AD-A107 874 TRANSPORTATION SYSTEMS CENTER CAMBRIDGE MA F/G 17/7

BUFFALO AIR TRAFFIC CONTROL TOWER OPERATIONS ANALYSIS.(U)

SEP 81 M S HUNTLEY, R L MUMFORD, R RUDICH

UNCLASSIFIED TSC-FAA-81-12 FAA-RD-81-58 NL

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DOT-FAA-RD-81-58

Buffalo Air Traffic Control Tower Operations Analysis

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Cambridge MA 02142

September 1981
Final Report

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-FAA-RD-81-58	AD-A1[illegible]	

4. Title and Subtitle	5. Report Date
BUFFALO AIR TRAFFIC CONTROL TOWER OPERATIONS ANALYSIS	September 1981
	6. Performing Organization Code: DTS 532
7. Author(s): M. Stephen Huntley, Jr., Robert L. Mumford and Robert Rudich	8. Performing Organization Report No.: DOT-TSC-FAA-81-12
9. Performing Organization Name and Address: U.S. Department of Transportation, Research and Special Programs Administration, Transportation Systems Center, Washington DC 20590	10. Work Unit No. (TRAIS): FA[illegible]
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: U.S. Department of Transportation, Federal Aviation Administration, Systems Research and Development Service, Washington DC 20590	13. Type of Report and Period Covered: Final Report APRIL 1981
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report provides a description of the non-surveillance aspects of the FAA air traffic control facility operation at Greater Buffalo International Airport from the air traffic controller's point of view. It includes photographs of all controller consoles with all equipment and posted paper identified; descriptions of weather, NOTAMs, flight data and methods for distributing information on equipment status; and controller requirements for this information. In addition the terminal airspace, major arrival and departure routes, aircraft mix, and hourly operation activity levels are briefly described.

17. Key Words	18. Distribution Statement
Buffalo Airport, Tower cab, TRACON flight data, weather, status, controller information requirements	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

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PREFACE

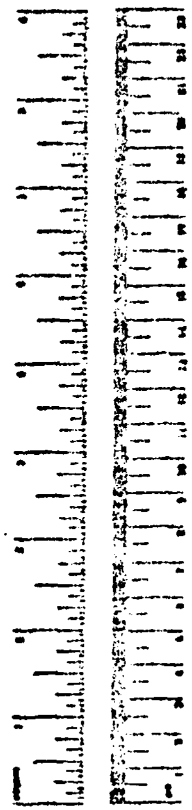
The weather, flight data, and equipment status aspects of controller operation at the Buffalo Air Traffic Control Tower are described in this report. The description is based upon data collected through direct observation, photographs, and interviews with tower personnel. The study was sponsored by the FAA Systems Research and Development Service and was conducted in the Buffalo Tower Cab and TRACON during May and July of 1980.

This work was completed with the cooperation of the Eastern Region of the FAA, and the Air Traffic Service (AAT) Division of that region in particular. Special thanks are due to Vito Borrello, the Chief of the Buffalo Tower for his valuable support in the collection and interpretation of the information presented herein. In addition, we are indebted to Mr. Holly Barlage of the FAA's Systems Research and Development Service for his close review and technical comments on this document.

METRIC CONVERSION FACTORS

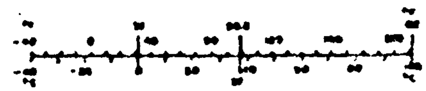
Approximate Conversions to Metric Measures

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	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



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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1. INTRODUCTION

This report is the fourth of a series of 8 reports which document and describe the non-surveillance functions and duties of tower controllers at 8 selected air traffic control towers. The series includes three Level V towers: Boston, Atlanta and Houston; two Level IV towers: Minneapolis, and El Toro, and two Level III towers: Albuquerque and Buffalo.

The series of studies is conducted to provide operational information to be considered in the design and local application of the Terminal Information Display System (TIDS) - a dual service system to be composed of the Flight Data Display (FDD) and the Consolidated Cab Display (CCD). FDD is a computer based system designed to replace paper flight strips and the aging Flight Data Entry and Printout (FDEP) equipment required to generate them. FDD will provide each controller with an electronic display and data entry device tailored to present flight data requirements and will eliminate the need for the FDEP and the associated flight progress strips. The CCD will consolidate much of the weather sensor data (e.g., runway visual range, centerfield wind), the equipment status information (e.g., for instrument landing system, approach lighting system, and field lighting controls (e.g., approach lighting system, runway edge lights), to be presented by electronic displays at each control position, tailored to the specific needs of each controller. Designs for the CCD were developed for the Atlanta tower and are described in "Atlanta Tower Cab and TRACON Interpretation Analysis, Report No. FAA-RD-80-126" and were not redeveloped for Buffalo. FFD and the CCD will be driven by a common computer and probably will share common input devices. Federal Aviation Administration flight data summary forms and some used only at the Buffalo facility are presented in Appendix A.

The present study series is designed to identify the operational requirements that the different towers have in common as well as the unique aspects of each tower that should be accommodated by TIDS to facilitate the speed and safety of tower* operation. The study is concerned primarily with the controller information requirements and the controller-equipment interface. It is not concerned with the engineering or operating aspects of tower and field equipment nor does it include a critique of current systems. Its main purpose is to identify the information that the controllers require from their existing equipment and the tower operational procedures related to that equipment.

Buffalo ATCT was selected as one of the two Level III airports to be studied both because it represents northeastern Class III towers as well as having a relatively equal mix of general aviation and air carrier operations. No important changes to the physical or operational aspects of this tower are anticipated in the near future.

The information for this report was obtained by (a) examining existing written material, (b) photographing controller work spaces, (c) observing controllers at work, and (d) interviewing journeyman controllers and tower management staff.

The written material examined in this study included Jeppesen Air Manuals, tower SOPs, Letters of Agreement, and a day's sample of flight strips. Where possible, the information in this material was verified through observations of controllers at work and interviews with tower personnel.

Photographs were taken of all controller consoles, posted notices and selected control panels. These photos were used as subject matter for the interviews, and serve to document the physical aspects of the tower as it existed during the study. To avoid

*The term "tower" is used in this report to include both Cab and TRACON facilities.

interfering in tower operations, all photographs of TRACON consoles were taken during the midshift. Photographs of Cab equipment and consoles were taken during the day to take advantage of natural light. A total of four controllers were interviewed for information on tower equipment, their informational needs, and tower operational procedures. Since different subject areas were discussed with different controllers, much of the information obtained was based upon the knowledge of a single controller, and so some errors are possible. However, when the interviewer identified information as inconsistent with tower SOPs or practices at other towers, it was verified in discussions with tower management personnel.

To supplement the controller interviews, the actions of controllers at work regarding their use of equipment and handling of flight strips was observed in the TRACON and Cab during peak and slack traffic periods. Over 30 hours of observation time was spent in these two work spaces for this study.

The results of the operations analysis are presented in Sections 2 through 6 of the report. An overview of the Buffalo Terminal Area TRACON and Cab operations is provided in Section 2. This section includes a map of the airport, a chart of the terminal area, the major runway configurations and approach and departure routes used, drawings of the Cab and TRACON floor plans, definition of control positions, and the location of each control position in the Cab and TRACON. In addition, a photograph of every controller work station is presented on which every display and control device is identified. The use of equipment providing information on weather and the status of field NAVAID's, and the control of field lighting to be incorporated in the CCD is presented in Section 3. A photograph, locations in the Cab and TRACON, users, and the condition of use are presented in this section for each device. The sources and controller requirements for information on operational status of tower and NAVAID equipment are presented in Section 4 with discussions of the use of NOTAMs and other procedures for determining and disseminating status information on this equipment and the means of controlling this dissemination. The operation of the current flight data system is presented in Section 5. The location of flight data equipment in the tower is shown on floor plans of the Cab and TRACON; the format and form of selected categories of printed and handwritten flight strips and hand notations used with these strips is presented and discussed; and the flow and arrangement of flight strips from console to console throughout the Cab and TRACON is presented in this section. The tower weather information system is presented in Section 6. This presentation covers the types of weather information received, the formats of weather messages, sources of the information, and the procedures and means by which weather information is disseminated from the tower.

2. BUFFALO AIR TRAFFIC CONTROL SYSTEM

OVERVIEW

The environment and operations of the Buffalo air traffic control system are described in this section which includes a description of:

- o The general setting of the Buffalo Tower (location, weather, site-specific factors);
- o The specific air traffic control environment (airport, runways, taxiways, airspace, radar service);
- o Aircraft operations; and
- o The TRACON and Cab facilities in terms of layout, positions, staffing, controller duties, and controller issues.

The Buffalo Tower is located in an airport facility serving Buffalo, New York. A 50-mile radius of the Tower includes Niagara Falls, parts of Ontario, Canada, sections of Lake Erie and Lake Ontario and western New York State. Part of the Buffalo Approach Control Area includes Canadian airspace over the Province of Ontario.

Major natural factors affecting tower operations include prevailing west-southwest winds off Lake Erie and the Northeast winter climate. The airport is largely a one-runway (05-23) operation which results from the prevailing southwest winds and the fact that the second runway (14-32) is not sufficiently long (5,373 feet) to handle large aircraft. The predominantly one-runway configuration means that all types of aircraft must be served and therefore mixed in the same approach and departure patterns.

The airport layout lacks a perimeter road for vehicular traffic. Daily tower operations are complicated by the need for many service vehicles crossing taxiways and runways.

The Buffalo TRACON's instrument operation traffic mix is approximately 48% air carrier, 10% air taxi, 36% general aviation and 6% military. Military traffic results from the tower's IFR responsibility for Niagara International Airport, located approximately 13 miles northwest of the Buffalo Tower. Niagara (IAG) has a VFR tower and is the home base of several military units.

Buffalo traffic levels for FY79 included approximately 170,000 tower operations and slightly over 200,000 instrument operations.

Regular TRACON staffing includes two approach control radar positions (east and west) and one departure radar position; these controllers are assisted by controllers staffing the Arrival Data and Coordinator (part-time) positions. Tower Cab staffing is typical in terms of positions and responsibilities.

2.1 GENERAL SETTING

The Buffalo air traffic control tower is located at Greater Buffalo International Airport (elevation 725 MSL). This airport is situated approximately three miles east of the City of Buffalo and nine miles east of the Canadian border on the Niagara River. A 50-mile radius of the airport includes the Niagara Falls region, a section of western New York state, the southern portion of the Province of Ontario and large areas of Lake Erie and Lake Ontario (see Figure 2-1). The airport is a port of entry into the United States and has a U.S. Customs Facility. The City of Toronto is located approximately 60 miles to the northwest across Lake Ontario.

Prevailing winds at Buffalo are from the west-southwest off Lake Erie. At times, these winds carry industrial smog from the heavy industrial operations (steel, oil, rubber) on the shores of Lake Erie. The smog can adversely affect tower visibility to the southwest for five to ten miles. Weather conditions at Buffalo feature regular Northeast seasonal variations. According to tower

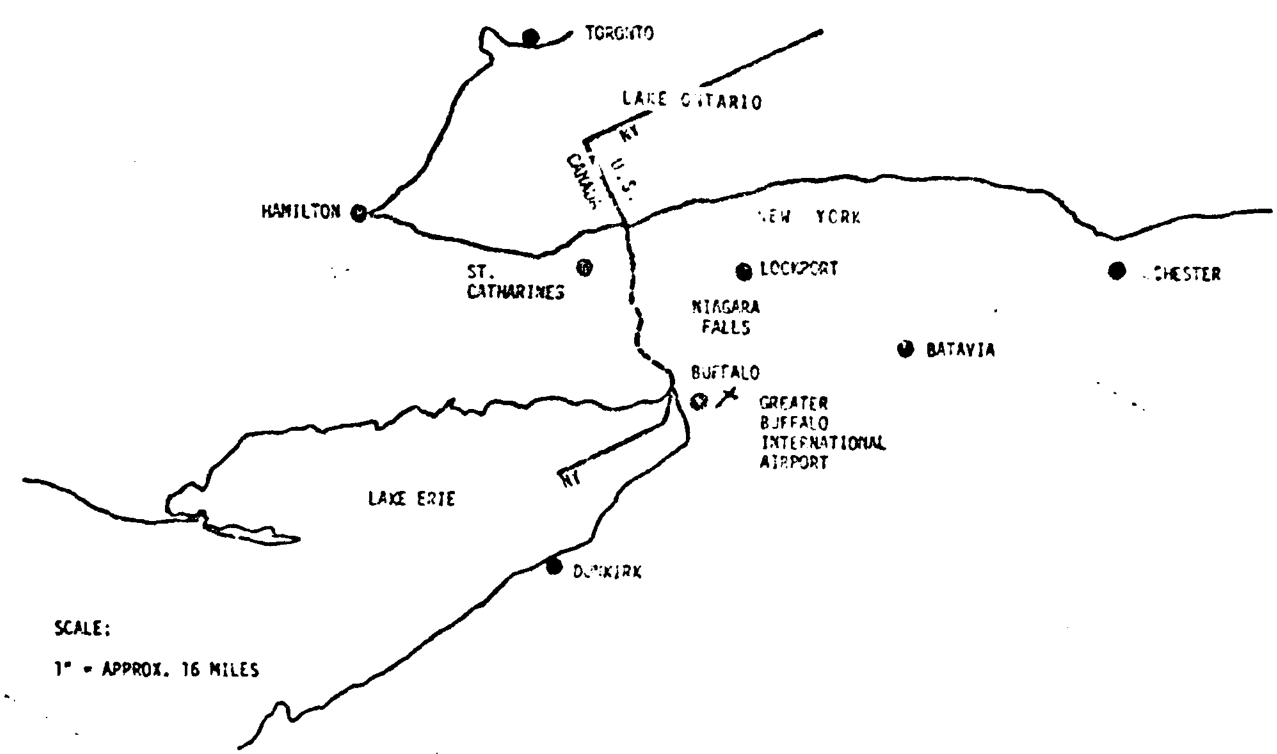


FIGURE 2-1. SETTING OF THE GREATER BUFFALO INTERNATIONAL AIRPORT

personnel, snow conditions do not significantly influence airport operations to any greater degree than in other Northeast cities.

The Grand Island area on the Niagara River is notable for heavy concentrations of bird flights during the spring and fall. Grand Island is also the site of several tall television antenna towers.

Approximately 18 miles northwest of the airport is Niagara Falls International Airport (NFIA), a facility with a VFR Tower. This airport is the home of several military reserve units which fly helicopters, F-101 interceptor aircraft, and C130 transports.

2.2 AIR TRAFFIC CONTROL ENVIRONMENT AT BUFFALO

2.2.1 Airport Layout

The runway layout at Buffalo (see Figure 2-2) is centered on the northeast-southeast runway, 05-23; this runway was increased to its present length (8,102 feet) by a northeast extension over a railroad right of way, a roadway, and a creek. The extension bridge structure on the runway limits takeoff and land weights for heavy, wide-bodied aircraft. Runway 23 is the primary runway for a very high percentage (about 70%) of the time due to the prevailing southwest winds; runway 05 serves as the primary runway for approximately 20% of the time. Both runway 23 and 05 are equipped with Instrument Landing Systems (ILS).

The second runway is on a southeast-northwest alignment (14-32) and is approximately one-third shorter in length than the first (5,373 feet). Runway 32 serves as the primary runway for only 10% of the time and only when northwest winds approach 15 to 20 knots; under these conditions, air carriers are given the option of using runway 05-23. Runway 32 is not ILS equipped; however, it does have a VOR approach. Aircraft approaching touchdown on runway 32 must pass directly over a large Westinghouse manufacturing plant. The location of this structure is due to its

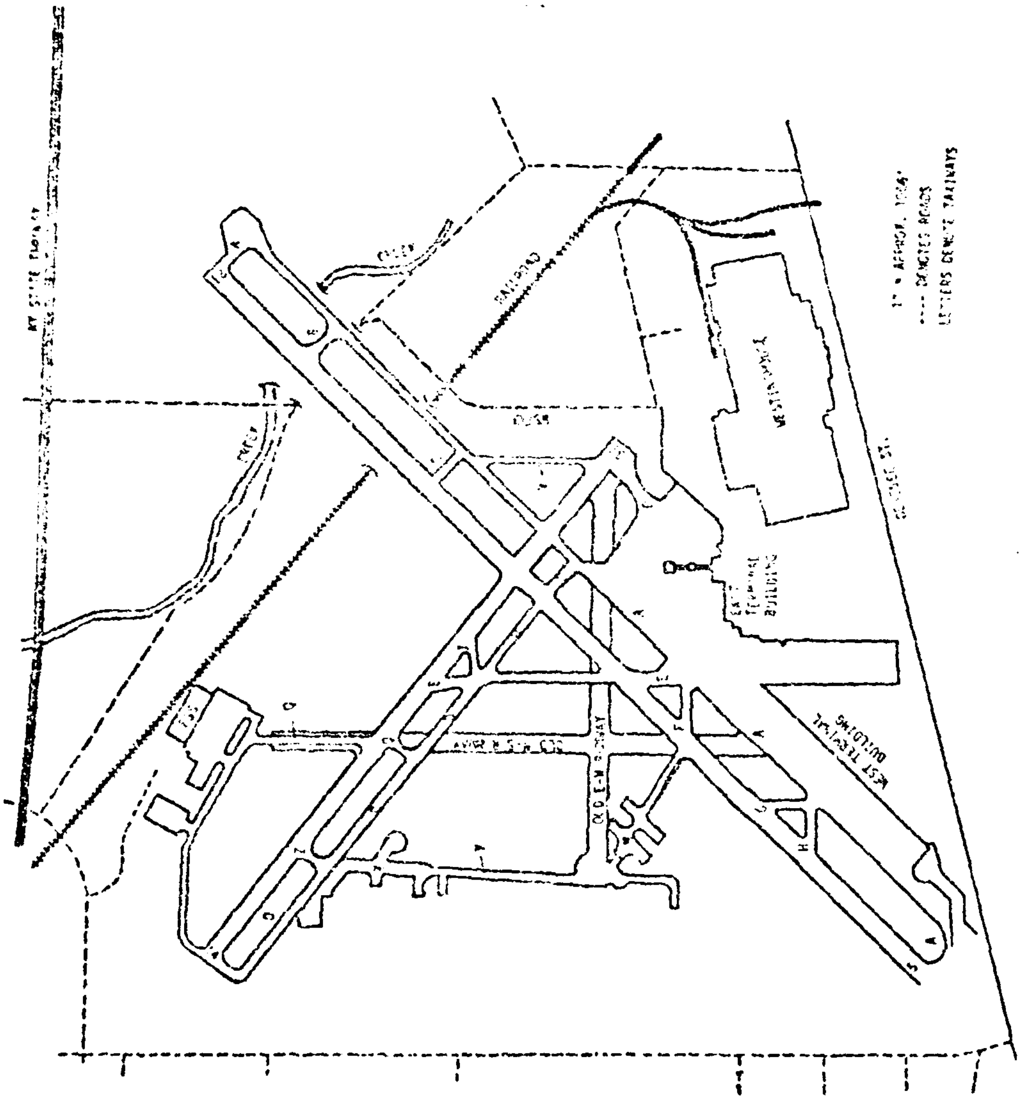


FIGURE 2-2. BUFFALO AIRPORT RUNWAYS AND TAXIWAYS

former status as an aircraft assembly plant. Runway 14 is not used as the primary runway and is not equipped with any NAVAIDs except runway lights.

The taxiway network connects the three major activity centers in the airport: the East Terminal Building near the Tower, the West Terminal Building paralleling runway 05, and the north terminal area containing the U.S. Customs facility. The main terminal area and the north terminal area are each served by one fixed base operator. The two major links in the taxiway network parallel runways 05-23 and 14-32; other links consist of sections of older closed runways and short segments near the runway intersection area.

According to controllers, there are two taxiway visibility problems with the present layout. First, aircraft or vehicles taxiing in the "slot area" between the two major terminal buildings are not readily visible from the Cab. Second, during periods of poor visibility, it is difficult to monitor moving aircraft and vehicles in the vicinity of the U.S. Customs facility.

A more frequent taxiing problem confronted by the Cab controllers is the high number of vehicle movements within the airport area. These include official vehicles, support vehicles, maintenance vehicles, and rescue vehicles. Due to the absence of a perimeter roadway, Ground Control and Local Control spend a good deal of time monitoring and coordinating vehicle movements across and between runways.

From the pilot viewpoint, one snow-related taxiway problem is the narrowness of the taxiway leading to runway 23. Snow removal operations create high snow and ice piles in the area abutting the taxiway. Pilots of large jet aircraft with broad wing spans must exercise caution to avoid hitting hanging engine pods on the accumulated snow. This problem was most evident during the great snowfalls of 1978.

2.2.2 Buffalo Tower: Airspace and Radar Services

The Buffalo air traffic control tower (see Figure 2-3) is located in the East Terminal Building. The tower facility houses the Cab and a TRACON with ARTS III equipment. The airport surveillance radar is located on the airfield just south of the mid-point of runway 14-32.

Airspace serviced by the Buffalo Tower includes four distinct areas (see Table 2-1), each designed in response to specific operational requirements. The Buffalo Tower officially provides air traffic control service within the "Buffalo Terminal Area" (see Figure 2-4). This area is irregularly shaped as a result of the Cleveland ARTCC delegating airspace according to operational requirements of the Toronto Center (Canadian Air Traffic Service) and neighboring towers such as Rochester. For example, the Rochester Tower controls the approach to Batavia; this explains the indentation on the east terminal area boundary. Within the terminal area, the Buffalo Tower has the responsiblity for IFR arrival, departure, and tower en route aircraft. IFR aircraft are provided with radar vectors and radar separations to standards of three miles distance or 1,000 feet in altitude. At the terminal area boundary, the ARTCC accepts and hands off IFR traffic to the Buffalo Tower.

Niagara Falls International Airport is located within the terminal area and is provided with IFR service by the Buffalo Tower.

The Terminal Radar Service Area (TRSA) consists of two sections (see Figure 2-5):

1. From the surface to 7,000 feet MSL; within a five-mile radius of the ASR.
2. From 2,500 feet to 7,000 feet MSL between the 5 and 12 mile radii of the ASR.

