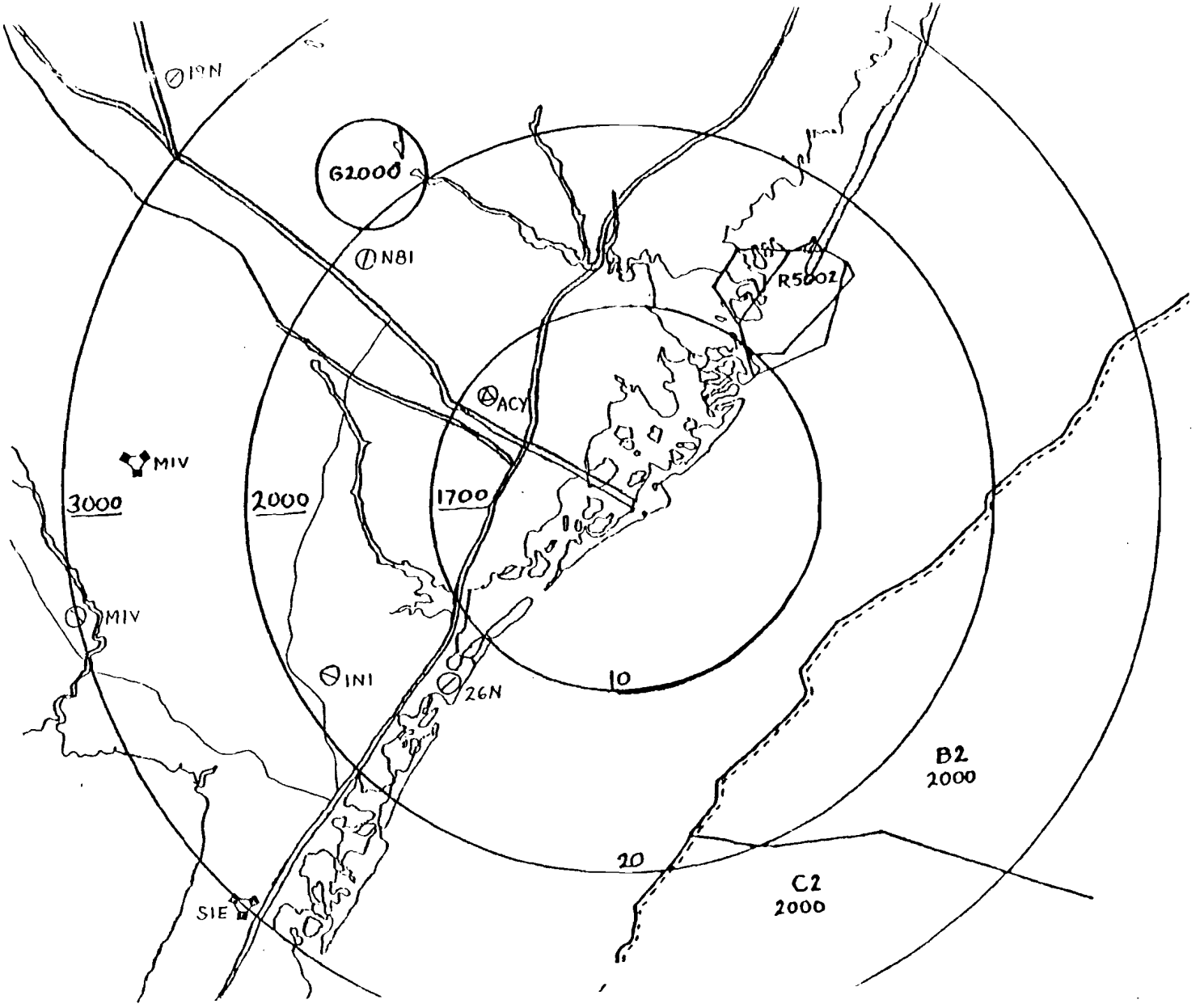


FIGURE G-2. AIRSPACE OVERLAY

