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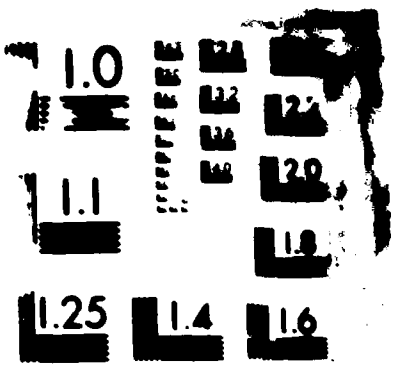
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FAA TECHNICAL CENTER
Atlantic City International Airport
N.J. 08406

The Operational Suitability of the Automated Weather Observing System (AWOS) at Heliports

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Final Report

US Department of Transportation
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16. Abstract

A questionnaire, based on an OPM-approved questionnaire, was distributed to pilots and users who were involved in the project, The Siting, Installation, and Operational Suitability of the Automated Weather Observing System (AWOS) at Heliports. This report documents the conclusions of the questionnaire analysis and provides basis for the determination of operational suitability of AWOS at heliports.

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LIST OF TABLES

EXECUTIVE SUMMARY

During 1985, a series of flight tests were made at the Federal Aviation Administration (FAA) Technical Center to develop siting standards for the installation of Automated Weather Observing Systems (AWOS) at heliports. The results of this evaluation were documented in the report "The Siting, Installation, and Operational Suitability of the Automated Weather Observing System (AWOS) at Heliports." A questionnaire (OMB approved) was distributed through the heliport operators/managers to the users of the New Orleans Downtown Heliport, Indianapolis Downtown Heliport, and Technical Center Heliport. This report presents the analysis of the questionnaires used to determine the operational suitability of AWOS at heliports.

The results of the analysis of the questionnaires indicate that the AWOS equipment is suited for heliport use. A distinction should be made between the prevailing winds at the landing area and winds in the heliport vicinity. This situation can be resolved with the use of a wind sock in conjunction with the anemometer. The wind sock should be placed near the landing pad to provide surface wind information and the anemometer should be placed as close to the nominal landing decision point height as possible in order to provide prevailing wind information above the height of obstacles surrounding the heliport.

1. INTRODUCTION.

The Federal Aviation Administration's (FAA's) Technical Center was tasked to site, install, and evaluate an Automated Weather Observing System (AWOS) at a heliport. This report documents the evaluation of AWOS in terms of its operational suitability for use at a heliport. The AWOS equipment used at all the sites was prototype hardware and not production equipment.

2. PURPOSE.

AWOS equipment was installed at the Indianapolis Downtown Heliport (Indiana), the New Orleans Downtown Heliport (Louisiana), and at the FAA Technical Center's Interim Concept Development Heliport (Atlantic City, New Jersey). A pilot questionnaire was distributed to the users at these locations. The questionnaire was designed to evaluate the operational suitability of AWOS at heliports. This report contains the analysis of these questionnaires.

3. BACKGROUND.

3.1 HELIPORTS.

The Indianapolis Downtown Heliport is located approximately 4 nautical miles (nmi) east-northeast of the Indianapolis International Airport. It averages 10 operations (arrivals/departures) daily. The AWOS platform is located in a depression which is 6 feet below the landing pad. The anemometer is 12 feet above ground level (AGL) and the wind sock is 6 feet from the AWOS site (appendix A-1).

The New Orleans Downtown Heliport is located approximately 12 nmi from the New Orleans International Airport. It is across the street from the Superdome, next to a major elevated highway in the New Orleans downtown business district. The AWOS is located on the southwest corner of the field next to railroad tracks. The anemometer was placed 14 feet AGL. A wind sock is located about 110 feet from the center of the landing pad next to the parking lot on the north side of the heliport (appendix A-2).

The FAA Technical Center's Interim Concept Development Heliport is located on the grounds of the Atlantic City International Airport. It is situated at the approach end of the closed runway 35. The AWOS was installed 195 feet from the center and abeam the leading edge of the landing pad. The anemometer was placed on a crank-up tower to permit evaluation of the wind sensors in the range of 11 to 30 feet AGL (appendix A-3).

3.2 PILOT INFORMATION.

Twenty-eight pilots completed the AWOS questionnaire: 16 from Indianapolis, 7 from New Orleans, and 5 from the Technical Center. Characteristics of the sample

pilot population are contained in table 1. The pilots represented a broad spectrum of affiliations; military, government (city, state, and federal), media, emergency medical services, and private corporations. Although no attempt was made to guarantee a cross-section of experience in the sample population, their recent helicopter flying experience ranged from 6 to 550 flight hours during the last 6 months. Their instrument flying hours ranged from 0 to 800 hours.

4. METHODOLOGY.

Pilots at the three sites were asked to complete a questionnaire. A sample questionnaire is presented in appendix B. Three categories of information were requested: (1) pilot background information, (2) evaluation of AWOS performance, and (3) recommendations for enhancement of the AWOS at heliports.