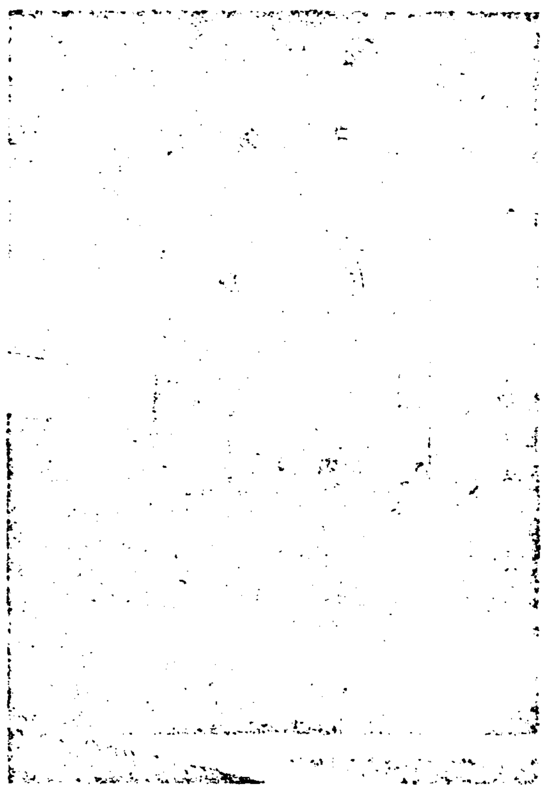


FIGURE 2-3. BUFFALO TOWER

TABLE 2-1. BUFFALO TOWER AIRSPACE AREAS

Airspace Area	Area Dimension	Altitude	Description-- Use
1. Terminal Area	An irregularly shaped area at a varying radius of 20 to 35 miles of the Buffalo VORTAC See Figure 2-4.	Surface to 10,000 feet MSL in main section; surface to 6,000 feet MSL in two fringe areas See Figure 2-4.	Official airspace delegated to BUF Tower by Cleveland ARTCC for IFR control service; at Terminal Area Boundary the ARTCC accepts/hands off IFR traffic
2. Service	2 sections: 5 mile radius of ASR 5 mile radius of ASR to 12 mile radius of ASR See Figure 2-5.	Surface to 7,000 feet MSL 2,500 feet MSL to 7,000 feet MSL See Figure 2-6.	A defined positive control area for those who wish to participate in one of the three available radar service programs
3. Airport Control Zone	An approximate 5 mile radius of the ASR with extensions for the approaches to runways 05 and 23 and an easterly rectangular extension approximately 4 miles beyond BUF VORTAC See Figure 2-6.	Surface to 14,500 feet MSL	A positive control zone for instrument approaches and departures
4. Airport Traffic Area	A 5 mile radius of ASR	Surface to 3,000 feet AGL	A buffer area around and above airport in which aircraft must talk to Tower

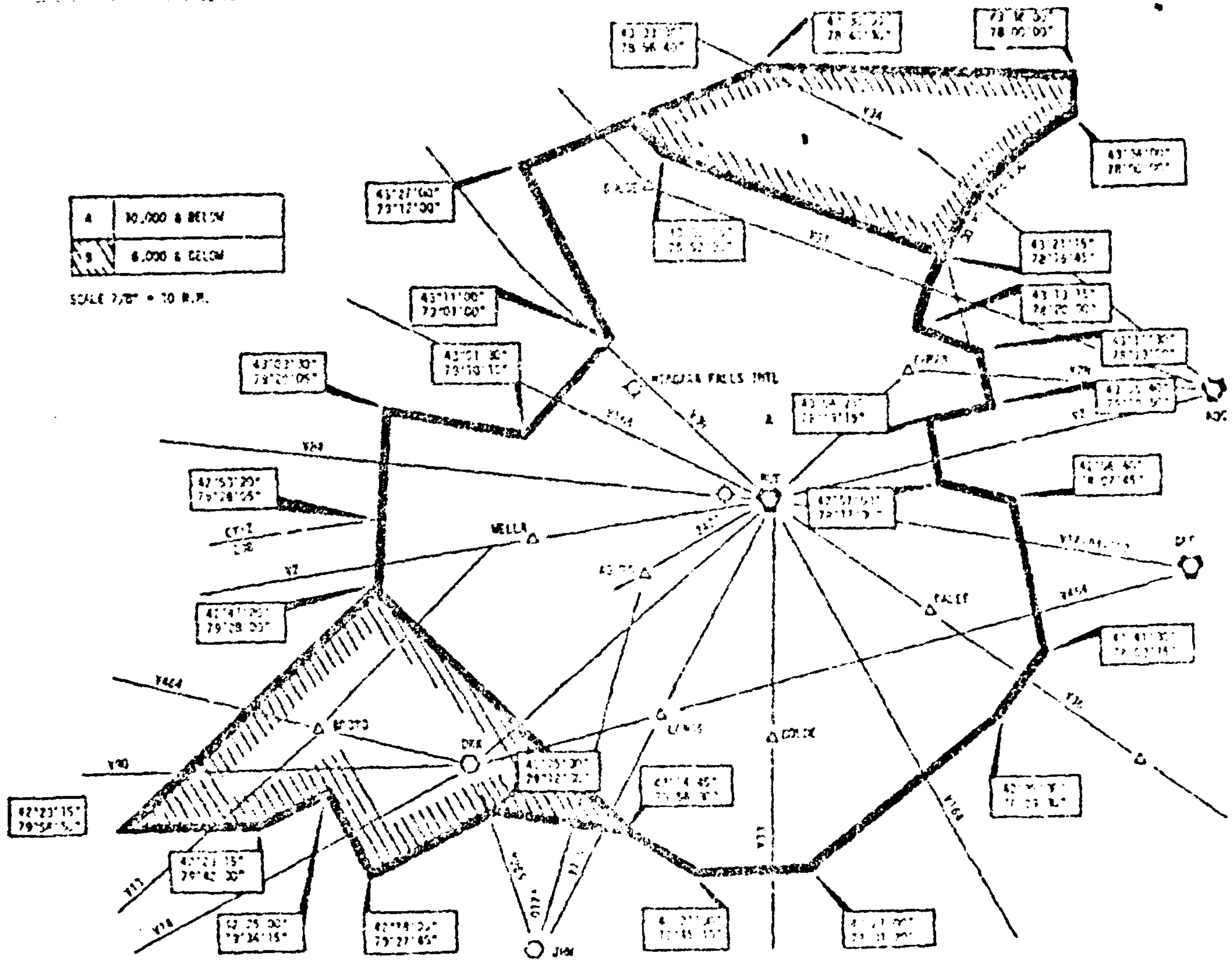


FIGURE 2-4. BUFFALO TERMINAL AREA

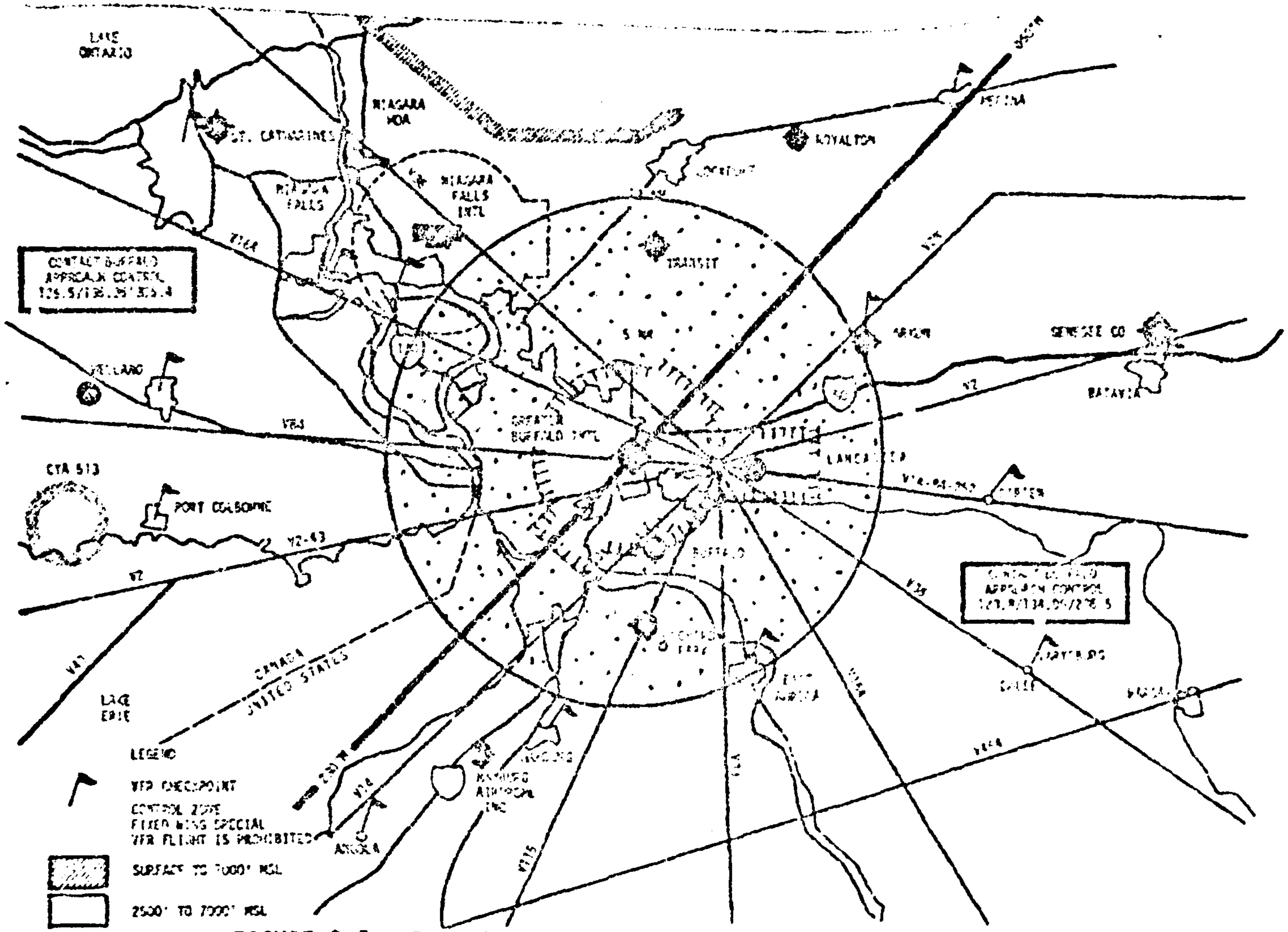


FIGURE 2-5. BUFFALO TERMINAL RADAR SERVICE AREA (TRSA)

The TRSA is a defined, positive control area for those VFR aircraft who wish to participate in one of three radar service programs available.

Stage I: Radar Service Advisory

Buffalo Tower radar control provides information on wind and the runway in use (unless pilot has received ATIS and gives the ATIS code), and specifies time or place for pilot to contact Tower Cab; radar service terminated.

Stage II: Radar Service Advisory and Sequencing

Buffalo Tower radar control provides advisory information (as above) and provides standard VFR radar separation (minimum 1 1/2-mile distance or 500 feet altitude) until aircraft is sequenced for landing or until the pilot sees the traffic he is to follow.

Stage III: Radar Service

Buffalo Tower radar control provides standard separation between all participating VFR and IFR aircraft operating within the TRSA; VFR pilots are encouraged to accept Stage III service but it is not mandatory.

Time permitting, the Buffalo radar control provides radar service to VFR Stage III aircraft outside the TRSA but within the terminal area. (Niagara Falls International Airport is located approximately two miles beyond the TRSA boundary.)

The third airspace area is the "Airport Control Zone"; this zone is irregular in shape and extends up through the TRSA to the base of the continental control area (14,500 MSL) (see Figure 2-6). This zone is designed to provide a positive control area for instrument approaches and departures.

The fourth airspace area is the "Airport Traffic Area" which is a five-mile radius of the ASR from the surface to 3,000 feet AGL; this area defines the airspace in which aircraft must talk to the Tower (Figure 2-6).

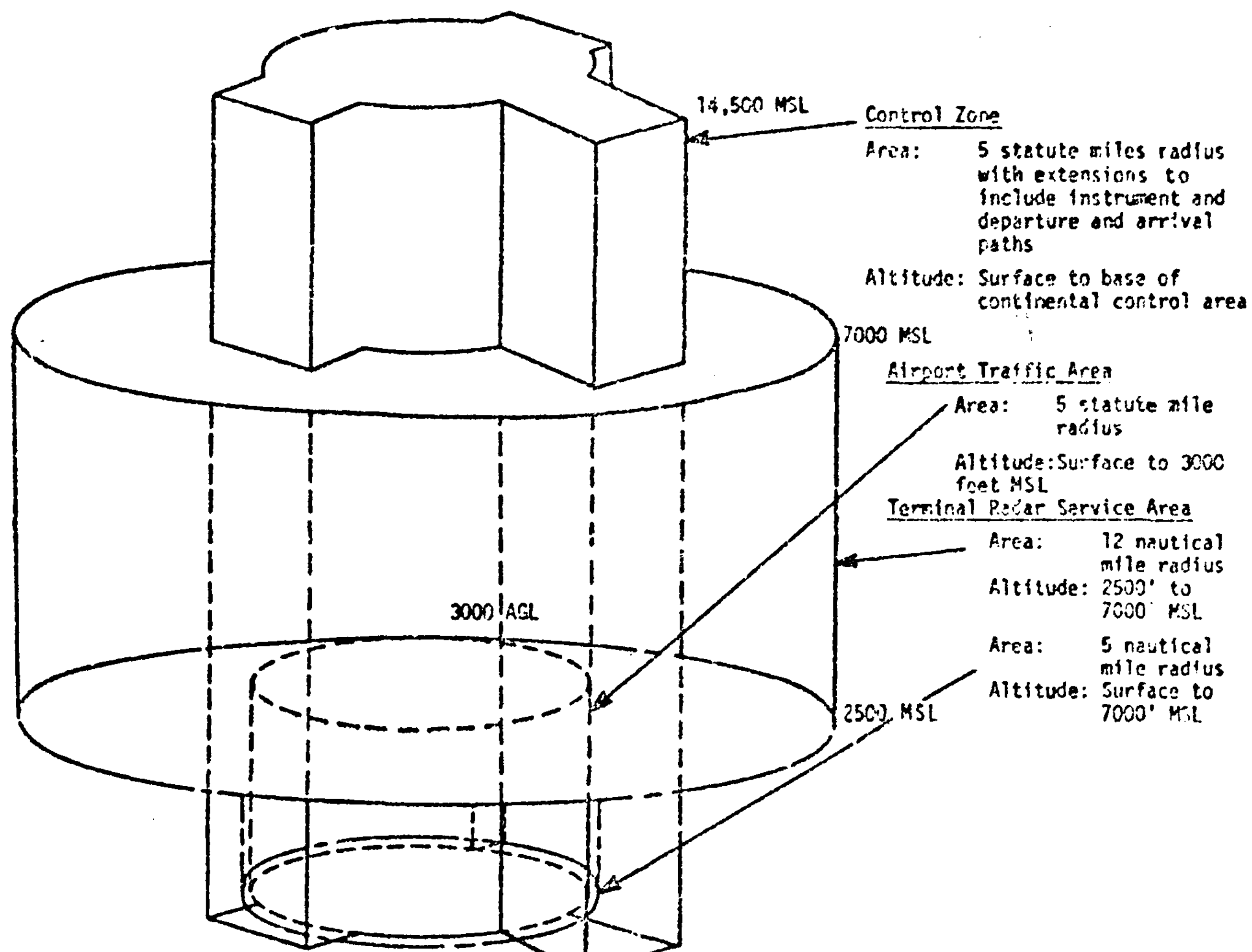


FIGURE 2-6. AIRSPACE DIVISIONS AT BUFFALO

2.2.3 Typical Approach and Departure Profiles (Runway 23)

An IFR arrival flight approaching Buffalo will be vectored by the ARTCC to a "transfer point" near one of the four major arrival fixes which are located just inside the terminal area boundary. Per agreement with the Center, these arriving IFR flights approach the fix in level flight at 250 knots and at an altitude of either 11,000 or 9,000 feet MSL. Aircraft cross the easterly fixes (Ehman and Dalee) at 11,000 MSL; the westerly fixes (Wella and Dunkirk) are crossed at 9,000 feet MSL. The ARTCC and the Buffalo Tower will coordinate the transfer of control of the flight; this transfer is usually accomplished via a silent ARTS handoff. The radar controller in the Buffalo TRACON will then provide the aircraft with radar separation, approach vectors and altitude assignments to permit an interception of the ILS glide slope. Typical approach sequencing involves several communications between the radar controller and the aircraft (see Figure 2-7).

After the flight crosses the approach fix at either 11,000 or 9,000 feet MSL, the approach controller will normally clear the aircraft for a descent to 7,000 feet MSL and a turn onto the "downwind" leg paralleling the landing runway. When the aircraft is clear of departure traffic, the radar controller will provide a clearance for a descent to 2,500 feet MSL.

When the aircraft is approximately three miles beyond the outer marker of the ILS, the radar controller will authorize the aircraft to make an inward descending turn onto the base leg; this procedure enables the pilot to fly an eight-mile final on the ILS. When the pilot has the runway in sight, the aircraft is cleared for a visual approach; responsibility for the flight is usually transferred from the TRACON to the Cab between eight and five miles from touchdown.

A one day sample of instrument operations flights indicated that "Wella" was the most frequently used arrival coordination fix:

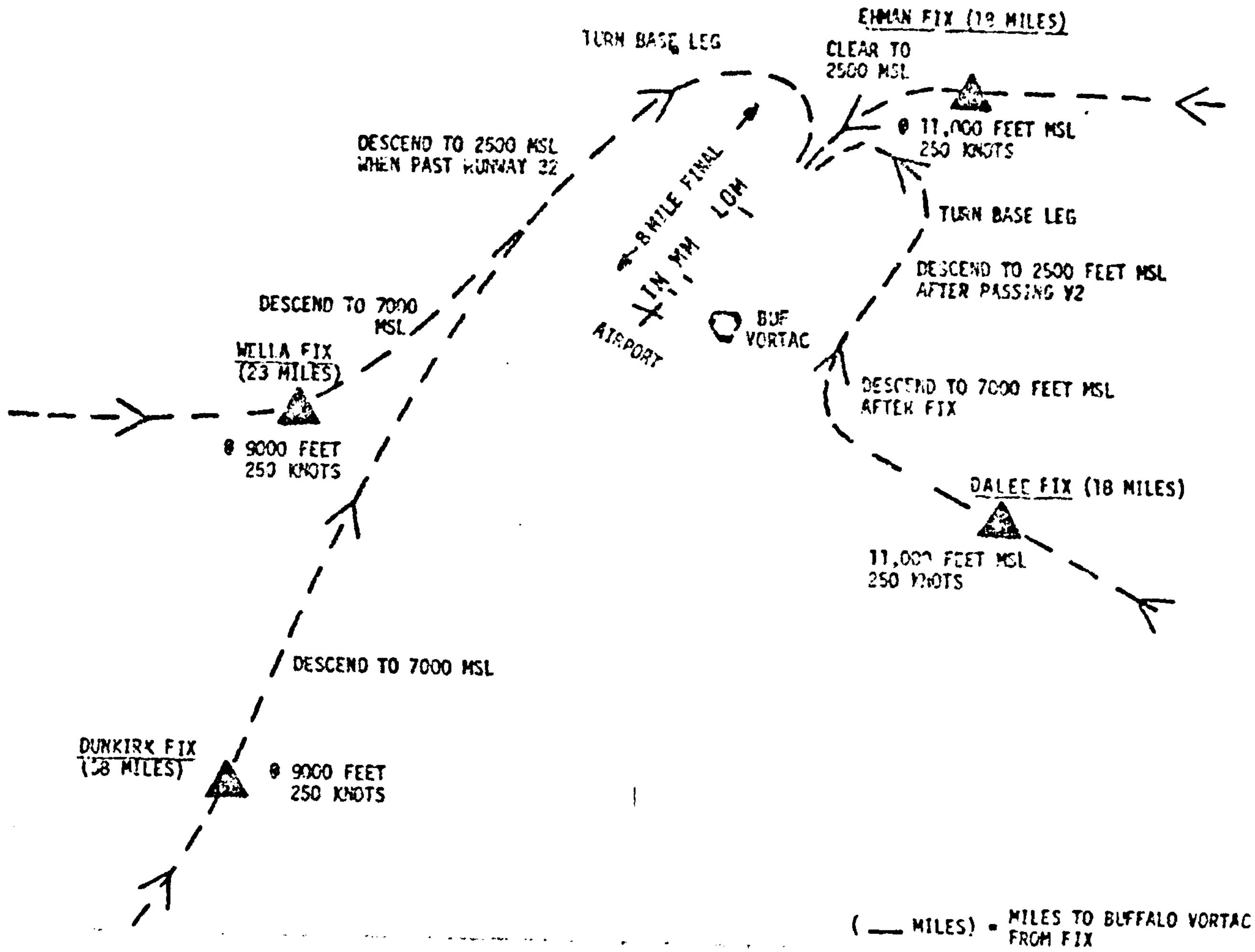


FIGURE 2-7. TYPICAL APPROACHES TO RUNWAY 23 AT BUFFALO

	Name	Frequency Used (on April 25, 1980)
West Fixes:	WELLA	45
	THORL	13
	BROTO	2
	ERI	1
East Fixes	EHMAN	14
	DALEE	13
	BURST	6
	ELZ	5
	JHW	5
	ROC	4
	DT	1
NAVAID Fixes	Buffalo VORTAC (BUF)	36
	Niagara TACAN (IAG)	15
	Geneso VOR (GEE)	12
	Dunkirk VOR (DKK)	2

IFR flights departing Buffalo normally fly the runway heading to 3,000 feet MSL. The radar controller in the TRACON then issues a departure route vector to direct the aircraft to one of the transfer points on the 20-nautical mile DME of the Buffalo VORTAC (see Figure 2-6). During this time, departing aircraft are usually restricted to the initial assigned altitude of 6,000 feet MSL; when the departing flight is beyond the path of arriving flights, the radar controller will normally authorize a higher altitude. The radar controller will effect a radar handoff of the flight to the ARTCC at or near the transfer point. (It is also possible for the Buffalo Tower to execute a radar handoff with the ARTCC prior to the transfer point; in this case, the Center may climb the departure but cannot alter the departure route until the aircraft is outside the terminal area.)

2.3 BUFFALO TOWER OPERATIONS

A quantitative summary of Buffalo Tower operations is provided in the following tables and figures:

Table 2-2. Buffalo Aircraft Operations and Instrument Operations for FY78 and FY79.

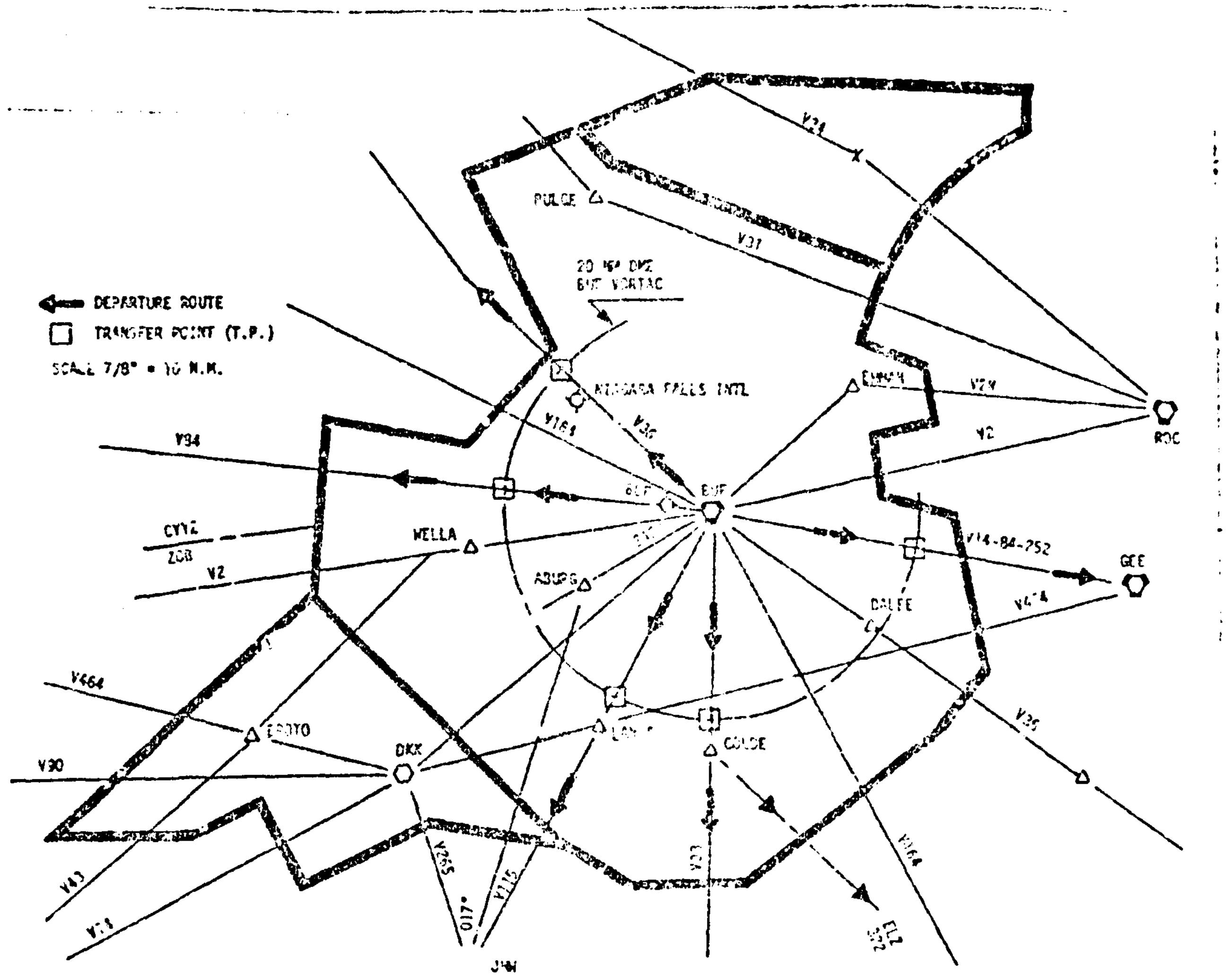


FIGURE 2-8. BUFFALO DEPARTURE ROUTE VECTORS IN TERMINAL AREA (RUNWAY 23)

TABLE 2-2. BUFFALO AIRCRAFT OPERATIONS AND INSTRUMENT OPERATIONS FOR FY78 AND FY79

Aircraft Operations	FY78	FY79	Percent Change
Air Carrier	78,393	73,581	-6.1%
Air Taxi	17,605	21,119	+20%
General Aviation			
o Itinerant	46,294	53,254	
o Local	14,948	18,780	
o Total	61,242	72,034	+17.6%
Military			
o Itinerant	1,647	1,478	
o Local	1,841	2,403	
o Total	3,488	3,881	+11.3%
Summary Totals			
o Itinerant	143,939	149,432	
o Local	16,789	21,183	
o Grand Total	160,728	170,615	+6.2%
Instrument Operations			
Air Carrier			
o Primary	76,987	72,007	
o Secondary	428	432	
o Overflights	2,905	3,151	
o Total	80,320	75,590	-5.9%
Air Taxi			
o Primary	15,601	17,086	
o Secondary	131	708	
o Overflights	3,081	3,380	
o Total	18,613	21,174	+12.5%
General Aviation			
o Primary	40,521	47,166	
o Secondary	13,337	15,663	
o Overflights	27,078	32,559	
o Total	80,936	95,388	+18.6%
Military			
o Primary	1,031	826	
o Secondary	9,009	9,465	
o Overflights	1,252	1,481	
o Total	11,292	11,772	+3.3%
Summary Totals			
o Primary	134,140	137,035	
o Secondary	22,905	26,268	
o Overflights	34,416	40,571	
o Grand Total	191,461	203,924	+6.5%

Derived from FAA AIR TRAFFIC ACTIVITY FY78 & FY79.