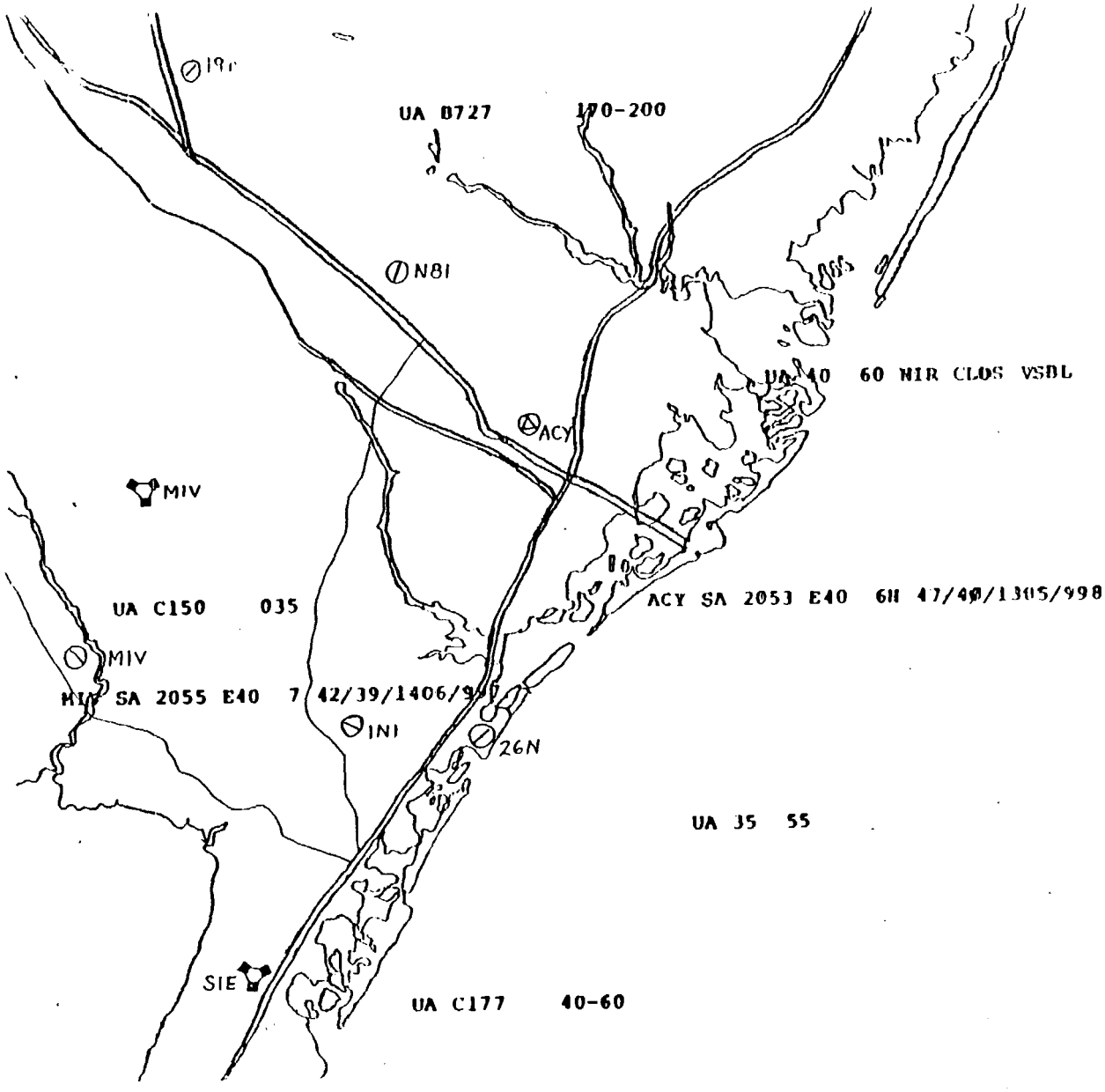


FIGURE G-3. WEATHER OVERLAY