Four Technical Center pilots completed the questionnaire twice. This was done because the anemometer was evaluted at two different heights, 15 and 30 feet. Emphasis was placed on the verbal comments of two of the pilots sampled, one from Indianapolis and the other from New Orleans. They were the primary users of their respective heliports representing approximately 12 operations (approach/departure) daily.

5. RESULTS.

The following is a summary of the questionnaire responses. Questions 2 through 5 required a rating response from 1 (poor) to 5 (excellent).

5.1 RECEPTION OF INFORMATION.

The AWOS reception distance and altitude requirements of 25 miles at 2500 feet AGL, as specified in the Airman's Information Manual (Par 509, Sub-Par B, Par 3) were met at all sites. Pilots reported receiving AWOS information from 0.5 to 90 nmi from the AWOS site. A summary of responses is shown in table 2. Two pilots from New Orleans indicated that the reception is poor when flying inbound from the northeast. This situation could be caused by the tall buildings located northeast of the heliport.

5.2 ACCURACY OF THE AWOS.

The mean response to the question on wind accuracy was 3.88 (appendix C-1). Table 3 presents the results of the wind accuracy survey. The individual site means ranged from 3.00 at New Orleans (14-foot sensor height), to 4.25 at the Technical Center (15-foot sensor height). The 32 responses received were distributed as shown in table 4.

TABLE 1. CHARACTERISTICS OF PILOT RESPONDERS

Helicopter IFR Hrs	Helicopter Flt Hours Last 6 mo.	Affiliation	Home Base	State
Atlantic City				
3	36	FAA Technical Center	Atlantic City	NJ
20	100	FAA Technical Center	Atlantic City	NJ
25	30	FAA Technical Center	Atlantic City	NJ
150	60	U.S. Air Force	Atlantic City	NJ
415	120	Army National Guard	Trenton	NJ
Indianapolis				
0	150	Indiana State Police	Indianapolis	IN
0	30	Indianapolis Police Dept.	Indianapolis	IN
0	75	Indiana State Police	Indianapolis	IN
0	300	Roto-Whirl Inc.	Indianapolis	IN
2	200	Lifeline Methodist Hospital	Indianapolis	IN
15	160	U.S. Army	Fort Knox	KY
20	156	Lifeline Methodist Hospital	Indianapolis	IN
30	500	Trafficopters Inc.	McCordsville	IN
75	200	Omniflight Helicopters	Janesville	WI
75	100	Ohio Army National Guard	Columbus	OH
85	6	Amax Coal Company	Indianapolis	IN
100	75	TV 13	Indianapolis	IN
200	20	Indianapolis Heliport Corp.	Indianapolis	IN
325	200	Ohio Army National Guard	Worthington	OH
600	250	Ohio Army National Guard	Greensburg	OH
800	350	Solar Sources Inc.	Indianapolis	IN
New Orleans				
0	250	Air Link Airways Inc.	Montegut	LA
0	100	Private-Self	New Orleans	LA
50	200	Petroleum/Acadian Ambulance	Jefferson	LA
50	185	Suwest Airways	Slidell	LA
100	50	Air Logistics	Bell Chase	LA
300	550	Petroleum Helicopters, Inc.	Jefferson	LA
300	50	Petroleum Helicopters, Inc.	Lafayette	LA

TABLE 2. RECEPTION DISTANCES OF AWOS INFORMATION FROM ALL THREE SITES

Heliport	Reception in nmi
Technical Center	
30 ft. sensor	2 to 50 nmi
15 ft. sensor	2 to 50 nmi
Indianapolis	2 to 90 nmi
New Orleans	0.5 to 45 nmi

TABLE 3. ACCURACY OF AWOS WIND INFORMATION (THREE SITES)

Heliport	Mean Pilot Rating*
Technical Center	
30 ft. sensor	4.20
15 ft. sensor	4.25
Indianapolis	4.06
New Orleans	3.00

*On a scale of 1 to 5, where 1 is poor and 5 is excellent.

TABLE 4. DISTRIBUTION OF WIND ACCURACY RESPONSES

		Location			
	Total No.	Tech Center 15 ft Sensor Height	Tech Center 30 ft Sensor Height	IND	N.O.
Excellent	10	2	2	5	1
Better than fair	14	1	2	9	2
Fair	4	1	1	0	2
Less than fair	2	0	0	2	0
Poor	2	0	0	0	2

Note:

IND = Indianapolis
N.O. = New Orleans

Two Technical Center pilots responded "excellent" to both sensor heights, 15 and 30 feet. The two pilots who rated the accuracy below fair indicated that the site location influenced their rating. One Indianapolis user said, "...AWOS is in a depression and among building (*sic*) where wind speed is dampened and deflected by the building and the ground." Three pilots from New Orleans commented that the accuracy of the wind information is affected by the location of the AWOS at the heliport.