Table 2-3. Buffalo Tower Aircraft Operations by Day of Week.

Figure 2-9. Buffalo Instrument Operations by Time of Day (April 25, 1980 - Friday).

Highlights of these data summaries are discussed below.

The Buffalo Tower Cab handled approximately 160,000 aircraft operations (Buffalo arrivals and departures) in FY78 and 170,000 in FY79 (Table 2-2). This increase was largely attributable to increases in air taxi and general aviation operations. The number of air carrier operations decreased by approximately six percent from FY78 to FY79. The traffic mix for operations handled by the Cab in FY78 and FY79 were as follows:

	FY78	FY79*
Air carrier	49%	43%
Air taxi	11%	12%
General aviation	38%	42%
Military	2%	2%

*Do not add to 100% due to rounding.

The Buffalo TRACON handled approximately 191,000 instrument operations (primary, secondary and overflights) in FY78 and 204,000 in FY79. Again, this increase was based on general aviation and air taxi activity; the number of air carrier instrument operations was reduced by approximately 5,000 flights from FY78 to FY79. Overflights as a percentage of total instrument operations was 18% in FY78 and 20% in FY79. Traffic mix for the Buffalo TRACON during FY78 and FY79 were as follows:

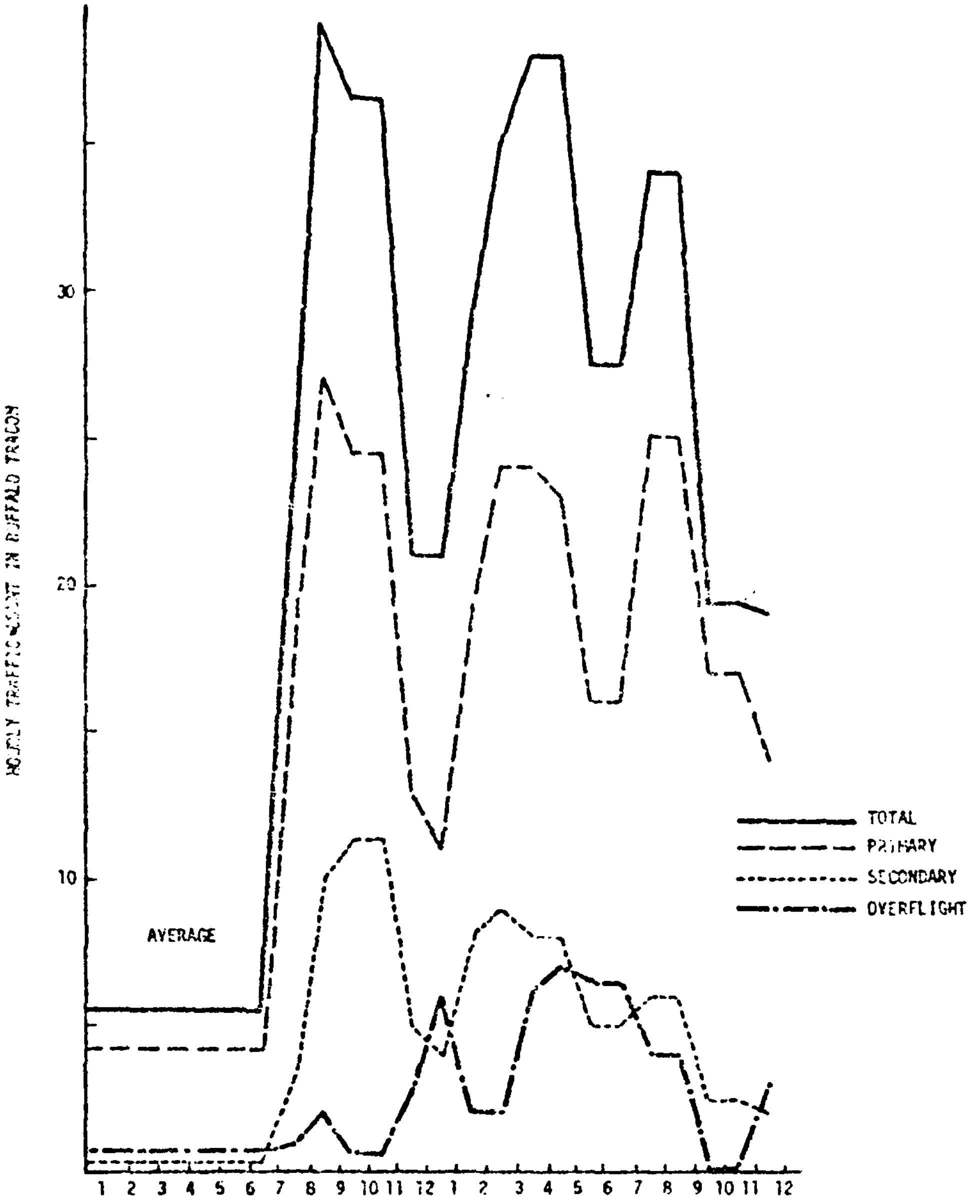
	FY78	FY79
Air carrier	42%	37%
Air taxi	10%	10%
General aviation	42%	47%
Military	6%	6%

TABLE 2-3. BUFFALO TOWER AIRCRAFT OPERATIONS BY DAY OF WEEK

Operations Category	Sun.	[illegible]	Tues.	Wed.	Thurs.	Fri.	Sat.	Average Daily	Percent
Air Carrier o Itinerant o Local	206	219	218	222	220	220	202	215	48%
Air Taxi o Itinerant o Local	18	44	63	71	69	68	28	52	11%
General Aviation o Itinerant o Local o Total	 103 48 151	 119 33 152	 148 38 185	 161 43 204	 155 45 200	 148 42 190	 106 44 150	 134 42 176	 39%
Military o Itinerant o Local o Total	 5 4 9	 3 4 7	 3 5 8	 4 6 10	 5 5 10	 6 6 12	 4 6 10	 4 5 9	 2%
Total by Day	384	422	475	507	495	490	390	452	100%
Percent of Operations by Day *	12%	13%	15%	16%	16%	15%	17%		

Source: Tower Airport Statistics Handbook Calendar Year 1978

*Do not total 100% due to rounding.



SOURCE: DERIVED FROM HOURLY TRAFFIC LOG, APRIL 25, 1980

FIGURE 2-9. BUFFALO INSTRUMENT OPERATIONS BY TIME OF DAY

The percentage of military flights is significantly higher for the TRACON owing to the IFR responsibility for Niagara (IAG).

Total daily Tower traffic exhibits little variability and averages approximately 500 operations on weekdays and 400 on weekends (Table 2-3). The two daily traffic peaks are from 7:00-9:00 a.m. and from 3:00-5:00 p.m.; a smaller peak also occurs in the early evening from 7:00-8:00 p.m. (Figure 2-9).

According to Tower personnel, future traffic levels will be affected by a decrease in air carrier service to Buffalo. In July 1980, two large carriers were considering the decrease or elimination of service to Buffalo. The prime air carrier patron is, and will continue to be U.S. Air; at present, this airline accounts for approximately 65% of all air carrier traffic at Buffalo. The forecast on air taxi activity is for continued moderate growth based upon the economics of serving small and medium centers more efficiently. The continual growth in general aviation activity may be slowed by the recent increases in the cost of aviation fuel.

The future of military traffic for Buffalo is dependent upon the status of military operations at Niagara. One of the planning elements for Niagara Tower involves the installation of a slave BRITE radar unit to improve approach control coordination with the Buffalo Tower.

2.4 BUFFALO TOWER CAB/TRACON

2.4.1 Buffalo TRACON

The layout, staffing, operations and working environment of the Buffalo TRACON is presented in the following:

- Figure 2-10: Buffalo TRACON Floor Plan Showing Controller Positions
- Table 2-4: Buffalo TRACON Positions, Staffing and Duties.
- Table 2-5: Summary of Typical Tower Staffing: Cab and TRACON.

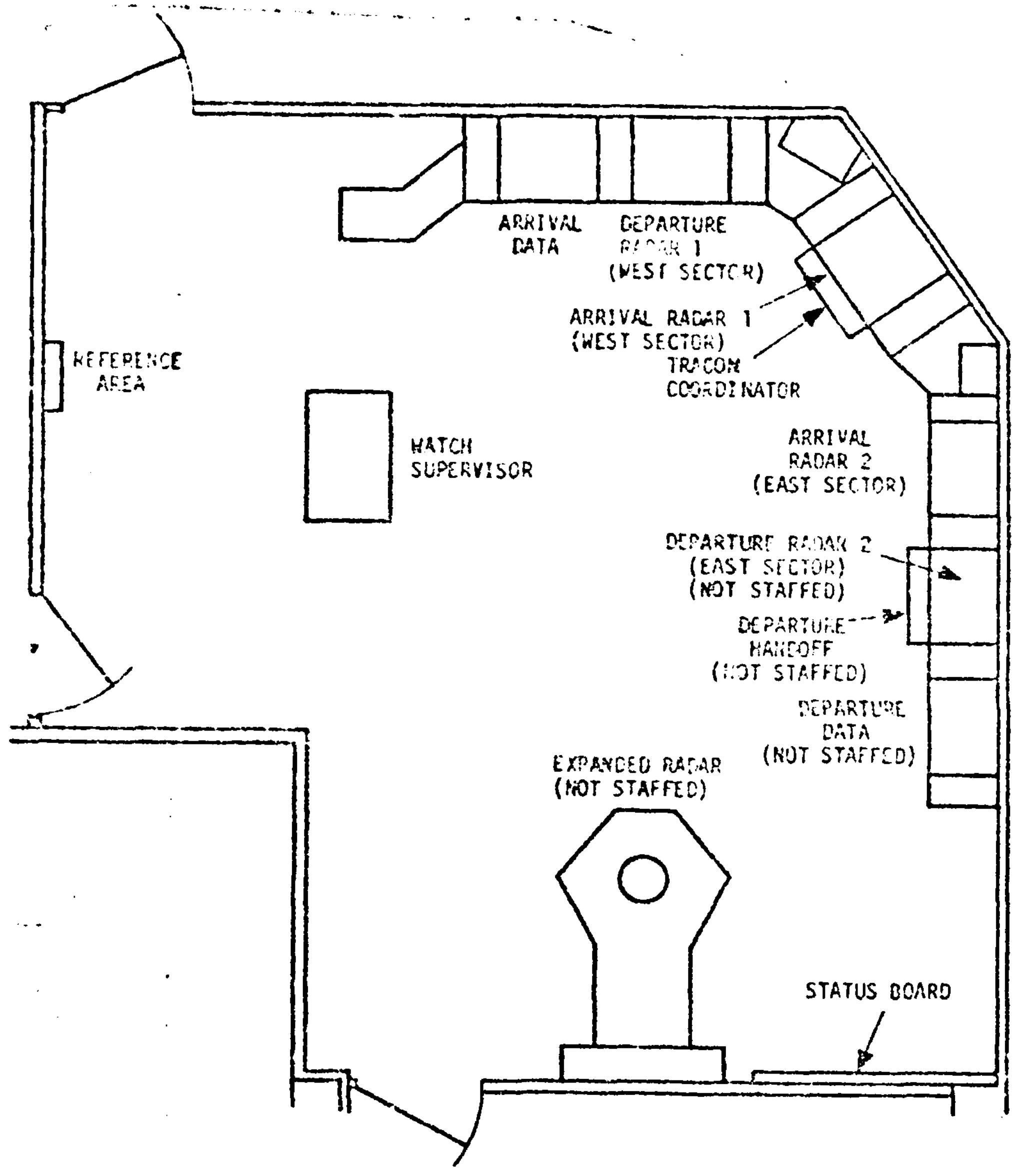


FIGURE 2-10. BUFFALO TRACON FLOOR PLAN SHOWING CONTROLLER POSITIONS

TABLE 2-4. BUFFALO TRACON - POSITIONS, STAFFINC AND DUTIES

OFFICIAL POSITION TITLE	ABBREVIATED TITLE	TYPICAL STAFFING FROM	TO	COMMENTS	SUMMARY OF PRIMARY DUTIES
1. APPROACH CONTROL FLIGHT DATA POSITION	ARRIVAL DATA (AD)	0700	2300	Staffed by 2 controllers during busy periods Performed by Team Supervisor	o Monitor FDEP and posts of all flight data received by printer or interphone at the appropriate position o Copies and relays clearances and messages, and maintains records and FDEP strips for traffic counts o Monitors electrowriter and posts current weather and NOTAMs o Copies and posts information on Stage III departures o Coordinates with Tower FD position o Coordinates with other facilities as required o In general, monitors all sources of information and assures that each position is kept informed
2. DEPARTURE CONTROL RADAR (DEP-1)	DEPARTURE WEST (DEP-W)	Always staffed		Departure west position handles all departures since departure east position is not staffed	o Provides separation between successive IFR and Stage III departing aircraft; coordinates hand-offs of IFR traffic to Center o Separates IFR and Stage III departure traffic from IFR and Stage III arrival traffic o Has authority to cancel local controller's blanket release for traffic departing primary runway o Issues headings to departing aircraft that comply with noise abatement procedures, to the extent feasible o Accepts missed approaches and provides separation between the miss and other IFR and Stage III aircraft o Coordinates with arrival radar on departure traffic in the tower enroute structure that will enter arrival radar airspace o Coordinates requested IFR clearances for VFR traffic departing satellite airports o For stage departures, owns airspace 15° on either side of departure runway centerline extended to 5 miles
3. APPROACH CONTROL RADAR WEST SECTOR (AR-1)	ARRIVAL WEST (AAR-W)	0700	2400	Position is staffed one hour into the mid-watch (2300-2400)	o Controls airspace west of centerline of runway 05-23 from the surface to 10,000 MSL within terminal area o Responsible for separation of all IFR and Stage III arrival traffic within designated airspace o Follows procedures to separate IFR and Stage III arrival, departure and overflight traffic o Determines approach sequence for runway 5 operation when coordinator position not manned o Responsible for all approaches to Niagara (IAG); responsible for approaches to secondary airports in his sector o Transfers arrival traffic to Tower frequency prior to the outer markers (5,23) o Responsible for Tower enroute IFR traffic originating in the west sector o Coordinates with departure control as required.

TABLE 2-4. BUFFALO TRACON - POSITIONS, STAFFING AND DUTIES (CONTINUED)

OFFICIAL POSITION TITLE	ABBREVIATED TITLE	TYPICAL STAFFING FROM	TO	COMMENTS	SUMMARY OF PRIMARY DUTIES
4. APPROACH CONTROL RADAR EAST SECTOR (AR-2)	ARRIVAL-EAST (ARR-E)	0700	2300		o Controls airspace east of centerline of runway 05-23 from the surface 10,000 MSL within terminal area o Other duties are analogous to those of ARRIVAL WEST except for Niagara arrivals, and determining approach sequence; ARRIVAL EAST determines approach sequence for runway 23 operation when coordinator position not manned
5. COORDINATOR POSITION TRACON	TRACON COORDINATOR (TC)	Staffed approximately 25% of total time focusing on peak AM and PM periods: 8:30-10, 3:30-5, 8-10			o Responsible for coordination necessary to assure safe and expeditious flow of traffic within Buffalo Tower airspace o Responsible for sequencing of arrivals to Buffalo Airport and satellite airports o Coordinates between arrival radar, and departure positions o Coordinates with Cab Coordinator (if manned) or Local Controller relative to type of approach, runway, field conditions, traffic flow o Coordinates with Cleveland and Toronto Centers to expedite movement of traffic
6. TRACON SUPERVISOR WATCH	SUPERVISOR WATCH (WS)	Always staffed 0700 2301	2300 0659	WS performs on AD position as well	o Overall responsibility for operation of TRACON o Rotates personnel for 2-hour shifts at positions o Insures necessary training of team controllers takes place o Performs hourly count (except on mid-watch) of flight strips that have been used and returned to AD position o On mid-watch performs flight strip administrative tasks for the preceding 24-hour period (midnight to midnight o Completes form 7230-4, the daily log on all activities
7. DEPARTURE RADAR -2	DEPARTURE EAST (DEP-E)	Not staffed		Scope can be used for surveillance approaches	
8. DEPARTURE DATA	Do	Not staffed			
9. DEPARTURE HANDOFF		Not staffed			
10. EXPANDED RADAR POSITION		Not staffed		Horizontal radar used for training	

TABLE 2-5. SUMMARY OF TYPICAL BUFFALO TOWER STAFFING CAB AND TRACON

Tower Cab Positions

Time of Day	CD	FD	GC	LC	CC
0700-2300	●	●	●	●	O
2301-2659	------	● developmental controller	------	● journeyman controller	------

TRACON Positions

Time of Day	WS	AD	DEP-W	ARR-W	ARR-E	TC
0700-2300	●	●	●	●	●	O
2301-2400	●		●	●------	------	
0001-0659	●------ supervisor	------	●------ journeyman controller	------	------	

Legend:

● = position staffed during time specified

O = position often not staffed

------ = pick up of other position responsibilities at specified times

CD and other position descriptions, see Tables 2-1, and 2-2.

Figures 2-11 through 2-22: Photographic survey of TRACON positions and equipment.

The operational nucleus of the TRACON is based upon three radar scope positions:

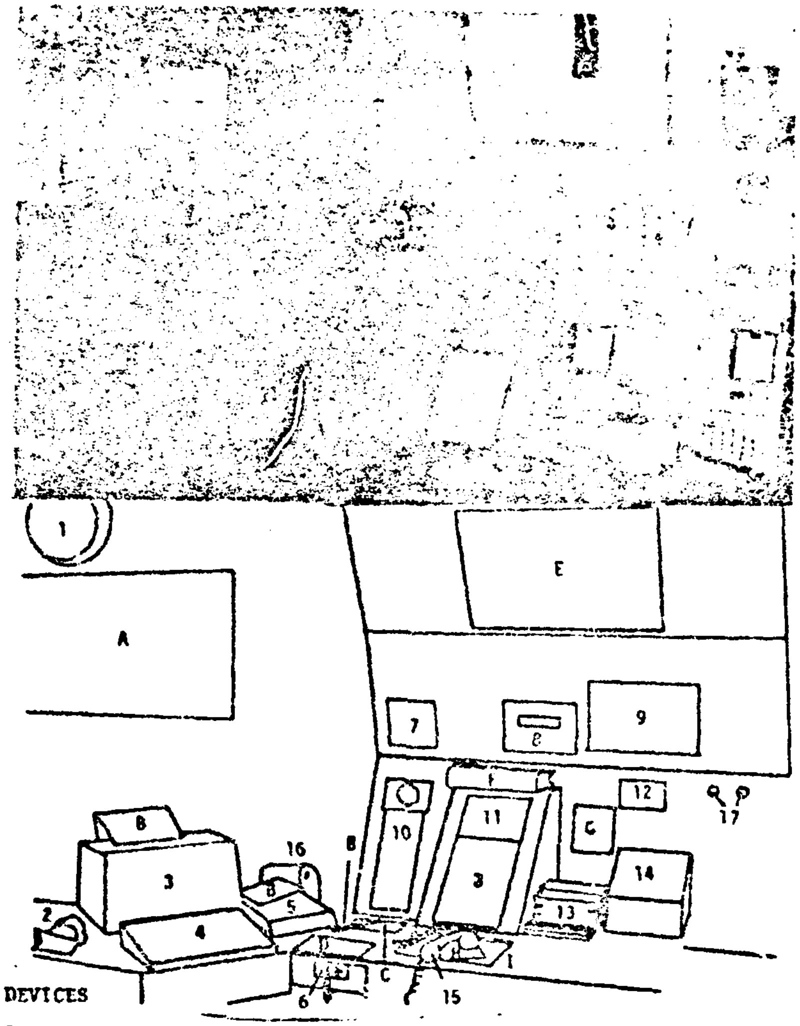
- o Departure--West (DEP-W)
- o Arrival--West (ARR-W)
- o Arrival--East (ARR-E)

DEP-W handles all departures while arrivals are split between ARR-W and ARR-E depending upon the aircraft's approach direction.

General support for the radar controllers is provided by the TRACON flight data position, referred to as Arrival Data (AD). The AD position at Buffalo is an extreme active one concerning monitoring, coordination, information dissemination, and flight data support activities (Table 2-4); this position can be staffed by two controllers during peak periods. (Double staffing of the AD position also results from FDEP outages. The FDEP is described in detail in Section 5--Flight Data.) Direct "over the shoulder" support for the radar controllers is provided by the TRACON Coordinator (TC), a position which is staffed approximately 30% of the time.

Four official positions in the original TRACON operational plan are not staffed; these include one regular radar position (Departure East), two support positions (Departure Data and Departure Hand-Off), and one horizontal radar position (Expanded Radar). The regular radar position is sometimes used for running "surveillance approaches" while the horizontal radar position is used for training.

TRACON position staffing for the five regular positions is fairly constant throughout the day (0700-2300). For the mid-watch, staffing is reduced down to two controllers including a Watch Supervisor and a journeyman radar controller (Table 2-5).