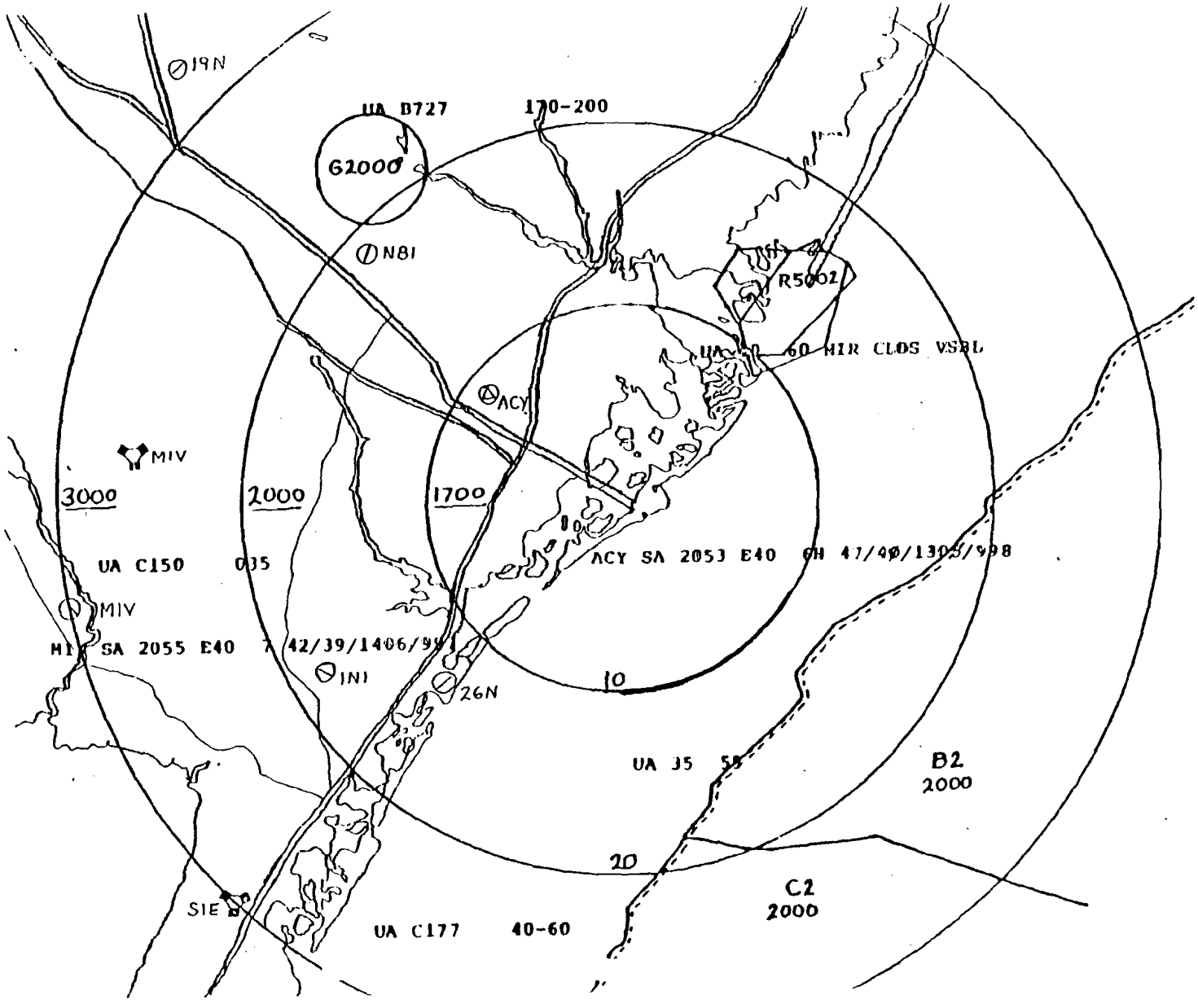


FIGURE G-4. AIRSPACE AND WEATHER COMBINED