5.3 OVERALL SYSTEM EVALUATION.

The mean of the responses to the question on overall system evaluation was 3.94, as depicted in appendix C-1. The individual site overall system evaluations are presented in table 5. Means responses ranged from 3.50 at the Technical Center (15-foot sensor height) to 4.19 at Indianapolis. The 32 responses received were distributed as shown in appendix C-1. The results of overall system performance at various locations are shown in table 6.

Two Technical Center pilots changed their rating, one to "excellent" and the other to "better than fair,"when the anemometer was raised to 30 feet. Several pilots rated the system "fair" as the result of the operation of an incomplete system. In New Orleans, the ceilometer and visibility sensors were out of service. In Indianapolis, the ceilometer was out of service. Only the Technical Center's AWOS had all the elements functional. According to the AWOS description in the Airman's Information Manual, the New Orleans installation was classified as an AWOS-2 and the Technical Center an AWOS-3.

TABLE 5. RATINGS OF THE OVERALL AWOS SYSTEM FROM ALL THREE SITES

Heliport	Mean Pilot Rating*
Technical Center	
30 ft sensor	3.80
15 ft sensor	3.50
Indianapolis	4.19
New Orleans	3.71

*On a scale of 1 to 5, where 1 is poor and 5 is excellent.

TABLE 6. OVERALL SYSTEM RATINGS AT VARIOUS LOCATIONS

		Location			
	Total No.	Tech Center 15 ft Sensor Height	Tech Center 30 ft Sensor Height	IND	N.O.
Excellent	6	0	1	4	1
Better than fair	18	2	2	11	3
Fair	8	2	2	1	3
Less than fair	0	0	0	0	0
Poor	0	0	0	0	0

Note:

IND = Indianapolis
N.O. = New Orleans

5.4 AWOS SUITABILITY FOR HELIPORT OPERATIONS.

The mean of the responses to the question of AWOS suitability for heliport operations was 4.44, as presented in appendix C-1. The individual site means were very close and are presented in table 7. They range from 4.0 at the Technical Center (15-foot sensor height) to 4.56 at Indianapolis.

The 32 responses, at the various locations, to this question were distributed as shown in table 8.

TABLE 7. SUITABILITY OF AWOS FOR HELIPORT OPERATIONS

Heliport	Mean Pilot Rating*
Technical Center	
30 ft sensor	4.40
15 ft sensor	4.00
Indianapolis	4.56
New Orleans	4.43

*On a scale of 1 to 5, where 1 is poor and 5 is excellent.

TABLE 8. AWOS SUITABILITY RATINGS AT VARIOUS LOCATIONS

		Location			
	Total No.	Tech Center 15 ft Sensor Height	Tech Center 30 ft Sensor Height	IND	N.O.
Excellent	16	0	2	10	4
Better than fair	14	4	3	5	2
Fair	2	0	0	1	1
Less than fair	0	0	0	0	0
Fair	0	0	0	0	0

Note:

IND = Indianapolis
N.O. = New Orleans

Two of the Technical Center pilots changed their ratings from "better than fair" to "excellent" when the anemometer was raised to 30 feet. No comments were expressed by the pilots who rated the system's suitability "fair." However, the overall consensus was that the equipment was very suitable for heliport operations. The "on location" weather information was considered valuable, particularly for use at remote heliports.

5.5 LOCATION.

The question on the systems' location, relative to the landing area, generated a wide variety of responses. The summary of responses is presented in appendix C-2. The mean responses for this question was 2.96. This indicated that the pilots were less satisfied with the equipment siting than they were with its performance. The individual site mean responses ranged from 2.5 at New Orleans to 3.5 at the Technical Center (15-foot sensor height), as shown in table 9.

The 32 responses received were distributed as shown in table 10.

The "no ratings" were from pilots who were unsure of the exact equipment location at both Indianapolis and New Orleans. Two Technical Center pilots changed their ratings when the anemometer was raised to 30 feet, one to "fair" from "better than fair" and the other to "better than fair" from "excellent". The lowered ratings were caused by the perception that the anemometer was more of an obstruction at the 30-foot height than at the 15-foot.

In Indianapolis, one user felt that the visibility report was often inaccurate due to the sensor location. The equipment is located in a gully below the level of the landing area where fog forms more quickly. Three pilots indicated that the anemometer should be located higher above the landing area, either close in lateral proximity to the landing decision point elevation or placed on the roof of an adjacent building. The wind sock should then be sited closer to the landing area for use in determining surface wind direction. Another pilot indicated that it is not uncommon to have three or more helicopters manuevering on the ramp at the same time and that the rotor downwash appears to have an impact on the anemometer. This effect seems to be due to the wind sensor height above the landing area elevation. This is supported by Technical Center test results when the anemometer was placed at a height of 15 feet.