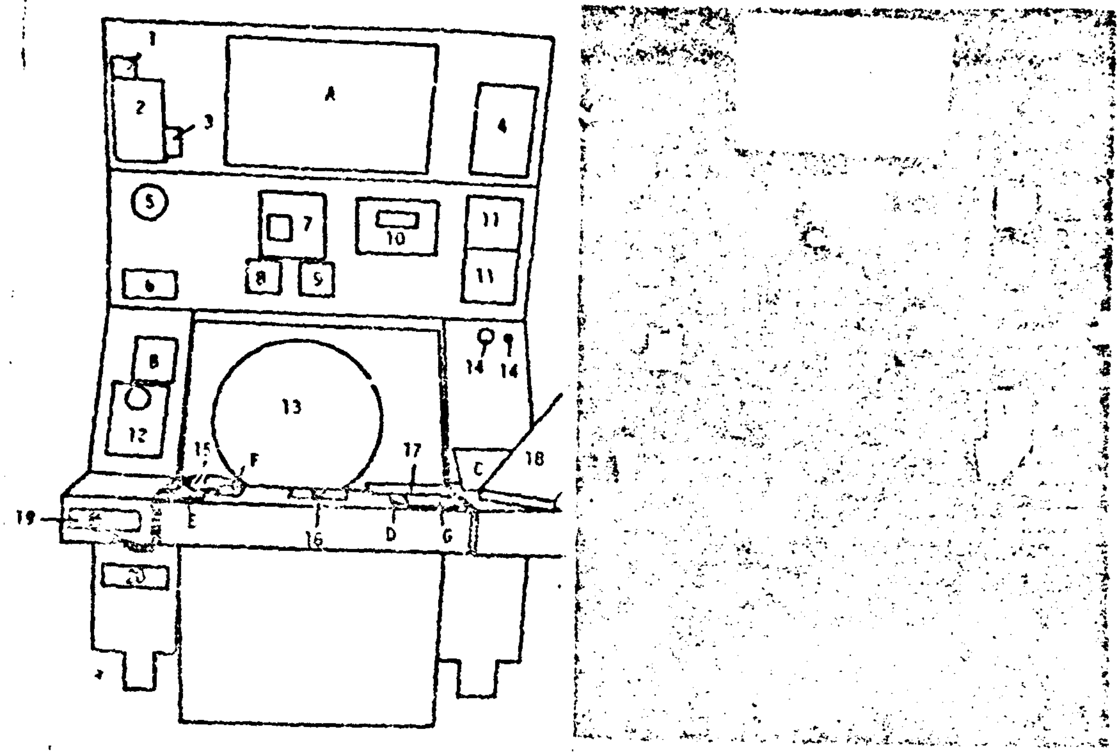
DEVICES

1. CLOCK
2. HEADSET
3. FDEP PRINTER
4. FDEP KEYBOARD
5. FLIGHT STRIP BOX
6. TELCO JACKS
7. TELCO SPEAKER
8. DIGITAL CLOCK
9. REMOTE INTERROGATOR CONTROL PANEL
10. TELCO DIAL AND KEYPACK
11. FLIGHT STRIP BAY
12. FLIGHT STRIP BIN
13. FLIGHT STRIP HOLDERS
14. ALPHANUMERIC KEYBOARD
15. TELEPHONE HANDSET
16. PENCIL SHARPENER
17. RHEOSTAT FOR OVERHEAD LIGHT

PAPER

A. DETROIT SECTIONAL CHART
B. FLIGHT STRIPS
C. LIST OF UNICOM AND COMPANY RADIO FREQUENCIES
D. LIST OF SECONDARY AIRPORT ABBREVIATIONS
E. AERONAUTICAL CHART
F. LOCATION IDENTIFIERS NOTEBOOK
G. POSITION LOG
H. SCRATCH PAD
I. CHART OF ARTCC SECTORS IN BUFFALO AREA

FIGURE 2-11. ARRIVAL DATA



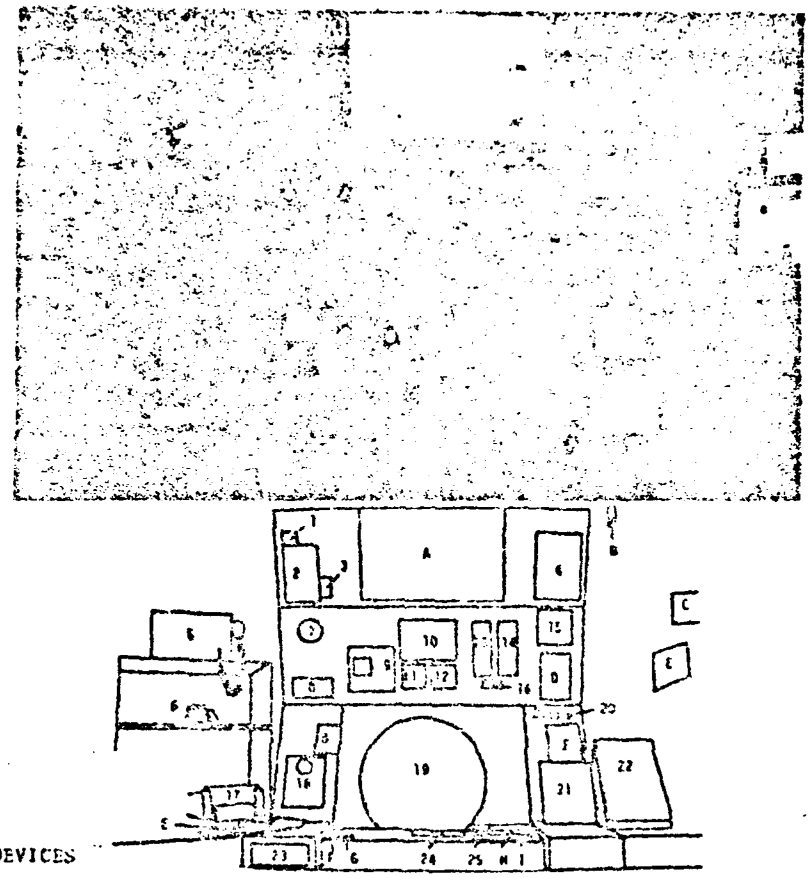
DEVICES

1. CONTROL PANEL FOR BACKUP FAA MICROPHONE
2. FAA COMMUNICATIONS PANEL
3. SPEAKER/HEADPHONE VOLUME CONTROLS
4. TRANSPONDER CONTROLS
5. FAA SPEAKER
6. VIDEO MAP SELECTOR PANEL
7. DIGITAL ALTIMETER
8. WIND DIRECTION INDICATOR
9. WIND SPEED INDICATOR
10. DIGITAL CLOCK
11. TELCO SPEAKER
12. TELCO DIAL AND KEYPACK
13. RADAR DISPLAY AND CONTROLS
14. RHEOSTAT FOR OVERHEAD LIGHT
15. CONTROLLER'S MICROPHONE
16. ARTS TRACKBALL
17. ALPHANUMERIC KEYBOARD
18. FLIGHT STRIP BAY
19. TELCO JACKS
20. FAA RADIO JACK

PAPER

A. AERONAUTICAL CHART
B. POSITION LOG
C. WEATHER MESSAGE
D. LIST OF SECONDARY AIRPORT DESIGNATIONS
E. LIST OF RADIO FREQUENCIES FOR CLEVELAND AND TORONTO ARTCC SECTORS
F. LIST OF PREFIXES FOR AIRCRAFT TYPES
G. SCRATCH PAD

FIGURE 2-12. DEPARTURE RADAR 1 (WEST SECTOR)



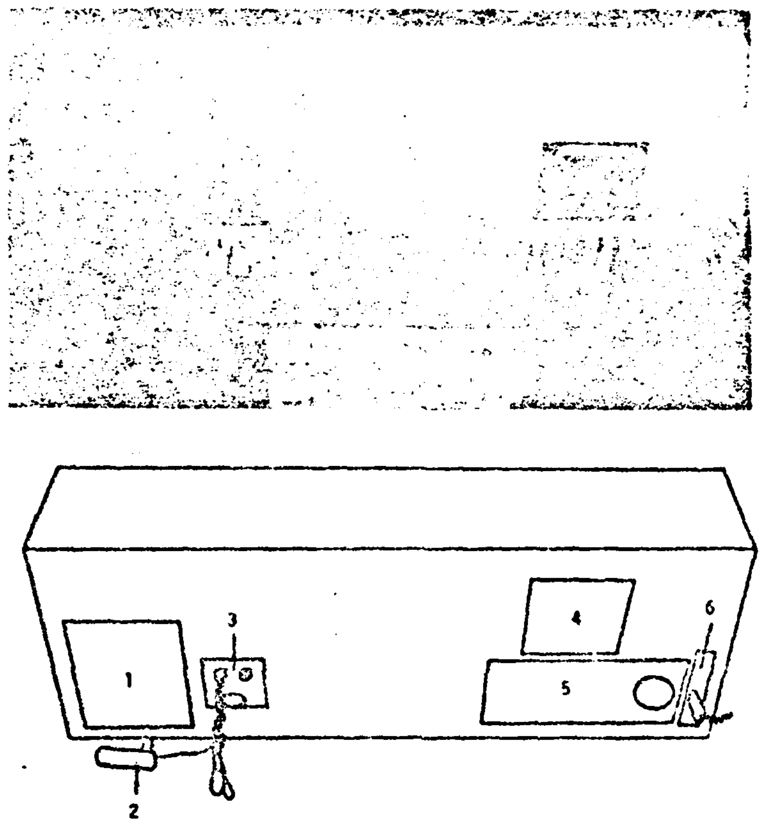
DEVICES

1. CONTROL PANEL FOR BACKUP FAA MICROPHONE
2. FAA COMMUNICATIONS PANEL
3. SPEAKER/HEADPHONE VOLUME CONTROLS
4. TRANSPONDER CONTROLS
5. BACKUP VHF TRANSCEIVER
6. TELEPHONE HANDSET
7. FAA SPEAKER
8. VIDEO MAP SELECTOR PANEL
9. DIGITAL ALTIMETER
10. RVR PANEL
11. WIND DIRECTION INDICATOR
12. WIND SPEED INDICATOR
13. RUNWAY 23 ILS MONITOR PANEL
14. RUNWAY 5 ILS MONITOR PANEL
15. TELCO SPEAKER
16. DIGITAL CLOCK
17. ELECTROWRITER
18. TELCO DIAL AND KEYPACK
19. RADAR DISPLAY AND CONTROLS
20. RHEOSTAT FOR OVERHEAD LIGHT
21. FLIGHT STRIP BOX
22. FLIGHT STRIP BAY
23. TELCO JACKS
24. ARTS TRACKBALL
25. ALPHANUMERIC KEYBOARD

PAPER

A. AERONAUTICAL CHART
B. POSITION LOG
C. LIST OF UNICOM AND COMPANY RADIO FREQUENCIES
D. BUF NAVAIDS FREQUENCY TABLE
E. WEATHER MESSAGE
F. LIST OF RADIO FREQUENCIES FOR CLEVELAND AND TORONTO ARTCC SECTORS
G. SECTOR HANDOFF LIST
H. LIST OF SECONDARY AIRPORT DESIGNATIONS
I. SCRATCH PAD

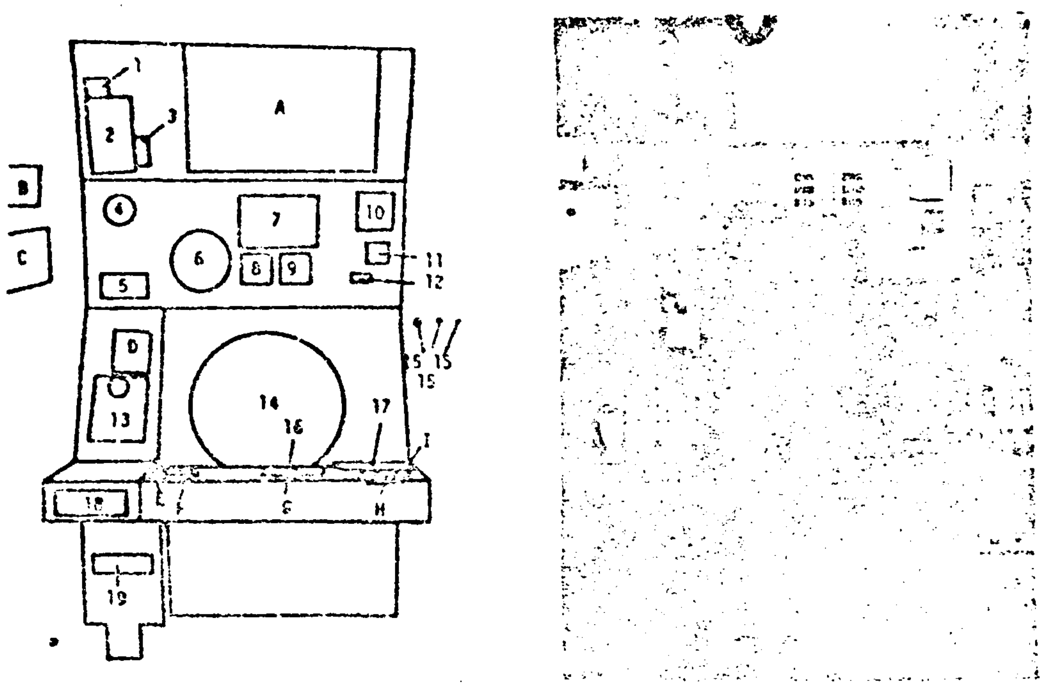
FIGURE 2-13. ARRIVAL RADAR 1 (WEST SECTOR)



DEVICES

1. STANDBY SELECTOR PANEL FOR FAA FREQUENCIES
2. LIGHT
3. ELECTRIC OUTLET, RHEOSTAT FOR OUTLET
4. TELCO SPEAKER
5. TELCO DIAL AND KEYPACK
6. TELCO JACKS

FIGURE 2-14. TRACON COORDINATOR



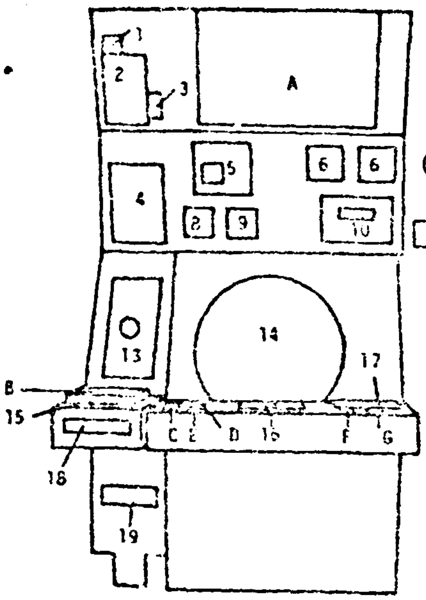
DEVICES

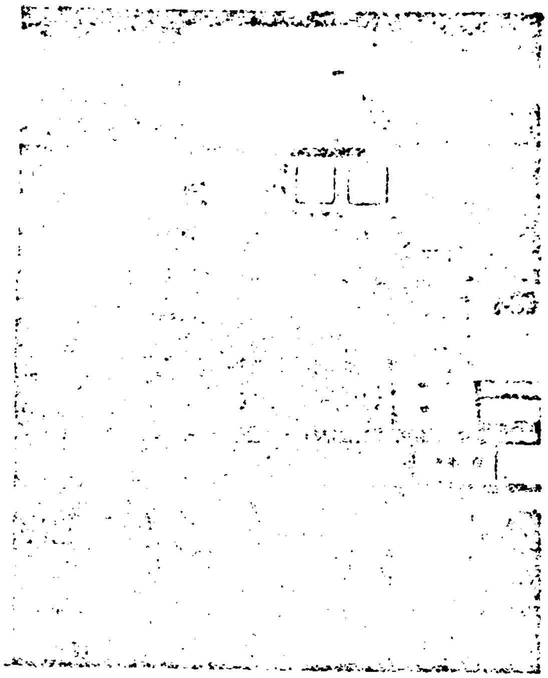
1. CONTROL PANEL FOR BACKUP FAA MICROPHONE
2. FAA COMMUNICATIONS PANEL
3. SPEAKER/HEADPHONE VOLUME CONTROLS
4. FAA SPEAKER
5. VIDEO MAP SELECTOR PANEL
6. ANALOG ALTIMETER
7. RVR PANEL
8. WIND DIRECTION INDICATOR
9. WIND SPEED INDICATOR
10. TELCO SPEAKER
11. DIGITAL ALTIMETER
12. DIGITAL CLOCK
13. TELCO DIAL AND KEYPACK
14. RADAR DISPLAY AND CONTROLS
15. RHEOSTAT FOR OVERHEAD LIGHT
16. ARTS TRACKBALL
17. ALPHANUMERIC KEYBOARD
18. TELCO JACKS
19. FAA RADIO JACK

PAPER

A. AERONAUTICAL CHART
B. LIST OF UNICOM AND COMPANY RADIO FREQUENCIES
C. WEATHER MESSAGE
D. POSITION LOG
E. LIST OF RADIO FREQUENCIES FOR CLEVELAND AND TORONTO ARTCC SECTORS
F. LIST OF PREFIXES FOR AIRCRAFT TYPES
G. SECTOR HANDOFF LIST
H. SCRATCH PAD
I. LIST OF SECONDARY AIRPORT DESIGNATIONS

FIGURE 2-15. ARRIVAL RADAR 2 (EAST SECTOR)





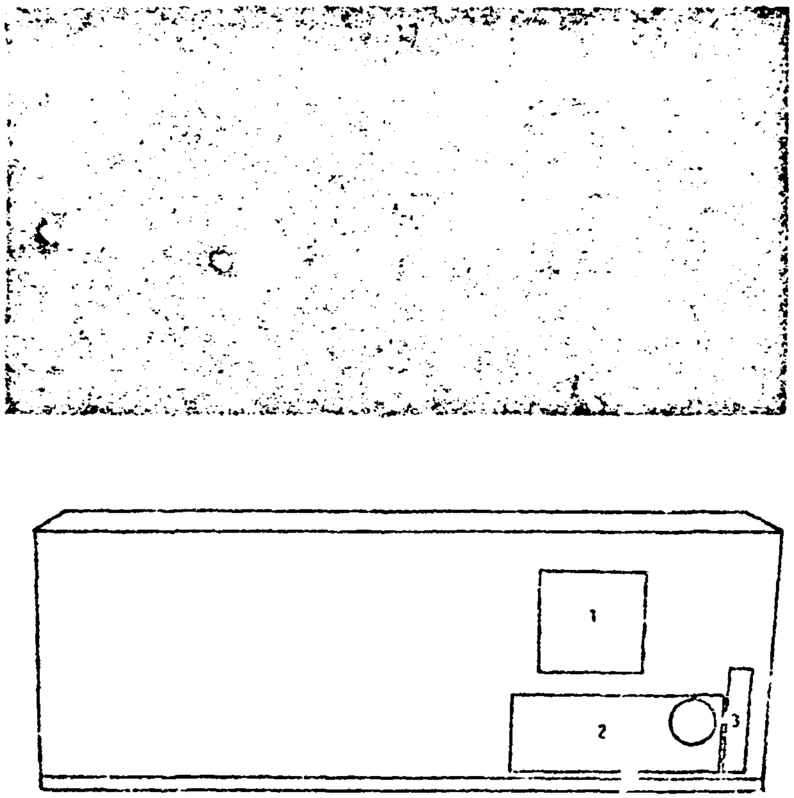
DEVICES

1. CONTROL PANEL FOR BACKUP FAA MICROPHONE
2. FAA COMMUNICATIONS PANEL
3. SPEAKER/HEADPHONE VOLUME CONTROLS
4. TRANSPONDER CONTROLS
5. DIGITAL ALTIMETER
6. TELCO SPEAKER
7. FAA SPEAKER
8. WIND DIRECTION INDICATOR
9. WIND SPEED INDICATOR
10. DIGITAL CLOCK
11. VIDEO MAP SELECTOR PANEL
12. RHEOSTAT FOR OVERHEAD LIGHT
13. TELCO DIAL AND KEYPACK
14. RADAR DISPLAY AND CONTROLS
15. FLIGHT STRIP BOX
16. ARTS TRACKBALL
17. ALPHANUMERIC KEYBOARD
18. TELCO JACKS
19. FAA RADIO JACK

PAPER

A. AERONAUTICAL CHART
B. FLIGHT STRIPS
C. LIST OF RADIO FREQUENCIES FOR CLEVELAND AND TORONTO ARTCC SECTORS
D. LIST OF PREFIXES FOR AIRCRAFT TYPES
E. MINIMUM TAKEOFF VISIBILITY REQUIREMENTS
F. SECTOR HANDOFF LIST
G. LIST OF MILITARY CHANNEL RADIO FREQUENCIES

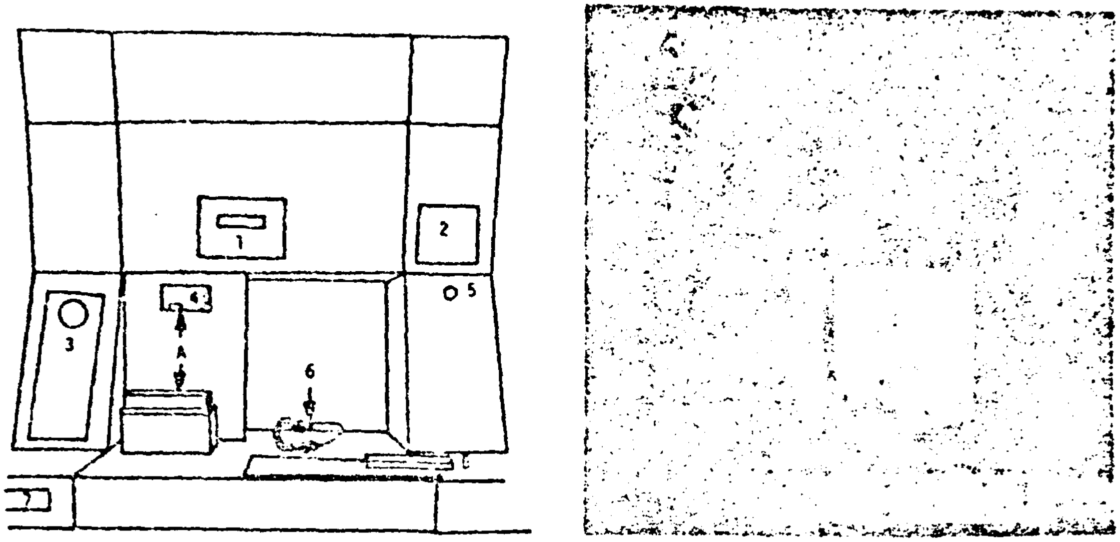
FIGURE 2-16. DEPARTURE RADAR 2 (EAST SECTOR) (NOT STAFFED)



DEVICES

1. TELCO SPEAKER
2. TELCO DIAL AND KEYPACK
3. TELCO JACKS

FIGURE 2-17. DEPARTURE HANDOFF (NOT STAFFED)