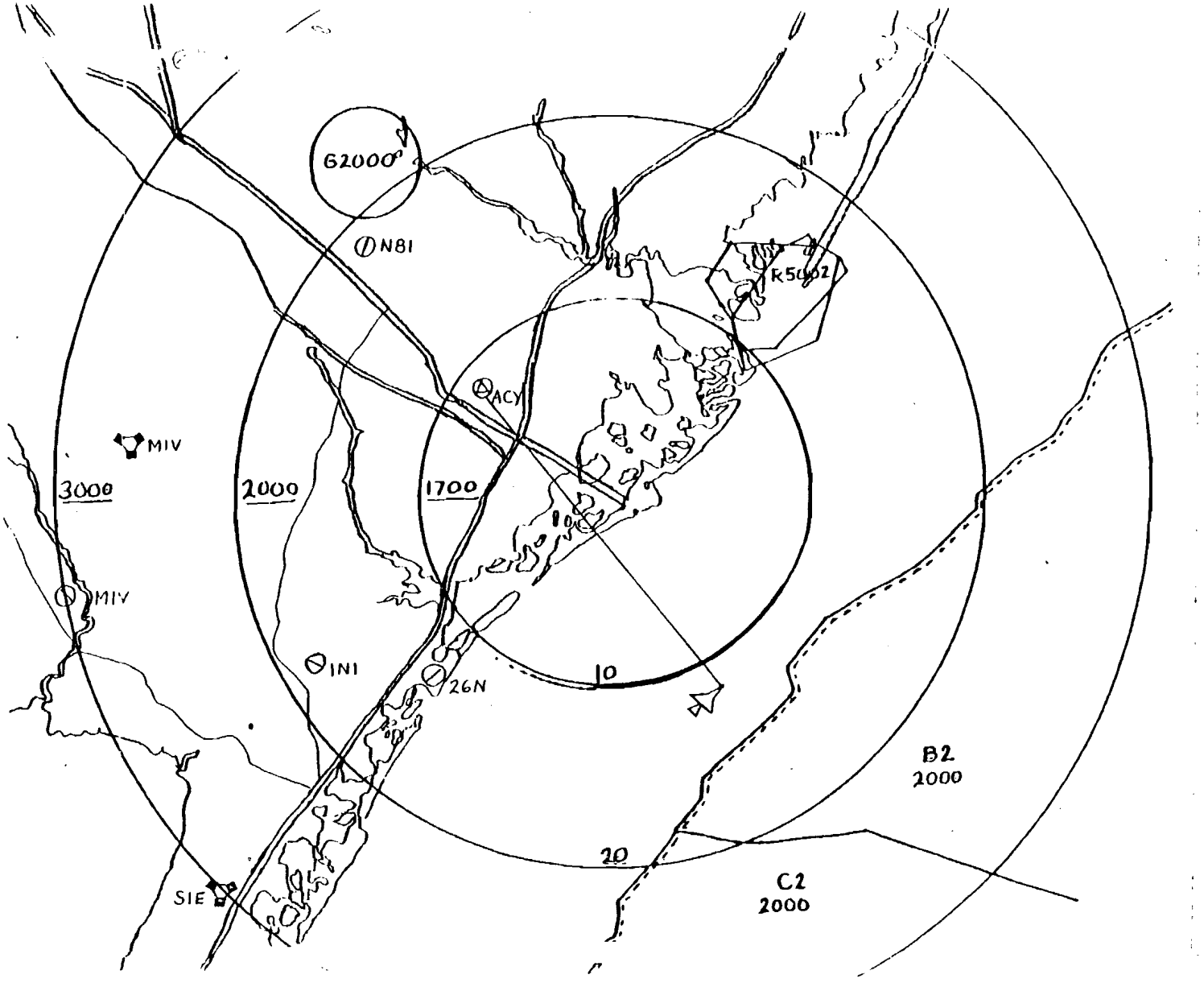


FIGURE G-5. AIRCRAFT POSITION AND COURSE LINE