In New Orleans, the comments received voiced similar concerns as those from Indianapolis. The AWOS is located at ground level, approximately 210 feet from the center of the landing area. It is surrounded by an elevated highway, structures, and a railroad track. Two users felt that the wind effects caused by these structures and transient railroad traffic caused inaccurate wind reports. A frequent user said, "...wind swirls so much at the heliport that the wind

TABLE 9. RATINGS OF THE LOCATION OF THE AWOS

Heliport	Mean Pilot Rating*
Technical Center	
30 ft. sensor	2.60
15 ft. sensor	3.50
Indianapolis	3.07
New Orleans	2.50

*On a scale of 1 to 5, where 1 is poor and 5 is excellent

TABLE 10. LOCATION SURVEY RESULTS

		Location			
	Total No.	Tech Center 15 ft Sensor Height	Tech Center 30 ft Sensor Height	IND	N.O.
Excellent	3	1	0	1	1
Better than fair	7	1	1	5	0
Fair	8	1	2	4	1
Below fair	4	1	1	2	0
Poor	5	0	1	2	2
No rating	5	0	0	2	3

Note:

IND = Indianapolis
N.O. = New Orleans

sensor seems to be too sensitive to the turbulence of the surroundings." He felt the wind sensor should be located at a higher elevation.

At the Technical Center, some of the negative ratings were caused by the perception that the AWOS site was too close to the landing pad. Three pilots remarked that the wind sensor was too close and that it caused an additional obstruction. It should be noted that the AWOS siting at the Technical Center, even at the 30-foot anemometer height, conformed to clearance zone criteria identified in the Heliport Design Guide, AC 150/5390-1B.

5.6 ACCURACY OF CEILING AND VISIBILITY REPORTS.

Question 6 asked the pilots to compare the broadcasted AWOS ceiling and visibility reports to their observed conditions. During the course of this evaluation, the ceilometer was nonfunctional in Indianapolis and New Orleans, and operating intermittently at the Technical Center. For the three Technical Center flights that the ceilometer was functional, there were no reported differences between the reported and actual ceiling information.

The visiometer (visibility sensor) was nonfunctional at New Orleans, intermittent at Indianapolis, and fully operational at the Technical Center. The few comments received questioning the accuracy of this sensor shows a lack of knowledge of the limitations of the equipment. When the visibility exceeds 5 miles, the AWOS reported "...visibility greater than 5 miles." At the Technical Center, where the pilots were briefed on equipment performance, the reported visibility was considered accurate. When this situation occurred in Indianapolis, several pilots felt that information was erroneous indicating a need for pilot training in the interpretation of AWOS information.

5.7 OTHER COMMENTS.

The following is a summary of the comments received for questions 7 through 11.

Question 7. "What did you like best about the AWOS?"

The pilots liked the availability of real time weather information. The message is clear and concise, and as one pilot put it, "short and sweet," and is available 24 hours a day. The telephone hook-up (dial-up capability) was found to be very helpful in making "go/no-go" decisions.

Question 8. "What did you like least about the AWOS?"

This question generated a wide variety of comments, such as; "its inability to determine precipitation accurately," "missing ceiling information" (at the three sites), "inaccurate visibility reports" (Technical Center and Indianapolis), "incorrect wind information" (New Orleans and Indianapolis), "altimeter setting sometimes missing," "the AWOS location is poor" and/or "the anemometer is too close to the landing area," and "the radio transmission bleeds over to the heliport unicom frequency, 123.05 MHz" (New Orleans and Indianapolis).

Question 9. "Was there any increase in your workload?"

Only two pilots felt that their workload was increased by the AWOS. One of these pilots stated that workload increased due to the resulting obstacle created by the 30-foot tower height at the Technical Center. The other pilot stated they workload increased because his helicopter only had one radio, requiring him to switch frequencies several times. Two pilots at Indianapolis felt that there was a decrease in their workload.

Question 10. "What additional information would you want for heliport installation?"

Several users indicated that they would like the following additional information transmitted by the AWOS: local Notice to Airmen's (NOTAM's), approach course information, and ceiling information. At the time of this evaluation the ceilometer at Indianapolis and New Orleans were inoperative.

Question 11. "(Optional) Please feel free to comment further."

The users felt that the AWOS provides useful, real time information to both inbound and outbound traffic. Some of the pilot comments were: "...the information is beneficial;" "particularly for remote areas, it is valuable for use during thunderstorms and clouds;" and, "for obstacle clearance and physical safety, the AWOS should be located as far as possible from the takeoff and landing area."

6. ADDITIONAL TESTING.

After analyzing the sensor performance data and comparing the results at the two sensor heights, 15 and 30 ft AGL, additional testing was conducted at the Technical Center heliport with the wind sensor at 20 and 25 feet AGL. The results indicated that the anemometer could be installed at 20 feet and provide the same performace that was found at 30 feet. Performance data for the various sensor heights can be found in Final Report DOT/FAA/PM-86/30, DOT/FAA/CT-86/9, "The Siting, Installation, and Operational Suitability of the Automated Weather Observing System (AWOS) at Heliports" dated August 1986 (AD A175232).