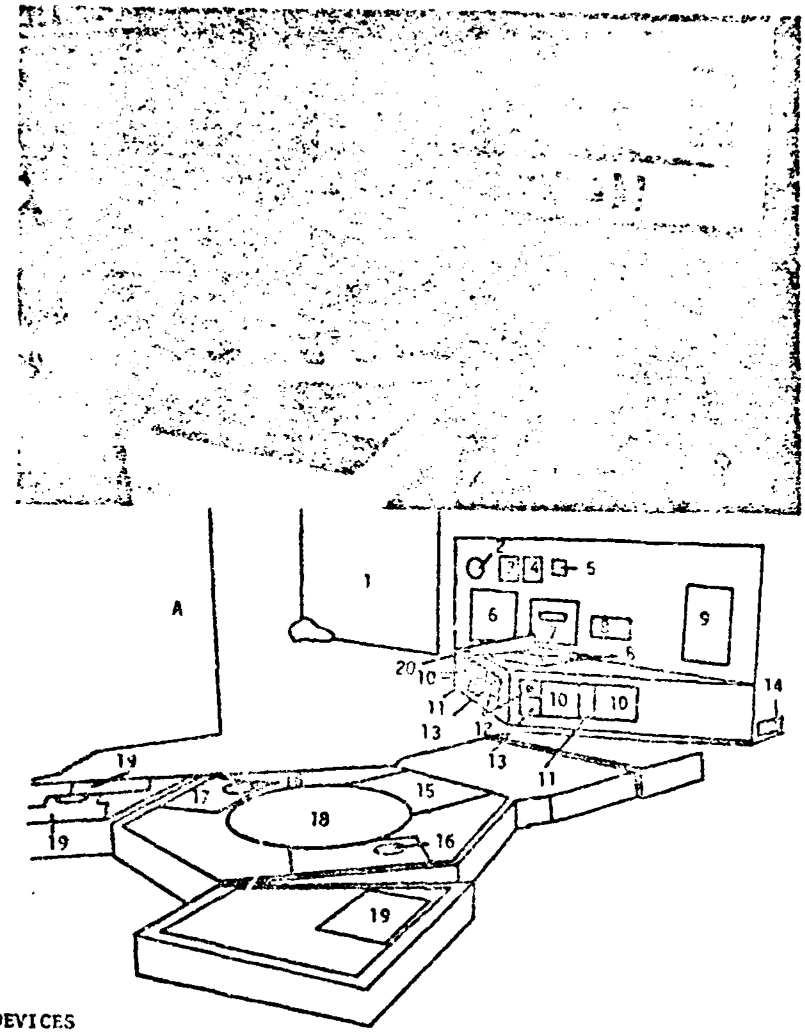
DEVICES

1. DIGITAL CLOCK
2. TELCO SPEAKER
3. TELCO DIAL AND KEYPACK
4. FLIGHT STRIP BIN
5. RHEOSTAT FOR OVERHEAD LIGHT
6. HEADSET
7. TELCO JACKS

PAPER

A. FLIGHT STRIPS
B. SCRATCH PAD

FIGURE 2-18. DEPARTURE DATA (NOT STAFFED)



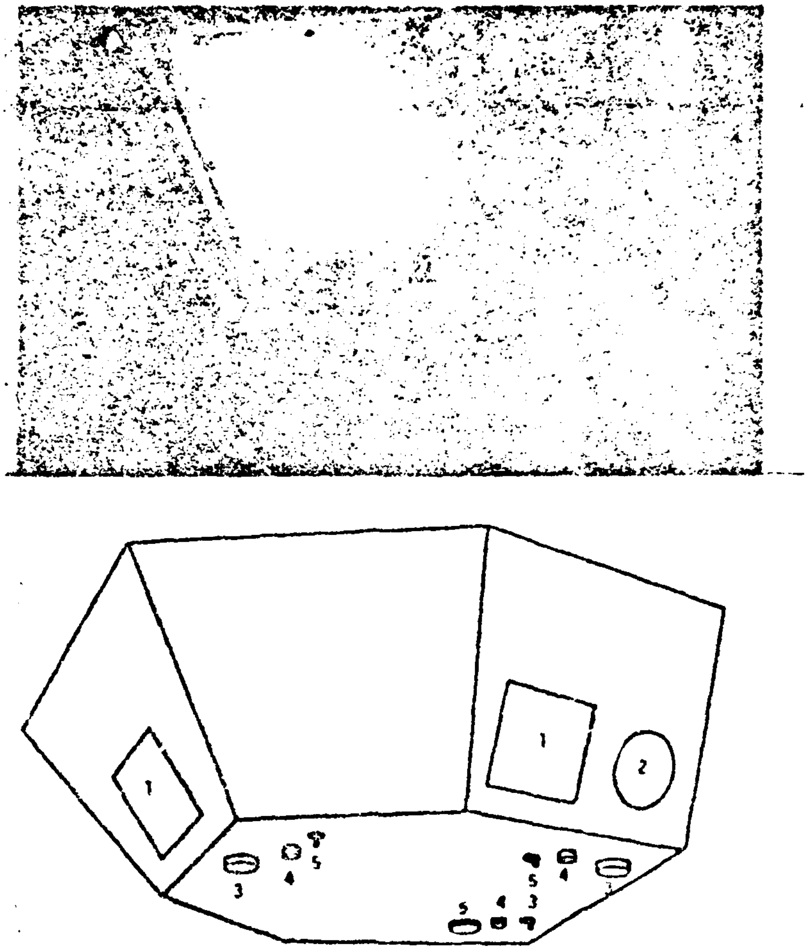
DEVICES

1. STATUS BOARD
2. FAA SPEAKER
3. WIND DIRECTION INDICATOR
4. WIND SPEED INDICATOR
5. DIGITAL ALTIMETER
6. (PAPER COVERING CONSOLE OPENING)
7. DIGITAL CLOCK
8. VIDEO MAP SELECTOR PANEL
9. TRANSPONDER CONTROLS
10. FAA COMMUNICATIONS PANEL
11. SPEAKER/HEADPHONE VOLUME CONTROLS
12. FAA RADIO JACK
13. CONTROL PANEL FOR BACKUP FAA MICROPHONE
14. TELCO JACKS
15. (SPACE FOR RADAR CONTROLS)
16. ARTS TRACKBALL
17. ALPHANUMERIC KEYBOARD
18. (SPACE FOR RADAR DISPLAY)
19. TELCO DIAL AND KEYPACK
20. FLIGHT STRIP BOX

PAPER

A. CRASH COORDINATION MAP
B. REFERENCE NOTEBOOK

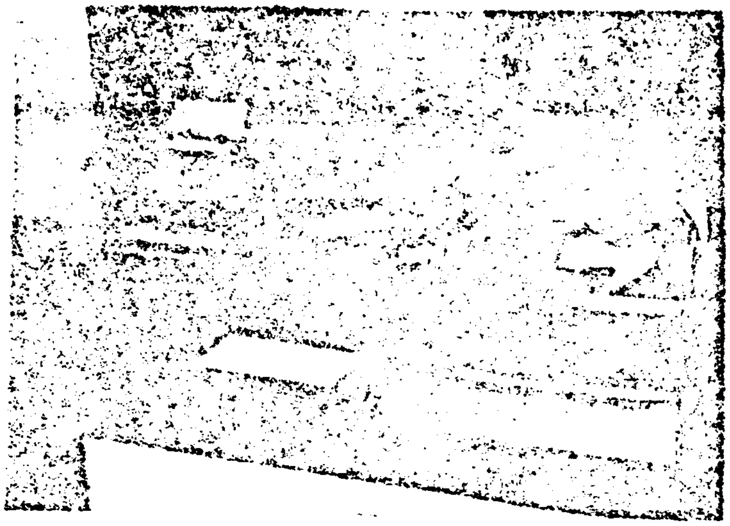
FIGURE 2-19. EXPANDED RADAR (NOT STAFFED)

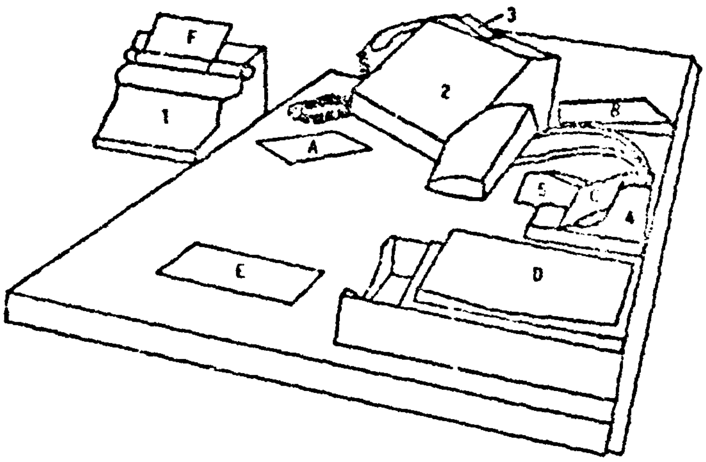


DEVICES

1. TELCO SPEAKER
2. FAA SPEAKER
3. OVERHEAD LIGHT
4. RHEOSTAT FOR OVERHEAD LIGHT
5. SWITCH FOR OVERHEAD LIGHT
6. FUSE FOR OVERHEAD LIGHT

FIGURE 2-20. ABOVE EXPANDED RADAR





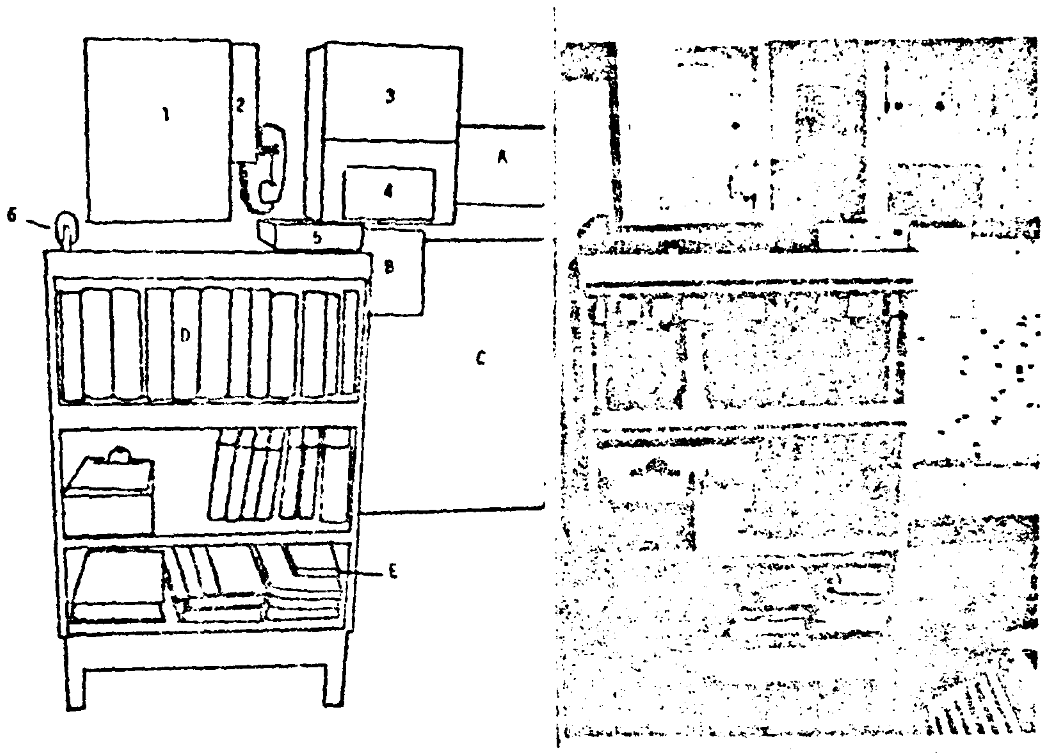
DEVICES

1. TYPEWRITER
2. TELCO DIAL, KEYPACK AND HANDSET
3. FLIGHT STRIP HOLDER
4. LAMP
5. TAPE DISPENSER

PAPER

A. SCRATCH PAD
B. REFERENCE NOTEBOOK
C. NOTE
D. TIME AND ATTENDANCE RECORD
E. NOTE PAPER
F. FORM 7230-4

FIGURE 2-21. WATCH SUPERVISOR DESK



DEVICES

1. RADAR BEACON CONTROL PANEL
2. DIRECT TELEPHONE TO RADAR SITE
3. MSAW CONTROL PANEL
4. ARTS COMMON EQUIPMENT CHANNEL SELECTOR
5. FIRST AID KIT
6. PENCIL SHARPENER

PAPER

A. CALENDAR
B. LIST OF SATELLITE AIRPORTS
C. MAP OF SATELLITE AIRPORTS
D. REFERENCE NOTEBOOKS
E. APPROACH PLATES

FIGURE 2-22. REFERENCE AREA

2.4.2 Buffalo Tower Cab

The layout, staffing, operations, and working environment of the Buffalo Tower Cab is presented in the following:

Figure 2-23: Buffalo Tower Cab Floor Plan Showing Controller Positions.

Table 2-6: Buffalo Tower Cab--Positions Staffing and Duties.

Figure 2-24 through 2-31: Photographic survey of cab positions and equipment.

(Reference Table 2-5 for Typical Cab Staffing by Time of Day.)

Regular Cab staffing (0700-2300) involves four or five positions:

- o Clearance Delivery (CD)
- o Flight Data (FD)
- o Ground Control (GC)
- o Local Control (LC)
- o Cab Coordinator (CC) (whenever possible)

The Assistant Local Control (AL) position is not staffed. The FD position is usually staffed by the least experienced controller (a trainee or developmental) (Section 2.5). The CD and FD positions are combined frequently during the day to permit controller breaks.

In the event the CD position is not staffed, GC performs the necessary clearance functions; this activity does not involve a change in physical position. The GC will monitor the CD frequency and organize flight data (Section 5) accordingly at his position.

Mid-watch staffing in the Cab usually involves two controllers at the LC and FD positions (Table 2-5).

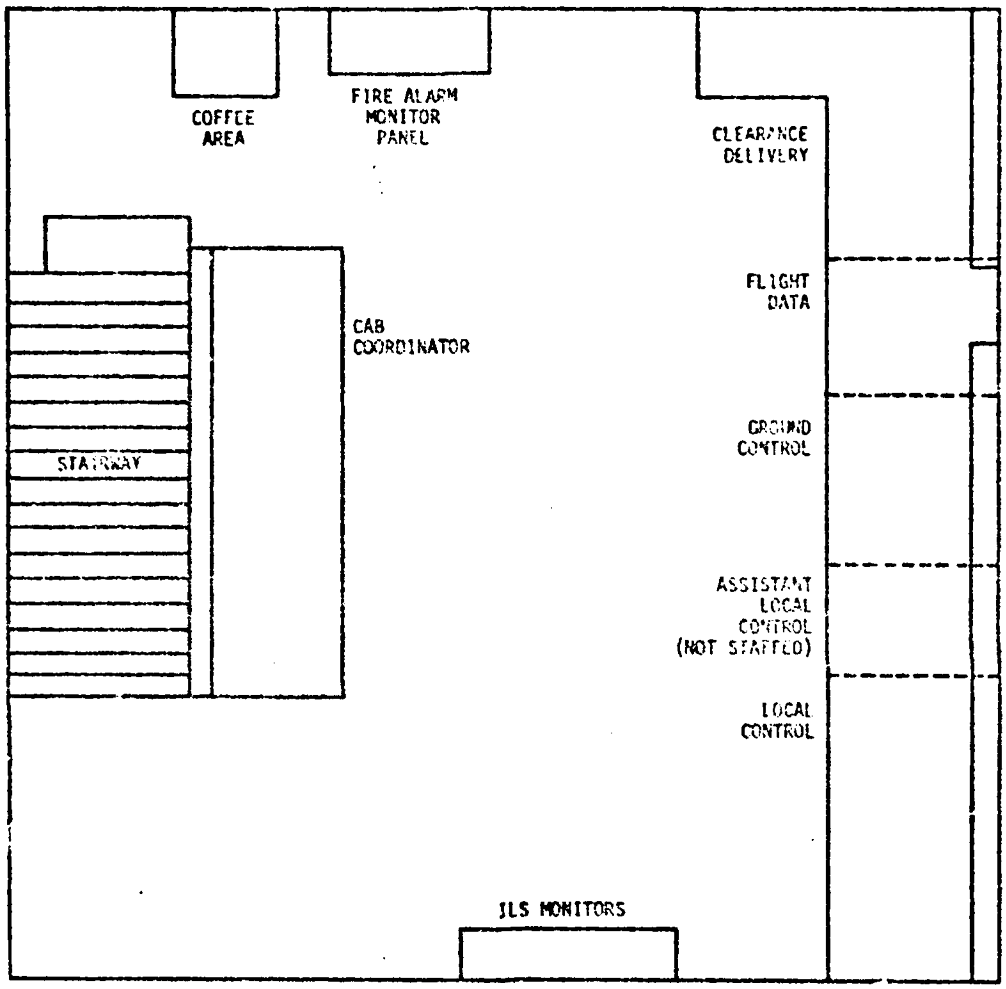


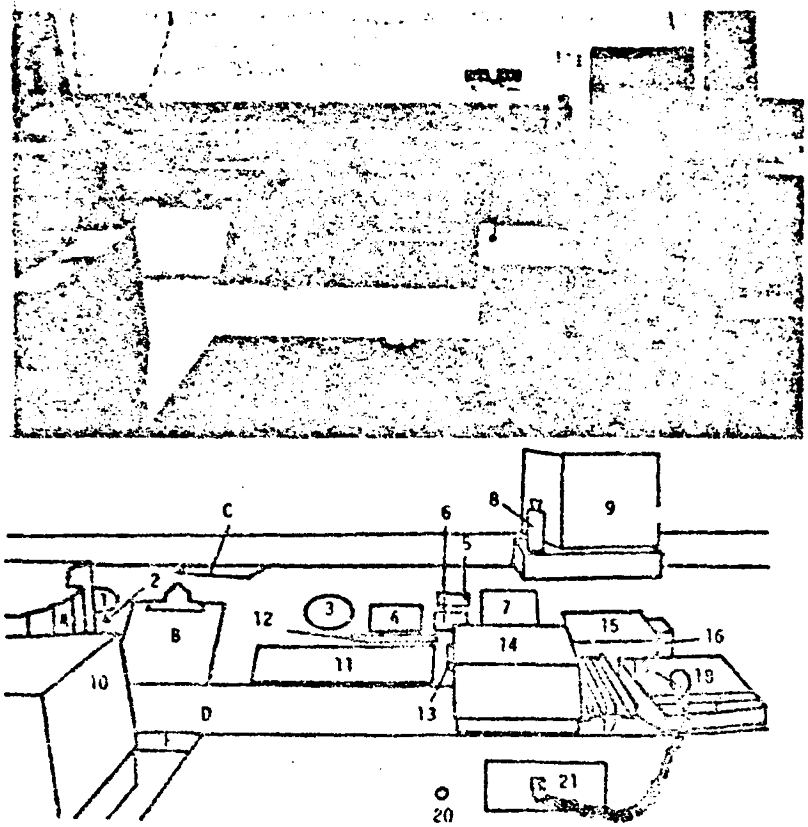
FIGURE 2-23. BUFFALO TOWER CAB FLOOR PLAN SHOWING CONTROLLER POSITIONS

TABLE 2-6. BUFFALO TOWER CAB - POSITIONS, STAFFING AND DUTIES

OFFICIAL POSITION TITLE	ABBREVIATED TITLE	TYPICAL STAFFING FROM	TO	COMMENTS	SUMMARY OF PRIMARY DUTIES
1. CLEARANCE DELIVERY	CD	0700	2300		o Responsible for the delivery of IFR and Stage III clearances to departing aircraft o Responsible for assigning initial altitude (normally 6,000 feet) to Buffalo IFR departures o Assure that the required altitude restrictions/amended routings beyond the route fix are applied as necessary o Assign proper frequency and beacon code appropriate to the clearance o Make up Stage III flight strips for VFR departures (unless pilot refuses) and issues departure frequency, heading, and transponder code; place strip at FD position.
		2301	0659	1 controller works CD and FD	
2. FLIGHT DATA	FD	0700	2300	Combined with CD for breaks	o Receives, posts, and relays flight data concerning IFR and Stage III traffic, and assists in operation of the facility o Obtains ATC clearances from centers of towers as appropriate; writes clearance on a departure strip using standard format o Forwards information on Stage III departures to TRACON FAD position) o Operates electrowriter and FDEP; removes weather from electrowriter and posts in front of Local Control o Coordinates with Buffalo FSS as required.
		2301	0659	1 controller works CD and CD	
3. GROUND CONTROL	GC	0700 - 2300			o Handles taxiing aircraft and vehicular traffic on the landing area o Performs function of the CD position when it is not manned o Relay to FD position any information on hazards to aircraft operating on the airport, which are not previously covered by NOTAMS or AIRADS, for delivery to N.F.T.A. (e.g., snow-ice conditions) o Offer all available assistance to Buffalo Fire Department during emergencies; keep frequency clear if necessary
		2301	0659	LC performs	

TABLE 2-6. BUFFALO TOWER CAB - POSITIONS, STAFFING AND DUTIES (CONTINUED)

OFFICIAL POSITION TITLE	ABBREVIATED TITLE	TYPICAL STAFFING FROM TO	COMMENTS	SUMMARY OF PRIMARY DUTIES
4. ASSISTANT LOCAL CONTROL	AL	Not staffed		o Responsible for coordination between Arrival Control and Local Control regarding the approach interval on arriving aircraft o Copies and posts flights data in the sequence order forwarded from TRACON o Insure that flight data has passed the departure time before removing strip from the board o Position may be combined with Local Control during radar outages or during periods of light traffic
5. LOCAL CONTROL	LC	Always staffed		o Responsible for the issuance of information and clearances to air and vehicular traffic operating on landing area, to VFR traffic operating in the control zone, and to IFR and Stage III traffic released to local control jurisdiction o Responsible for separation of departure traffic from aircraft on final approach o Responsible for providing initial separation between successive IFR departures o Will advise Cab Coordinator of suggested runway changes o Will call off each IFR departure "rolling" to Departure Controller o Responsible for approval or disapproval of any landing contrary to existing flow of traffic o Responsible for operating airport beacon and field lighting
6. COORDINATOR (CAB SUPERVISOR OR CONTROLLER IN CHARGE)	CC (CS OR CIC)	Variable-depends on traffic		o Responsible for coordination necessary to assure the safe and expeditious flow of traffic landing and departing the Greater Buffalo Airport o Coordinating and directing the activities of the designated positions in the tower Cab; rotates controllers on positions o Coordinates with TRACON coordinator - type of approach, runways, field conditions, traffic flow, etc o Updates, monitors, and disseminates current ATIS information o Assure tower portion of facility checklist is accomplished o Retain general traffic picture at all times



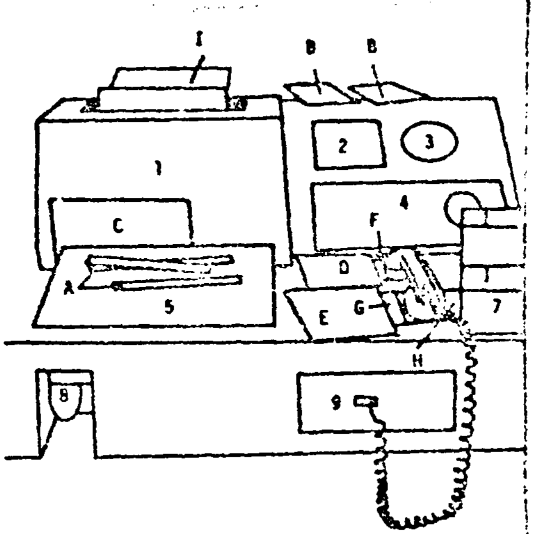
DEVICES

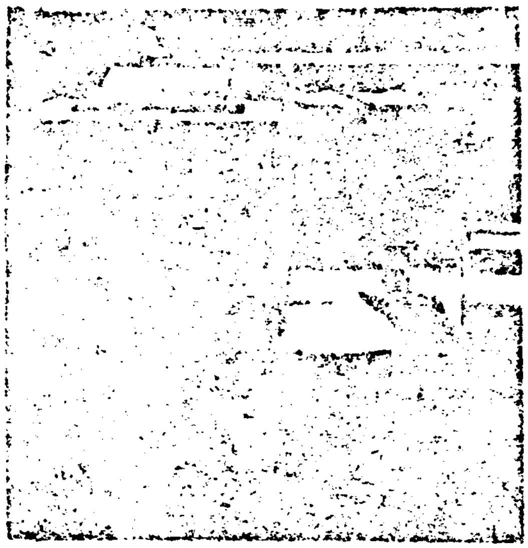
1. RHEOSTAT FOR OVERHEAD LIGHT
2. SWITCH FOR OVERHEAD LIGHT
3. FAA SPEAKER
4. FDEP SELECTOR SWITCH
5. CONTROL PANEL FOR BACKUP FAA MICROPHONE
6. DIGITAL CLOCK
7. TELCO SPEAKER
8. INK FOR ELECTROWRITER
9. CONRAC MONITOR
10. FDEP PRINTER
11. FAA COMMUNICATIONS PANEL
12. FLIGHT STRIP HOLDER FOR MESSAGES
13. TELCO DIAL AND KEYPACK
14. ELECTROWRITER
15. ALPHANUMERIC KEYBOARD
16. ARTS ENTER BUTTON, PEN STICK
17. FLIGHT STRIP HOLDERS
18. FLIGHT STRIP BOX
19. CONTROLLER'S MICROPHONE
20. FAA RADIO JACK
21. TELCO JACKS

PAPER

A. REFERENCE NOTEBOOKS
B. LIST OF AIRPORT/AIRCRAFT ABBREVIATIONS
C. INFORMATION GUIDE FOR PIPER AIRCRAFT
D. AERONAUTICAL CHART
E. POSITION RELIEF BRIEFING CHECK LIST
F. FLIGHT STRIPS

FIGURE 2-24. CLEARANCE DELIVERY





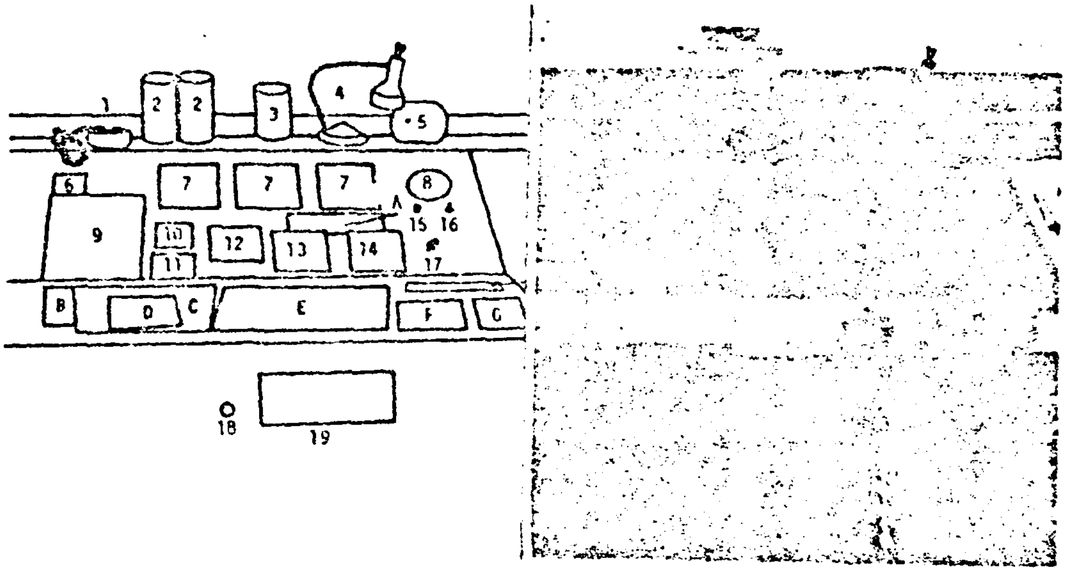
DEVICES

1. FDEP PRINTER
2. TELCO SPEAKER
3. FAA SPEAKER (GROUND CONTROL)
4. TELCO DIAL AND KEYPACK
5. FDEP KEYBOARD
6. TELEPHONE HANDSET
7. FLIGHT STRIP BOX
8. TELEPHONE HANDSET HOLDER
9. TELCO JACKS

PAPER

A. GI MESSAGES
B. POSITION LOG
C. ENROUTE FDEP DATA CARD
D. POSITION RELIEF BRIEFING CHECK LIST
E. SCRATCH PAD
F. LIST OF FDEP NUMBERS FOR CLEVELAND AND TORONTO SECTORS
G. LIST OF UNICOM AND COMPANY RADIO FREQUENCIES
H. SNOW REMOVAL INFORMATION
I. FLIGHT STRIPS

FIGURE 2-25. FLIGHT DATA



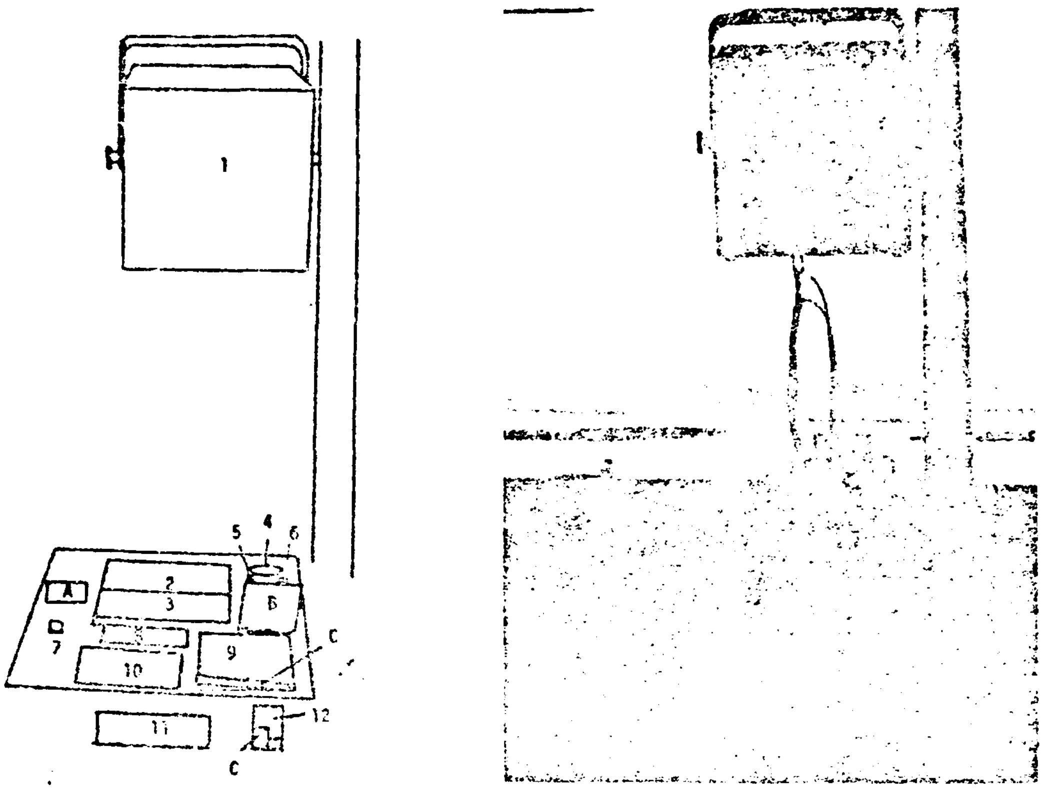
DEVICES

1. CONTROLLER'S MICROPHONE
2. ELECTROWRITER PAPER ROLL
3. PENCIL HOLDER
4. LAMP
5. PENCIL SHARPENER
6. CONTROL PANEL FOR BACKUP FAA MICROPHONE
7. TELCO SPEAKER
8. RHEOSTAT FOR OVERHEAD LIGHT
9. FAA COMMUNICATIONS PANEL
10. DIGITAL ALTIMETER
11. DIGITAL CLOCK
12. TELCO KEYPACK
13. WIND DIRECTION INDICATOR
14. WIND SPEED INDICATOR
15. FUSE FOR OVERHEAD LIGHT
16. SWITCH FOR OVERHEAD LIGHT
17. LIGHT RHEOSTAT FOR WIND INDICATORS
18. FAA RADIO JACK
19. TELCO JACKS

PAPER

A. MESSAGE CONCERNING REPAIRS TO GATE 15
B. MAP OF GATE LOCATIONS
C. REFERENCE MATERIAL
D. SCRATCH PAD
E. MAP OF RUNWAY LENGTHS FROM TAXIWAY INTERSECTION
F. POSITION RELIEF BRIEFING CHECK LIST
G. EMERGENCY ALERT CODES
H. LIST OF UNICOM AND COMPANY RADIO FREQUENCIES

FIGURE 2-26. GROUND CONTROL



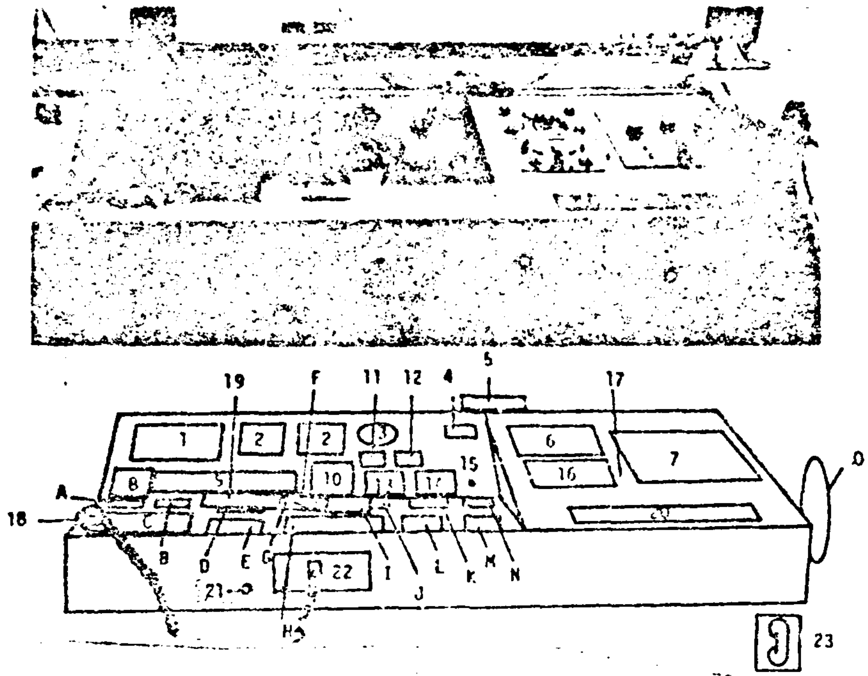
DEVICES

1. BRITE RADAR DISPLAY
2. BRITE RADAR CONTROL PANEL
3. ALPHANUMERIC CONTROL PANEL
4. RHEOSTAT FOR OVERHEAD LIGHT
5. FUSE FOR OVERHEAD LIGHT
6. SWITCH FOR OVERHEAD LIGHT
7. CLIP FOR NOTES
8. VIDEO MAP SELECTOR PANEL
9. FLIGHT STRIP BAY
10. TELCO KEYPACK
11. TELCO JACKS
12. FLIGHT STRIP BIN

PAPER

A. POSITION LOG
B. HOURLY WEATHER REPORT
C. FLIGHT STRIPS

FIGURE 2-27. ASSISTANT LOCAL CONTROL (NOT STAFFED)



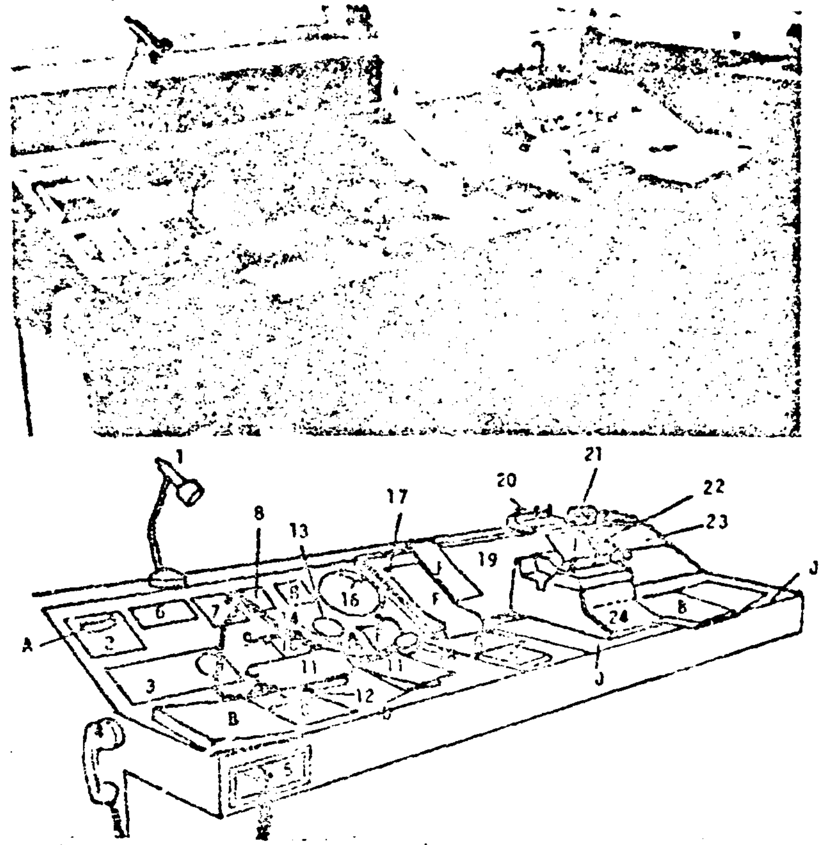
DEVICES

1. RVR PANEL
2. TELCO SPEAKER
3. FAA SPEAKER
4. CONTROL PANEL FOR BACKUP FAA MICROPHONE
5. NON-STAGE III VFR OPERATION COUNTER
6. RUNWAY 5 APPROACH LIGHT CONTROL PANEL
7. FIELD LIGHTING CONTROL PANEL
8. FLIGHT STRIP BIN
9. FAA COMMUNICATIONS PANEL
10. TELCO KEYPACK
11. DIGITAL ALTIMETER
12. DIGITAL CLOCK
13. WIND DIRECTION INDICATOR
14. WIND SPEED INDICATOR
15. LIGHT RHEOSTAT FOR WIND INDICATORS
16. RUNWAY 23 APPROACH LIGHT CONTROL PANEL
17. RUNWAY 32 REIL CONTROL SWITCH
18. CONTROLLER'S MICROPHONE
19. INSTRUMENT APPROACH COUNTER
20. ALS ENGINE GENERATOR REMOTE CONTROL PANEL
21. FAA RADIO JACK
22. TELCO JACKS
23. EMERGENCY TELEPHONE

PAPER

A. MINIMUM TAKEOFF VISIBILITIES CHART
B. LIST OF PREFIXES FOR AIRCRAFT TYPES
C. REFERENCES FOR SIMULTANEOUS LANDINGS ON INTERSECTING RUNWAYS
D. BUF NAVAIDS FREQUENCY TABLE
E. POSITION RELIEF BRIEFING CHECK LIST
F. SCRATCH PAD
G EMERGENCY ALERT CODES
H. SUNRISE/SUNSET TABLE
I. POSITION LOG
J. INSTRUMENT TRAFFIC COUNT MINIMUMS
K. CHECK LIST FOR AIR/GROUND COMMUNICATION RECORDER
L. INSTRUCTIONS FOR USE OF HIRL, RCLS, TDZL, MIRL AND REIL
M. INSTRUCTIONS FOR USE OF ALS AND SFL
N. LIST OF UNICOM AND COMPANY RADIO FREQUENCIES
O. EMERGENCY INFORMATION GUIDE

FIGURE 2-28. LOCAL CONTROL



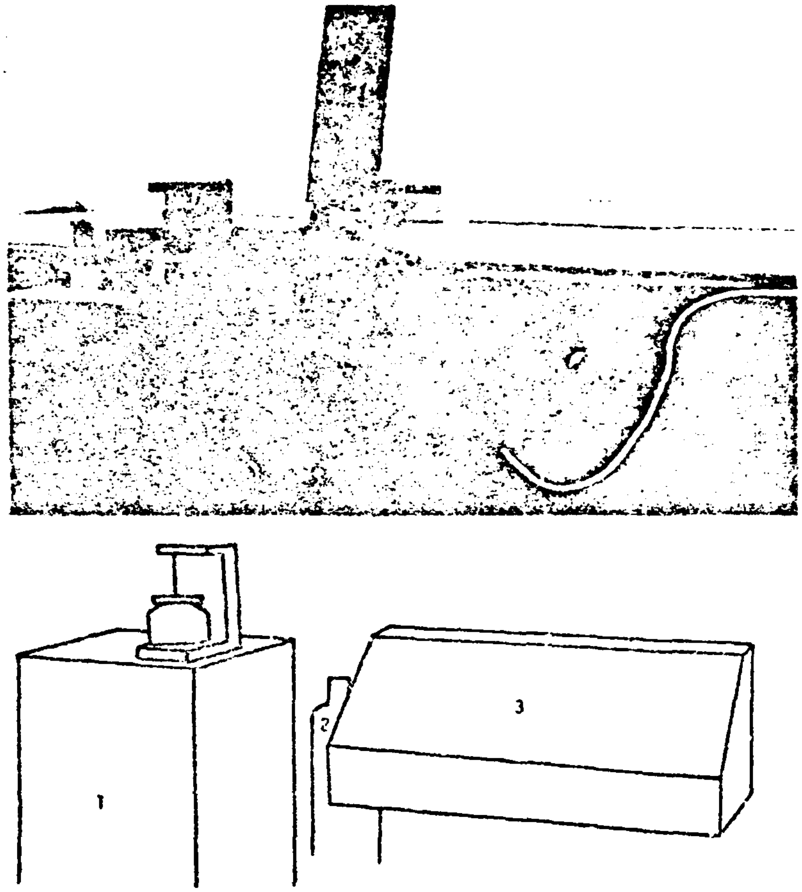
DEVICES

1. LAMP
2. TELCO SPEAKER
3. TELCO DIAL AND KEYPACK
4. TELEPHONE HANDSET
5. TELCO JACKS
6. VOT PANEL
7. ATIS RECORDING CONTROLS
8. STANDBY SELECTOR PANEL FOR FAA FREQUENCIES
9. OUT-OF-SERVICE MARKER
10. RECORDER STATUS PANEL FOR AIR/GROUND COMMUNICATIONS
11. HEADSET POUCH
12. ATIS SPEAKER
13. RHEOSTAT FOR OVERHEAD LIGHT
14. FUSE FOR OVERHEAD LIGHT
15. SWITCH FOR OVERHEAD LIGHT
16. ANALOG ALTIMETER
17. LIGHT SWITCH FOR ALTIMETER
18. ATIS MICROPHONE
19. BULLETIN BOARD
20. HOLE PUNCH
21. TAPE DISPENSER
22. MSAW SPEAKER
23. MSAW CONTROL PANEL
24. TYPEWRITER

PAPER

A. LIST OF INTERCOM NUMBERS
B. REFERENCE NOTEBOOK
C. WIND CHILL TABLE
D. POSITION RELIEF BRIEFING CHECK LIST
E. RAG TO CLEAN ATIS BOARD
F. NOTAM
G. RECORD OF ATIS MESSAGE
H. APPROACH PLATES
I. FORM 7230-4
J. DETROIT SECTIONAL CHART

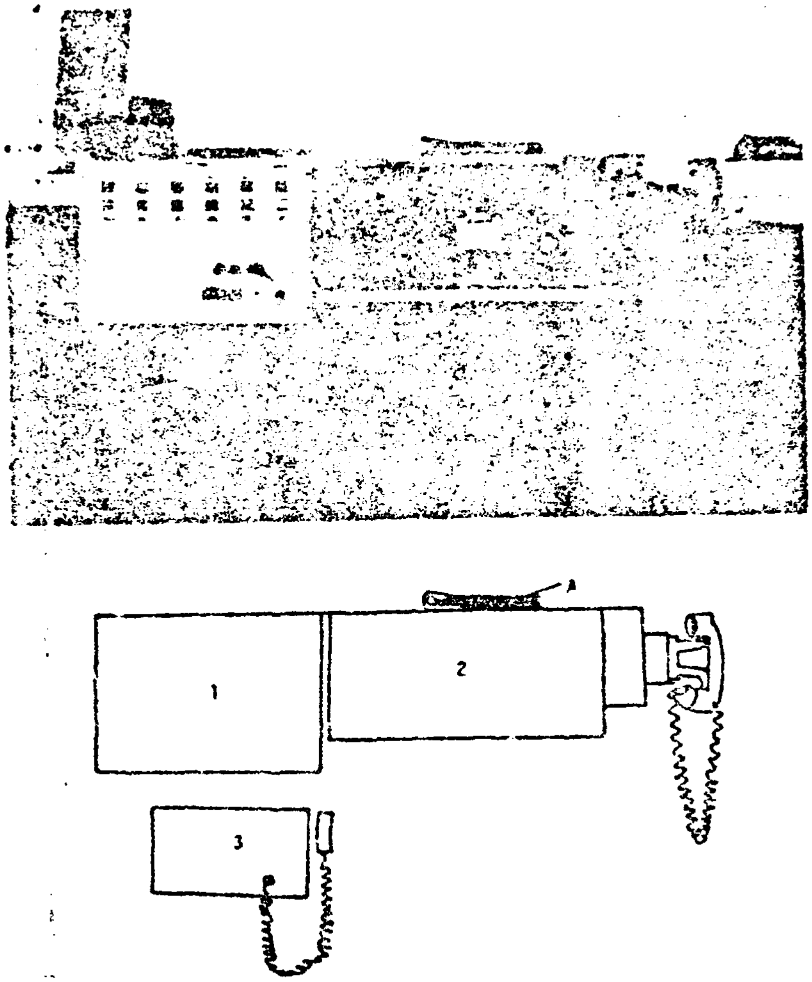
FIGURE 2-29. CAB COORDINATOR



DEVICES

1. STORAGE CABINET
2. FIRE EXTINGUISHER
3. FIRE ALARM MONITOR PANEL

FIGURE 2-30. COFFEE AREA AND FIRE ALARM MONITOR PANEL



DEVICES

1. ILS MONITOR PANEL FOR RUNWAY 23
2. ILS MONITOR AND CONTROL PANEL FOR RUNWAYS 5 AND 23
3. BACKUP VHF TRANSCEIVER

PAPER

A. REFERENCE NOTEBOOK

FIGURE 2-31. ILS MONITORS

2.5 CONTROLLER INFORMATION

Controllers at the Buffalo Tower are classified in one of the following categories:

- o Trainee.
- o Developmental.
- o Journeyman--Full Performance Level (FPL).
- o Full Facility Rated.

Each controller belongs to a "team" normally composed of a supervisor, four journeymen and two trainees. Training requirements for journeymen involve two over-the-shoulder evaluations per year, usually with one of each in the Cab and TRACON.

A survey of controller turnover at Buffalo revealed a 67% turnover rate over the past eight years. Many controllers leaving Buffalo receive assignments at Level V facilities in New York City or Pittsburgh.

Conversations with various Buffalo controllers over several days revealed one common complaint focusing on the FDEP equipment; major criticisms related to the slow printing speed and the frequent occurrences of FDEP outages.

3. EQUIPMENT

This section describes equipment in the Buffalo Tower Cab and TRACON to be considered in the design of the Consolidated Cab Display (CCD) and the Flight Data Display (FFD). These descriptions are from the controller's point of view. The locations, users, manner of use, and a picture are presented for each type of equipment described.

3.1 TIME AND WEATHER INFORMATION

Time and weather information is available from the console clocks, the altimeters, the wind speed and direction indicators, the Runway Visual Range (RVR) panels, and the radar displays. The locations of this equipment in the Cab and TRACON are shown in Figures 3-1 and 3-2 respectively.