7. CONCLUSIONS.

1. The AWOS equipment is suited for heliport use. Pilots may use weather information provided by the AWOS to fulfill the requirements of various FAR's.

2. There is a potential difference between the wind conditions at the landing area and the prevailing wind conditions in the vicinity of the heliport at elevations above the height of surrounding obstacles. A distinction must be made between the prevailing winds at both locations.

3. A wind sock should be used in conjunction with the anemometer. The anemometer should be placed at a height as close to nominal landing decision point height as possible in order to provide prevailing wind information. The wind sock should be installed near the landing pad to provide surface wind information. This placement of equipment would result in information similar to center field wind indications reported by air traffic control and pilot perceived wind condition sensed by a wind sock adjacent to the runway touchdown zone.

4. If the anemometer is placed near the landing area to provide surface wind information, then the sensor shall be placed between 20 and 30 feet above the landing surface.

APPENDIX A

ILLUSTRATIONS OF AWOS SITES

APPENDIX A

ILLUSTRATIONS OF AWOS SITES

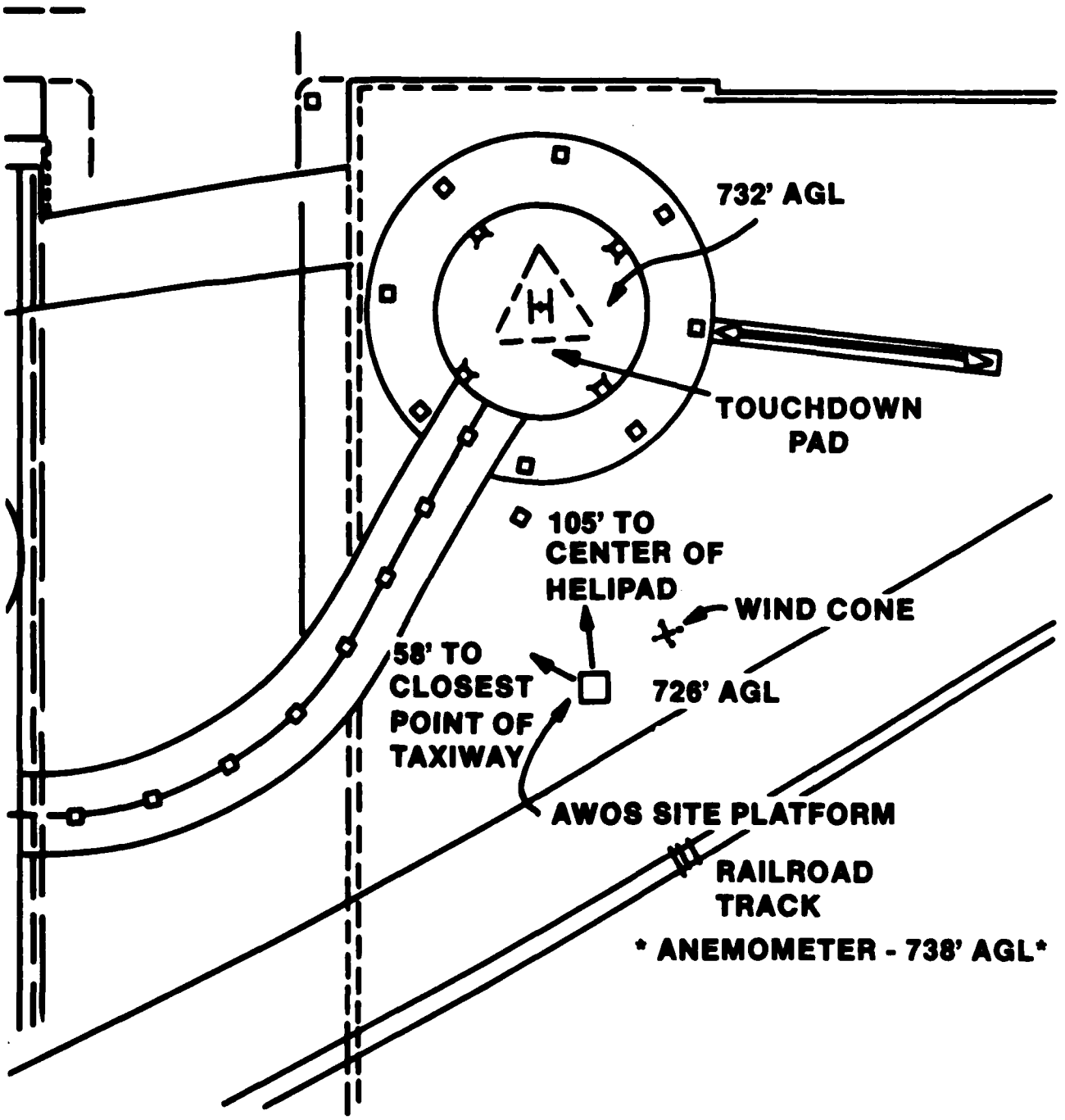


FIGURE A-1. INDIANAPOLIS DOWNTOWN HELIPORT

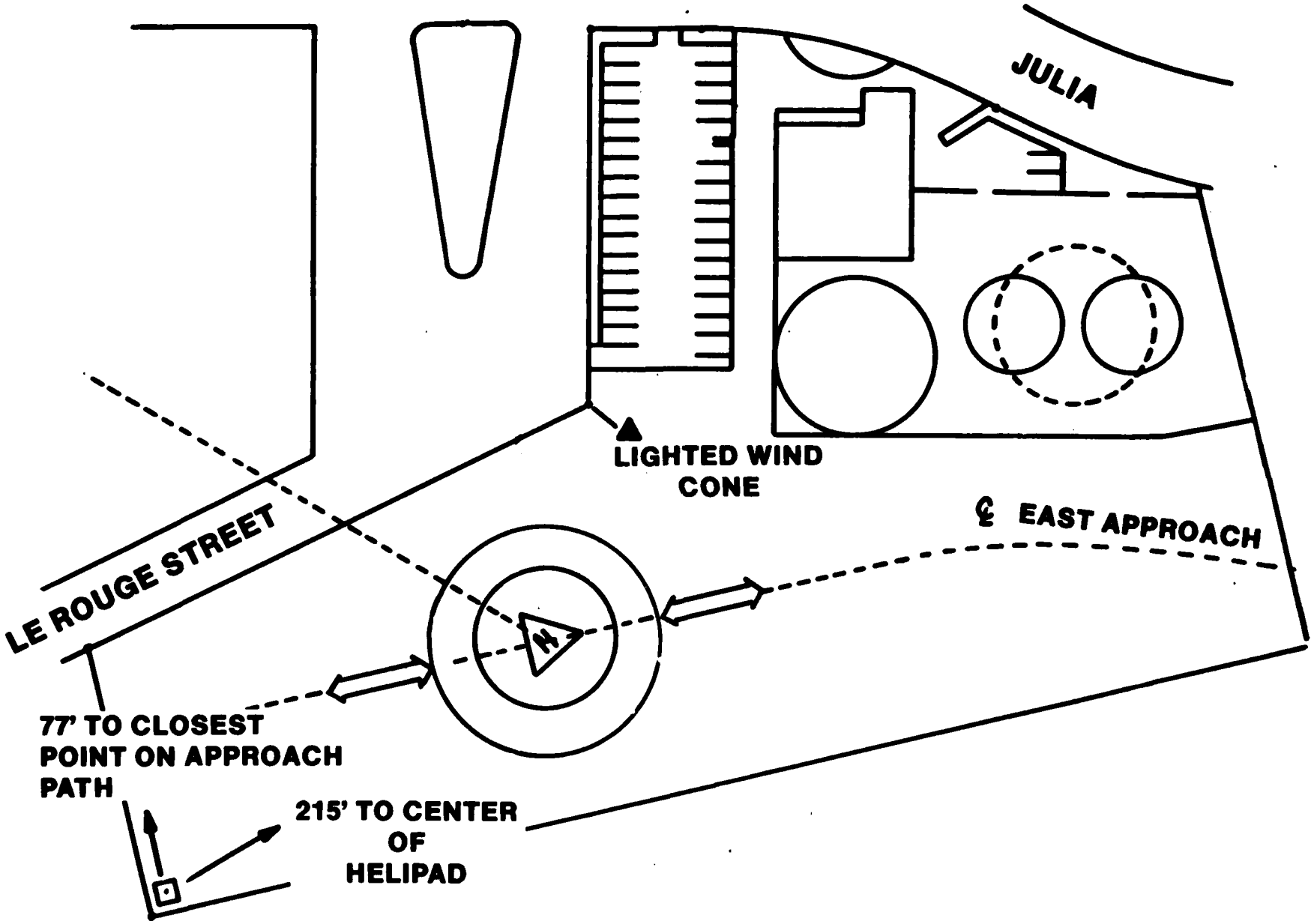


FIGURE A-2. NEW ORLEANS DOWNTOWN HELIPORT

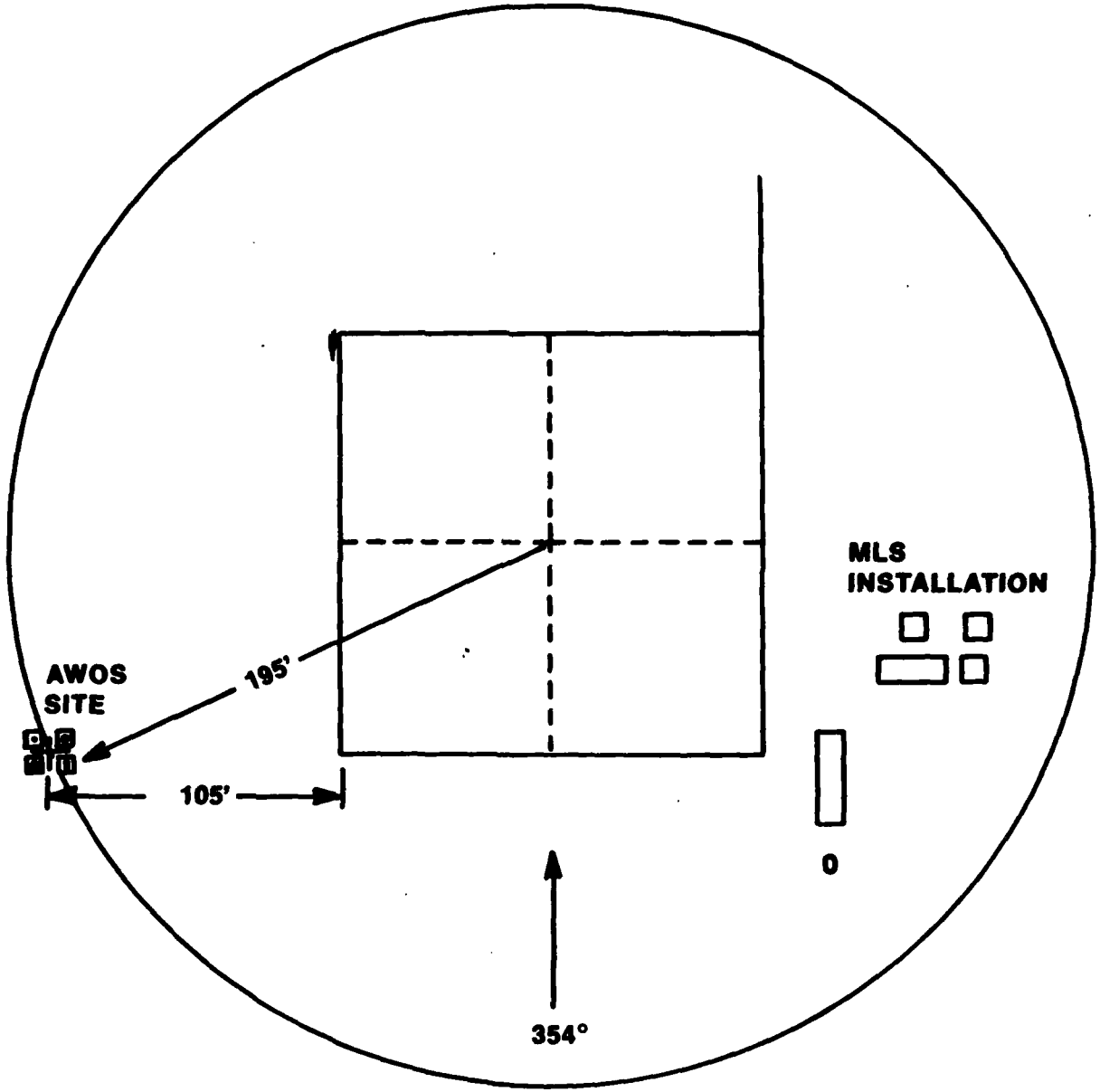


FIGURE A-3. FAA TECHNICAL CENTER'S INTERIM CONCEPT DEVELOPMENT HELIPORT

APPENDIX B

AWOS QUESTIONNAIRE

OPERATIONAL PILOT QUALIFICATIONS

NAME:

AFFILIATION:

ADDRESS:

CITY: STATE: ZIP:

ACTUAL HELICOPTER IFR HOURS:

HELICOPTER HOURS LAST 6 MONTHS:

PERIOD OF FAA FLIGHT TEST:

1. How far from the heliport were you when you received the weather information?

2. How accurate do you feel the wind direction and speed report is:

If poor, explain why if possible.

I-----I-----I-----I-----I
1 2 3 4 5
Poor Fair Excellent

3. Rate the overall system:

I-----I-----I-----I-----I
1 2 3 4 5
Poor Fair Excellent

4. Rate the suitability of AWOS for heliport operations?

I-----I-----I-----I-----I
1 2 3 4 5
Poor Fair Excellent

5. Rate the location of AWOS?

If poor, explain why if possible.