3.1.1 Time: Console Clock (Figure 3-3), Radar Display

a) Locations (Figures 3-1, 3-2)

Console Clock	Radar Display
Local Control (LC)	Assistant Local (AL)
Ground Control (GC)	Clearance Delivery (CD)
Clearance Delivery (CD)	Departure Radar-1 (DEP-E)
Departure Data (DD)	Arrival Radar-2 (ARR-E)
Departure Radar-2 (DEP-E)	Arrival Radar-1 (ARR-W)
Arrival Radar-2 (ARR-E)	Departure Radar-1 (DEP-W)
Arrival Radar-1 (ARR-W)	Expanded Radar (ER)
Departure Radar-1 (DEP-W)	
Arrival Data (AD)	
Expanded Radar (ER)	

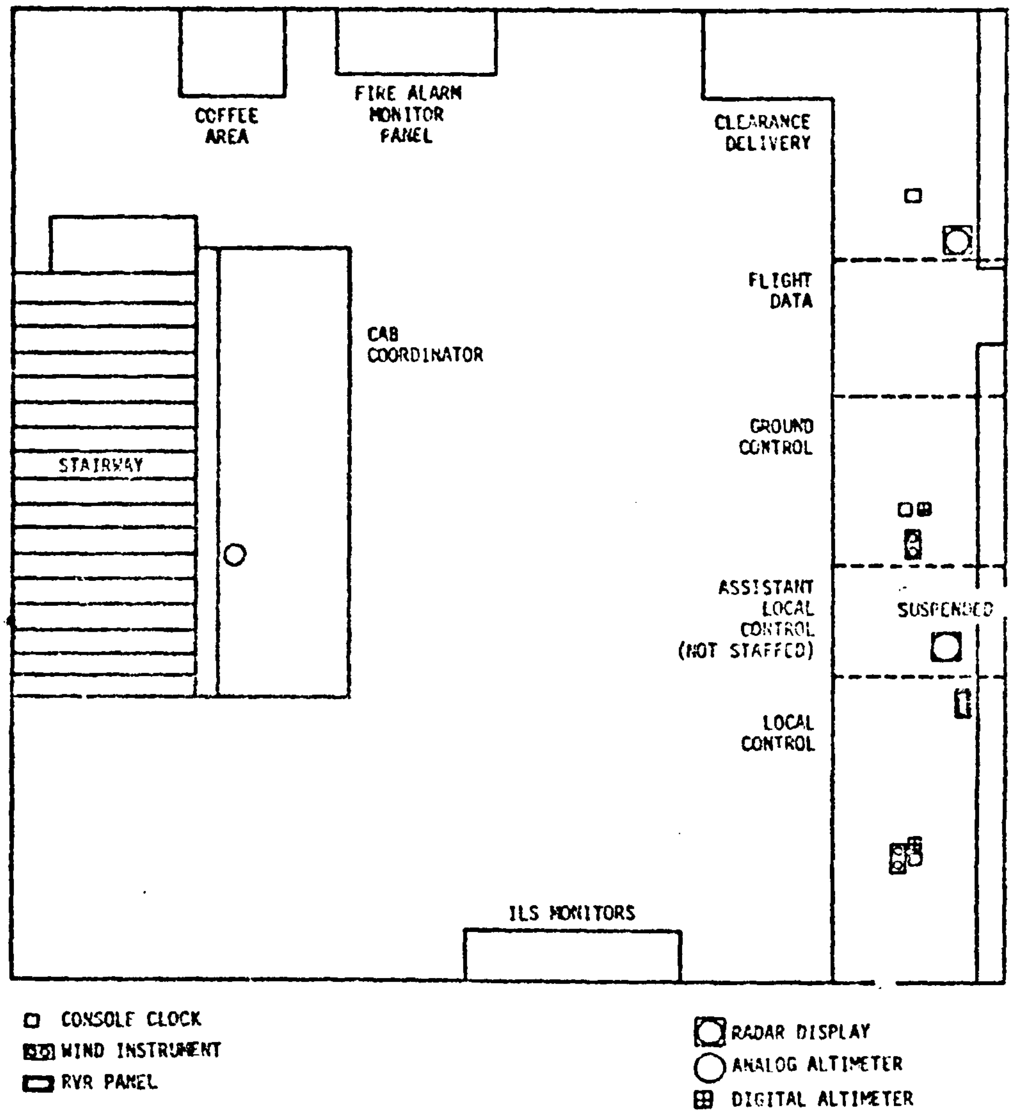


FIGURE 3-1. LOCATION OF WEATHER EQUIPMENT, CLOCKS, AND RADAR DISPLAYS IN CAB

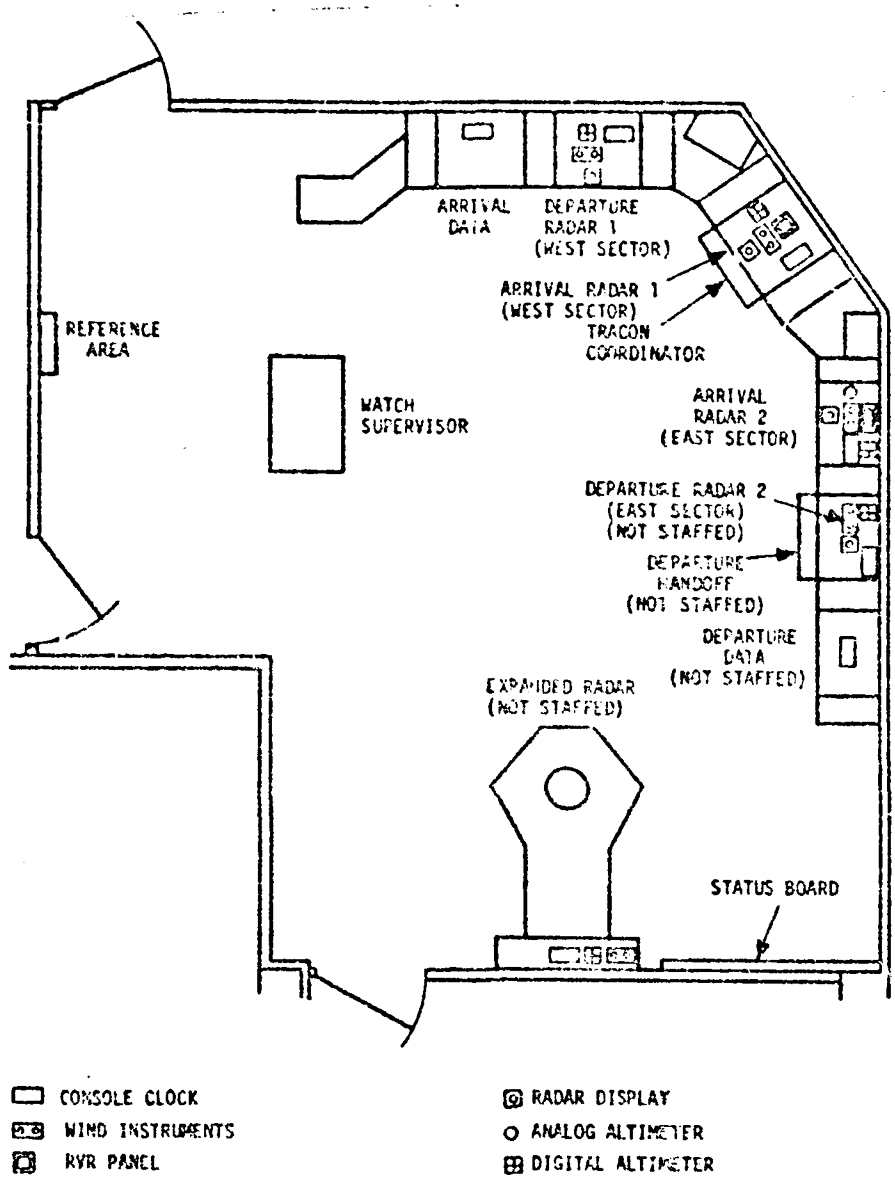


FIGURE 3-2. LOCATION OF WEATHER EQUIPMENT, CLOCKS, AND RADAR DISPLAYS IN TRACON

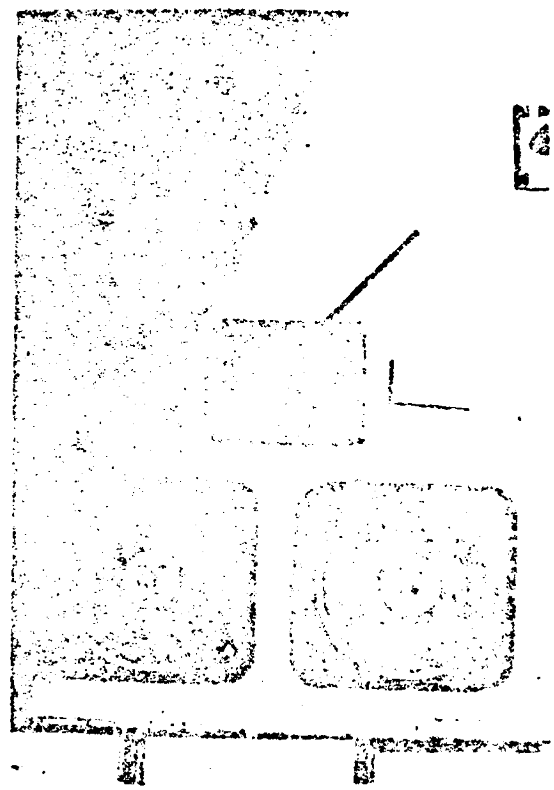


FIGURE 3-3. CONSOLE CLOCK AT LOCAL CONTROL

b) Users

Time is used by the controllers to reference events for the record, coordinate traffic flow and to give pilots time checks. In the Cab, the Controller-in-Charge (CIC) at the Cab Coordinator (CC) position (Figure 3-1), uses time when logging items on the Daily Record of Facility Operation (FAA Form 7230-4, Figure 3-4) and when scheduling breaks and work shifts. (Actually, the CC position is staffed with either a CIC or Cab Supervisor (CS), depending on the level of the person occupying it. For the purposes of this report, CS and CIC are used interchangeably.) The CIC may obtain time from any clock in the Cab, but usually uses the console clock at GC. LC uses the time to provide adequate separation for smaller aircraft arriving or departing behind heavy aircraft and for all aircraft arriving and departing when the radar is out of service. LC occasionally gives pilots time checks. He obtains time from either the console clock at his position or the BRITE radar display. GC requires time information for occasional time checks and when gate hold procedures are in effect. In the latter case, after being informed of a delay by CD, a pilot may try to hasten his departure by contacting GC and asking permission to start his engines before the scheduled time. GC needs to know the current time as well as the aircraft's engine start time to know if the request can be granted. GC has access to the BRITE radar display and the console clock at his position. Flight data (FD) needs time information to determine when to record the hourly ATIS message. He also needs the time to update flight strips that are not activated within 1.5 hours of the proposed departure time. FD calls the Flight Service Station (FSS), when the 1.5 hour limit is reached, to cancel or update the flight strips. When the time is updated, FD writes the time on the flight strip. He can obtain time from the CONRAC display, or the console clocks [illegible] or CD. CD needs time information for frequent pilot time checks and to monitor the departure flight strips. Any that approach the 1.5 hour delay are returned to FD to be updated. CD also needs time information during Gate Hold Procedures and for Flow Control

DAILY RECORD OF FACILITY OPERATION

PAGE NO. 1

DATE 6-18-80

CHECKED BY

LOCATION	IDENTIFICATION	TYPE FACILITY	OPERATING POSITION	CHIEF
Buffalo NY 14225	BUF	TOWER	CIC	

TIME (UNIT)	REMARKS
0400	NP ON ILS23 IN USE WND 18/7 WCLC. MAIN FDEP OTS ON SPARE. ELECTROWRITER OTS.
1159	NP OFF
1200	WE ON
1500	WE OFF, ST ON.
1531	ST OFF, WE ON
1616	WE OFF. JO ON.
2000	JO OFF. WM ON.
0359	END OF LOG.

I CERTIFY that entries above are correct; that all scheduled operations have been accomplished, except as noted, and that all abnormal occurrences and conditions have been recorded.

SIGNATURE(S) OF WATCH SUPERVISOR(S)

FAA Form 7230-4 (1-67) FORMERLY FAA FORM 366

FIGURE 3-4. FAA FORM 7230-4

purposes, to give pilots expected engine start times. When this information is given to a pilot, the current time is also issued. CD can obtain time from the CONRAC monitor or the console clock at his position.

In the TRACON, the Watch Supervisor (WS) uses time for scheduling and to count flight strips on the hour. For these purposes, the supervisor may use the wall clock to the left of AD, or a wrist watch, both giving local time. The arrival radar controllers issue time to aircraft when they are in a holding pattern, as well as the time they can expect further clearance. If the radar is out of service, they use time to sequence approaches. The arrival radar controllers write the time of initial contact on the flight strip, and at their discretion, the time the aircraft is cleared for an approach. The time a pilot cancels an IFR flight plan is also logged on the flight strips. The Departure Radar controller writes the time of initial contact with an aircraft on a flight strip. All the radar positions have access to time information from their radar screens as well as the console clocks at their positions. The AD position needs time information to update flight strips, to monitor times of arrivals, and to give flow control for spacing arrivals from the Center. AD also relays clearances from satellite airports to the FSS and must monitor the "clearance void time" for these aircraft. AD uses the console clock at this position for these purposes.

c) Discussion

The console clocks in the Cab and TRACON are all driven and set independently and are, therefore, less consistent than the time displayed on the ARTS, which is entered into the entire system from a single source. Due to their greater accuracy, many controllers prefer to obtain time from the radar displays. In the Cab, however, most controllers use the console clocks as they are visible from further away and are less susceptible to glare than the radar screens. All the Cab console clocks are identical to the one shown in Figure 3-3.

In the TRACON, the radar controllers generally obtain time from the ARTS except when the system is down for maintenance. The console clocks at the Arrival Radar positions have a 12-hour display (Figure 3-5), making their use slightly more difficult. The other console clocks have a 24-hour display (Figure 3-6). The console clocks at AD, DEP-W, DEP-E, DD and ER are equipped with rheostats to adjust the readout illuminator. These clocks also have a color coded seconds display, a different color for every 15 seconds, indicating time to the nearest quarter minute, as required by FAA regulations when controllers issue time.

3.1.2 Barometric Pressure: Analog Altimeter (Figure 3-7), Digital Altimeter (Figure 3-5), Radar Display

a) Locations (Figures 3-1, 3-2)

Analog Altimeter	Digital Altimeter	Radar Display
CC	LC	AL
ARR-E	GC	CD
	DEP-W	DEP-W
	ARR-W	ARR-W
	ARR-E	ARR-E
	DEP-E	DEP-E
	ER	ER

b) Users

Altimeter readings are issued to pilots when requested by a pilot, when required if the ATIS code is not given, or when there is a change in the altimeter reading of 0.01 inches or more from the value recorded on the ATIS. In the Cab, CD issues the altimeter reading to pilots of departing aircraft that do not have the ATIS code. He obtains this information by looking at the CON.AC display or from FD, who records the ATIS message. FD uses the altimeter reading from the Weather Service Forecast Office (WSFO) Surface Aviation Weather Report (SA), issued hourly, or the Special

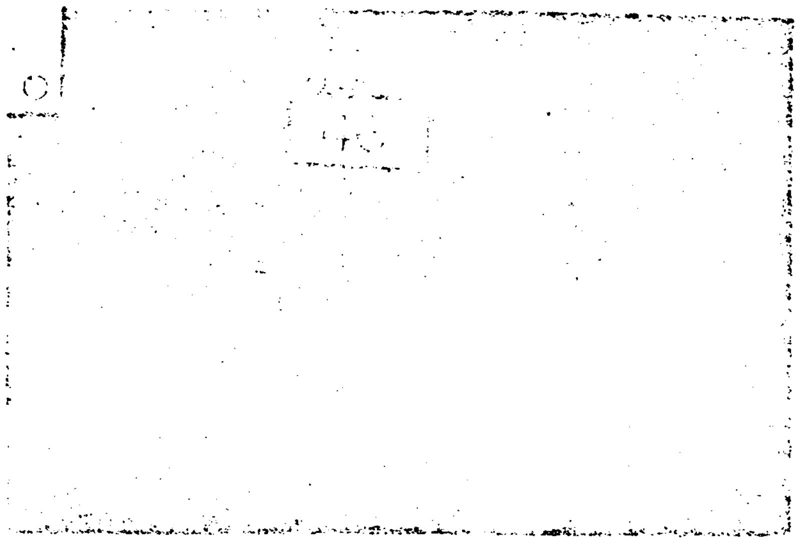


FIGURE 3-5. CONSOLE CLOCK AND DIGITAL ALTIMETER AT ARRIVAL RADAR-2

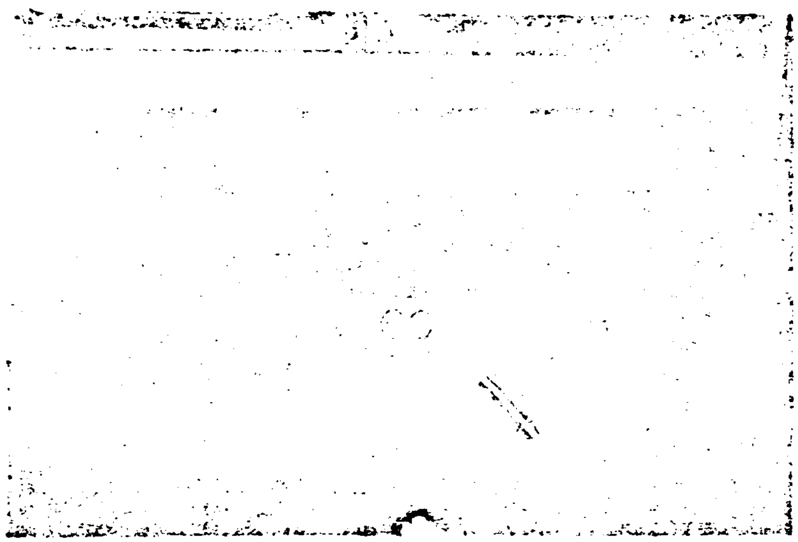


FIGURE 3-6. CONSOLE CLOCK AT DEPARTURE RADAR-2

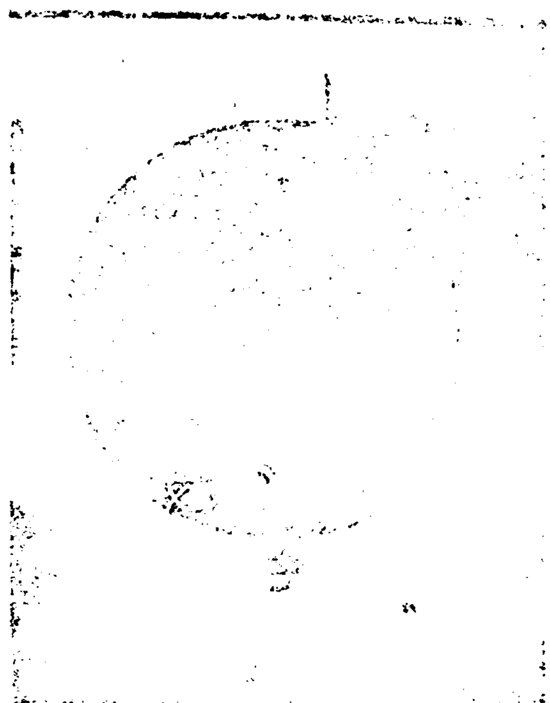


FIGURE 3-7. ANALOG ALTIMETER AT CAB COORDINATOR POSITION

Surface Aviation Weather Report (SP), issued when weather changes occur, for the ATIS message. He also observes the altimeter at GC occasionally to make sure the ATIS figure is within 0.02 inches of the current reading. GC and LC use their altimeters mainly to get an indication of weather changes. Occasionally, they relay the readings to pilots, if requested or if a change has occurred since the last ATIS recording.

The TRACON radar controllers issue altimeter readings to pilots upon request, and the Arrival Radar controllers issue the information to pilots of arriving aircraft that do not have the ATIS code or if a change has occurred since the last ATIS recording. Noticing improper altitude readings on the ARTS, radar controllers may also issue altimeter readings to pilots suspected of having incorrect altimeter settings.

c) Discussion

In the Cab, controllers tend to use the digital altimeters, because they are easier to read than the radar display values. They do compare the actual and ATIS figure so they know when a new ATIS is necessary or when they need to issue the actual readings. The WSFO also monitors the altimeter setting and issues an SP message if a change of 0.02 inches occurs within the hour. The controllers still monitor the reading however in case the weather message is delayed or the change is sudden.

TRACON controllers prefer to obtain altimeter readings from the ARTS because of its accessibility. They observe the digital altimeters occasionally to make sure the ARTS reading is current. When changes of 0.01 inches or more occur, they issue the actual reading to pilot. If they notice a change of 0.02 inches or more, the Watch Supervisor is notified. He changes the ARTS value and notifies FD to record a new ATIS.

The digital altimeters have rheostats to adjust the intensity of the display. The 2 analog altimeters, at CI and AR-2, have light switches to illuminate the dial. The analog altimeters, however, are used only if there is a disparity between the digital instruments and the weather reports.

3.1.3 Wind Direction/Velocity: Analog Display (Figure 3-8)

a) Locations (Figures 3-1, 3-2)

LC

GC

DEP-W

ARR-W

ARR-E

DEP-E

ER

b) Users

Wind information is used by controllers to relay to pilots, determine runways in use, vector aircraft and to get indications of weather changes. The CIC uses wind information to sequence traffic flow and to determine which runway to use. He obtains this information from the SA or SP messages or the wind instruments at GC. LC uses his wind instrument to issue current wind information before clearing an aircraft for landing and upon a pilot's request. GC issues wind direction and velocity upon a pilot's request and to aircraft departing on the secondary runways. GC obtains this information from the instruments at his position. FD uses wind information when recording the ATIS message. He usually obtains the information from the hourly weather reports, but may use the instruments at GC if that portion of the weather message is unreadable. CD issues wind information to pilots who do not give the ATIS code or to those who request wind information. He gets the wind information from the written record of the ATIS message at the CC position (Figure 3-9), by asking FD, or by looking at GC's instruments.

In the TRACON, the WS technically needs wind information because he is responsible for determining the runway in use. This responsibility, however, is usually delegated to the CIC. The WS does use wind information to verify that the active runway is

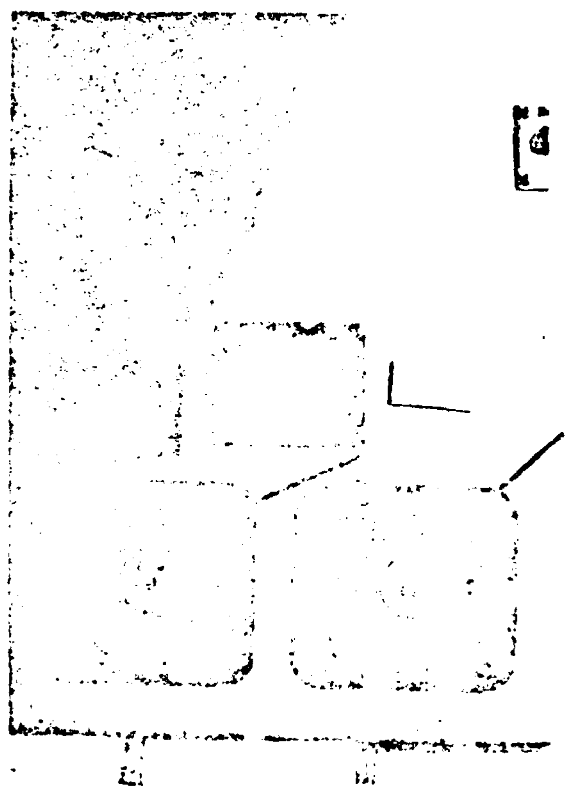


FIGURE 3-8. WIND INSTRUMENTS AT LOCAL CONTROL

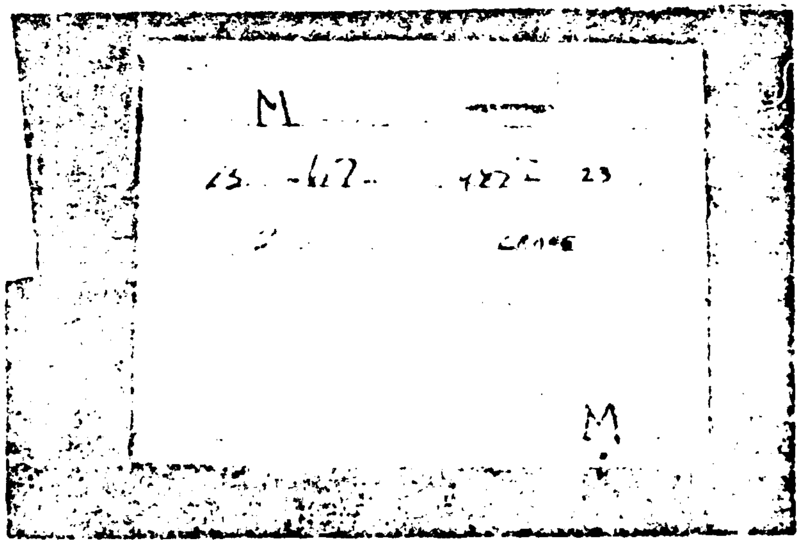


FIGURE 3-9. WRITTEN RECORD OF ATIS MESSAGE AT CAB COORDINATOR POSITION

appropriate and to be aware of a wind shift that would require a runway change and his coordination with the ARTCC.