I-----I-----I-----I-----I
1 2 3 4 5
Poor Fair Excellent

7. What did you like best about the AWOS?

8. What did you like the least about the AWOS?

9. Was there any increase in your workload?

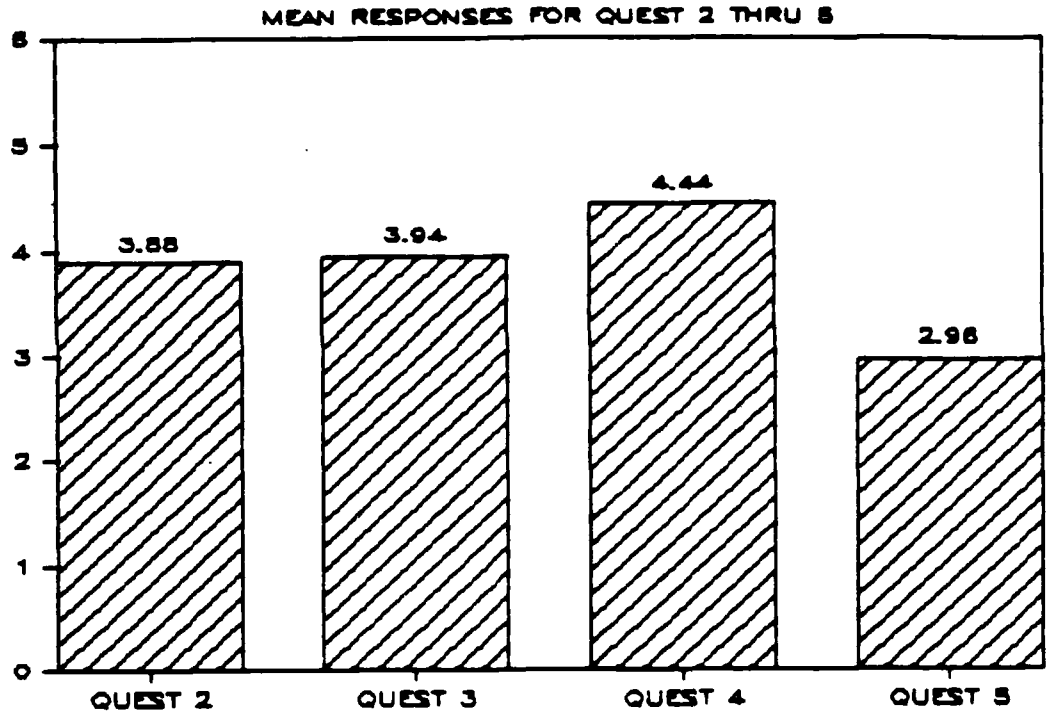
10. What additional information would you want for heliport installations?

11. (Optional) Please feel free to comment further.

APPENDIX C

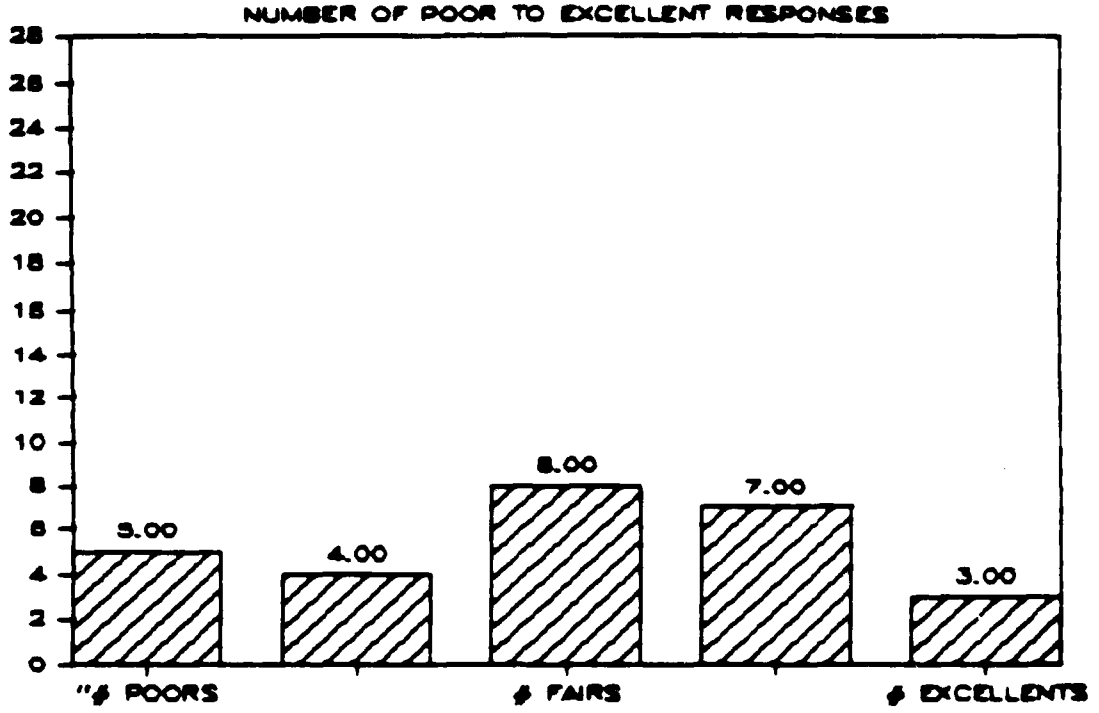
QUESTIONNAIRE RESPONSES

QUESTIONNAIRES FROM ALL THREE SITES



RATING OF OVERALL SYSTEM

LOCATION OF THE SYSTEM



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