He obtains wind information from the SA or SP reports or the wind instruments at any radar position. AD uses wind information to relay to other facilities, such as secondary airports, upon their request. He obtains this information from the instrument at DEP-W. The radar controllers use wind information to compensate for wind when vectoring aircraft. This is done primarily by the Arrival Radar controllers, who use either the instruments at their positions, or the WSFOs Winds Aloft Report (Figure 3-10) issued twice a day and posted between ARR-W and ARR-E. The Arrival Radar controllers also issue wind information to pilots who do not give the ATIS code upon initial contact. All the radar controllers issue wind upon a pilot's request.

c) Discussion

The wind instruments provide analog velocity and direction information from a single anemometer and vane located approximately 1000 ft due east of the intersection of the runways. There are also 2 wind socks on the field, one at the anemometer, the other at the ISS building.

The Winds Aloft Report contains wind speed and direction information from 1000 feet to 16,000 feet AGL in 1000-foot increments. Some controllers use this when vectoring aircraft if significant differences exist between instruments and the report. Most controllers, however, prefer the instruments because the information is more timely.

3.1.4 Runway Visibility: Runway Visual Range (RVR) (Figure 3-11)

a) Locations

LC

ARR-W

ARR-E

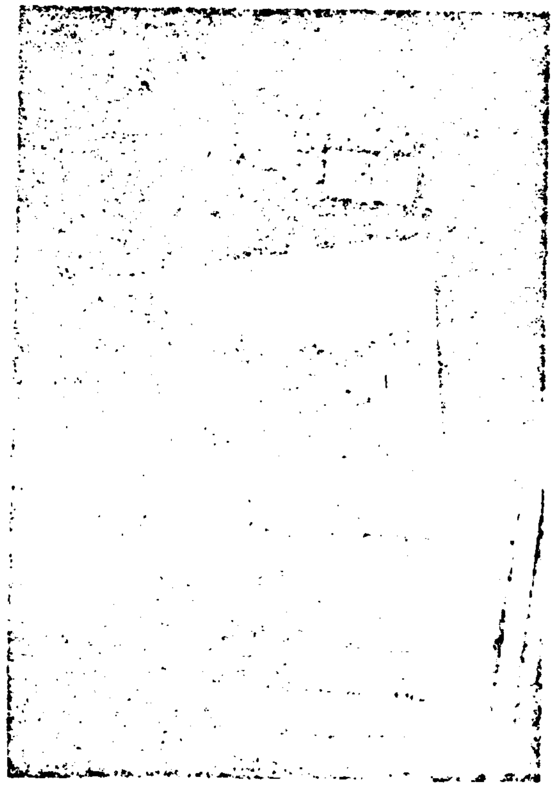


FIGURE 3-10. WINDS ALOFT REPORT AT ARRIVAL RADAR-1

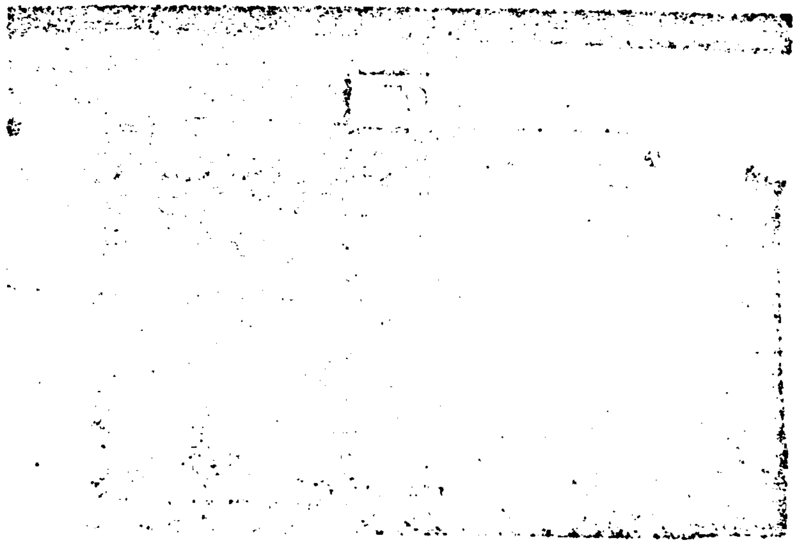


FIGURE 3-11. RUNWAY VISUAL RANGE PANEL AT LOCAL CONTROL

b) Users

Runway visibility information is issued to pilots whenever the RVR reading is 6000 feet or less or the prevailing visibility is 1.5 miles or less. During marginal conditions, LC and the Arrival Radar controllers observe the RVR panels approximately once every minute. Arriving aircraft are given the touchdown, midpoint, and rollout RVR values by the Arrival Radar controllers usually upon initial contact, but otherwise at some time while under their control. LC gives the arriving aircraft the three RVR values upon initial contact with the aircraft and again when it is about a mile from touchdown. Departing aircraft are given the midpoint and rollout RVR values by LC prior to being cleared for takeoff.

c) Discussion

The three transmissometers are located at the touchdown positions of runways 5 and 23 and southwest of the runway intersection (Figure 3-12). When runway 23 is in use, the touchdown RVR for 5 becomes the rollout RVR for runway 23. Similarly, when runway 5 is in use the touchdown RVR for 23 becomes the rollout RVR for runway 5. The RVR panels are usually left on, even when visibility is unrestricted. The RVR panels show the readings in 200-foot increments from 600 feet to 3000 feet and 500-foot increments from 3000 to 6000 feet (shown in units of 100's of feet with a "+" or "-", indicating the actual visibility is greater or less, respectively, than what is given). These panels have status indicators: an "E" displayed means there is an error in the system and a "T" means the system is being tested by Airways Facilities (AF). There are also six indicator lights. Three of them are labeled "3", "4", and "5" to indicate the intensity of the runway lights. Two others are labeled "D" and "N" to show if the transmissometers are sensing day or night conditions. These 5 lights give the controllers an indication that the system is working properly, as well as the runway lights being set correctly for the current weather conditions. The sixth light is a visual alarm that indicates if the reading has reached or gone below the Alarm

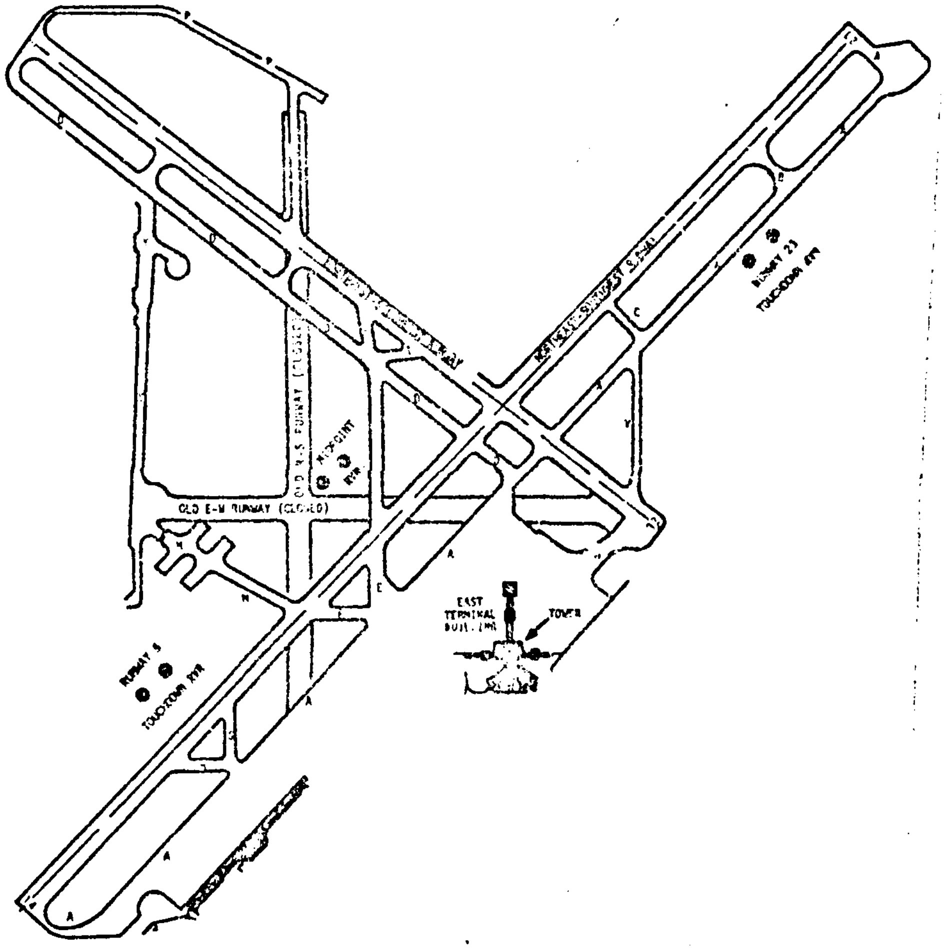


FIGURE 3-12. LOCATION OF RVR TRANSMISSOMETERS

Setting. This feature, which is combined with an aural alarm, is not used regularly; the alarm setting is usually set at "00" (for zero feet visibility). The panels also have an illuminator knob to vary the brightness intensity of the displayed values.

The controllers rarely make adjustments to the display and limit their use of it to reading the indicated RVR values.

3.2 CONTROL PANELS

The following panels are used to control some of the visual NAVAIDs and radio communications equipment at Buffalo. They are located at CC, LC, GC, CD in the cab and at the TC and radar positions in the TRACON. Figures 3-13 and 3-14 identify and show the locations of these control panels. This section includes a description of the control panels and the users of each.

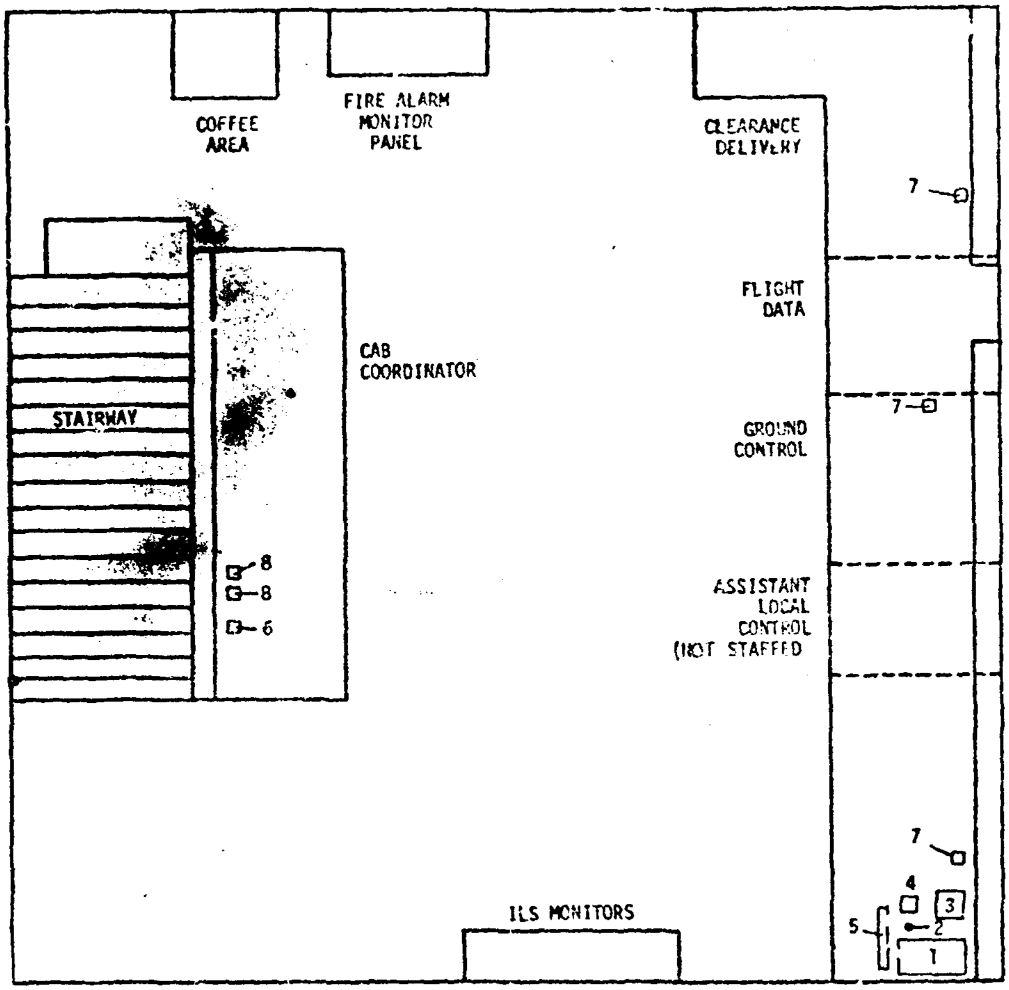
3.2.1 Field Lighting Control Panel (Figure 3-15)

a) Location (Figure 3-13)

LC

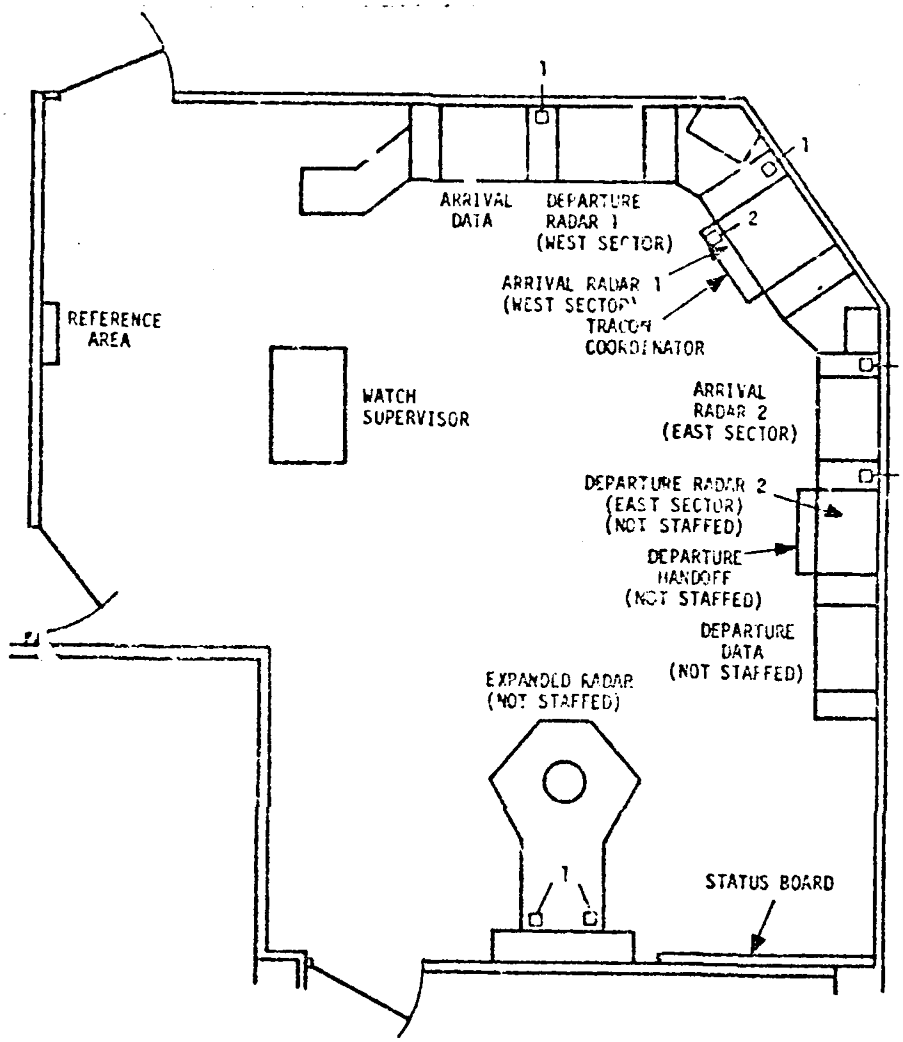
b) Description

This panel has seven on/off switches and four control knobs that control runway's 5 and 23 Highway Intensity Runway Lights (HIRL), Centerline Lights (CL), and Touchdown Zone Lights (TDZ); and the runway's 14 and 32 Medium Intensity Runway Lights (MIRL); and a major portion of the taxiway lights. To operate the lighting system, the four intensity knobs are turned to their lowest setting (to avoid overloading the system when they are initially turned on) and the power switch (located directly above each of the knobs) corresponding to the desired lighting is activated. Then, the desired intensity is selected. A single switch, located below the TDZ light intensity control knob, is used to select the TDZ lights for either the approach end of the runway 5 or approach end of runway 23. The taxiway switch, on the left side of the panel, activates the taxiway lights for most of the airport. A small portion of the taxiway lights in the northwest



1. FIELD LIGHTING CONTROL PANEL
2. REIL CONTROL SWITCH
3. RUNWAY 5 APPROACH LIGHT CONTROL PANEL
4. RUNWAY 23 APPROACH LIGHT CONTROL PANEL
5. ALS ENGINE GENERATOR REMOTE CONTROL PANEL
6. ATIS RECORDING CONTROLS
7. CONTROL PANEL FOR BACKUP FAA MICROPHONE
8. STANDBY SELECTOR PANEL FOR FAA FREQUENCIES

FIGURE 3-13. LOCATION OF CONTROL PANELS IN CAB



1. CONTROL PANEL FOR BACKUP FAA MICROPHONE
2. STANDBY SELECTOR PANEL FOR FAA FREQUENCIES

FIGURE 3-14. LOCATION OF CONTROL PANELS IN TRACON

AD-A107 874 TRANSPORTATION SYSTEMS CENTER CAMBRIDGE MA F/G 17/7
BUFFALO AIR TRAFFIC CONTROL TOWER OPERATIONS ANALYSIS.(U)
SEP 81 M S HUNTLEY, R L MUMFORD, R RUDICH
UNCLASSIFIED TSC-FAA-81-12 FAA-RD-81-58 NL

2 OF 3
AD A
107874

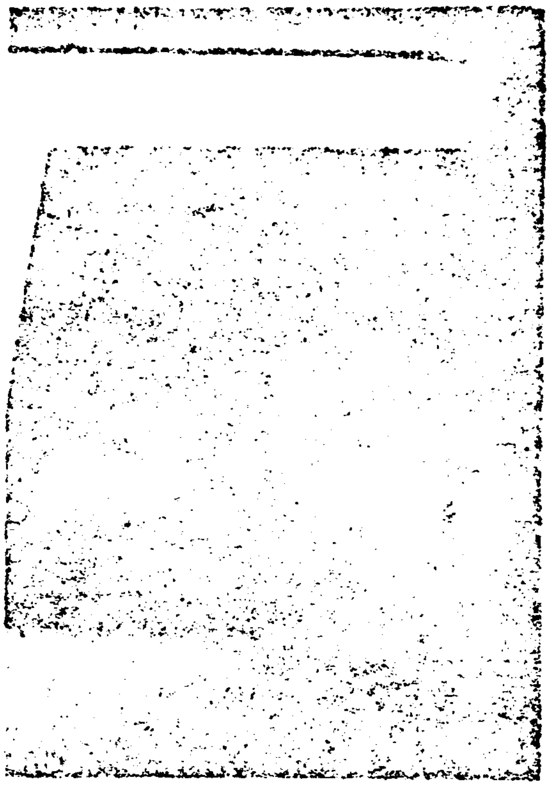


FIGURE 3-15. FIELD LIGHTING CONTROL PANEL AT LOCAL CONTROL

corner of the airport, near the approach end of runway 14 and the FSS building, turn on automatically with light sensors. The seventh switch on this panel, in the lower left corner, is apparently nonfunctional.

c) Users

LC uses this control panel. For night operation, the lights are turned on at sunset and off at sunrise. A sunset and sunrise table is posted at LC (Figure 3-16) to determine the exact times of operation. To operate, the controller turns on the switches for the HIRL, CL and TDZ lights for runways 5 and 23, selects the TDZ for either runway 5 or 23 and sets the light intensities according to the regulations in Air Traffic Control (7110.65B). For controller reference, actual portions of these regulations are posted at LC. All three parts of runways 5 and 23 lighting system are set at the same intensity, unless a pilot requests a specific change (these requests are usually for an increase in HIRL intensity). When runways 5 and 23 lighting system is activated so are the taxiway lights and runway 14 and 32 MIRL. The latter, however, are usually set at a lower intensity. The field lighting system is turned on during the day when requested by a pilot or maintenance, when the visibility is restricted, and consistent with regulations in 7110.65B. Pilot requests are received directly by LC, or sometimes through an Arrival Radar controller, when he is vectoring an aircraft in and the pilot wants the lights flashed to identify the runway. The Niagara Frontier Transportation Authority (NFTA) is responsible for maintenance and requests the operation of certain lights to check or repair the system. These requests are made through GC. He informs LC who carries out the request.

3.2.2 Runway 32 REIL Control Switch (Figure 3-18)

a) Location (Figure 3-13)

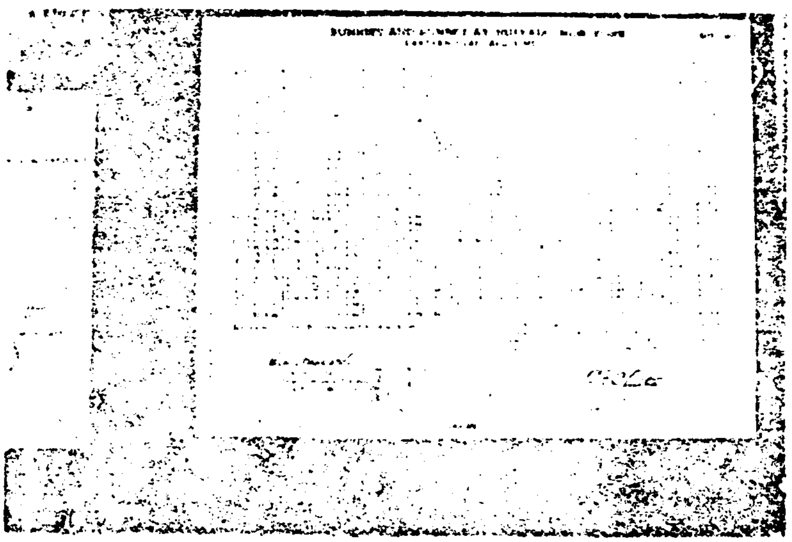


FIGURE 3-16. SUNRISE AND SUNSET TABLE AT LOCAL CONTROL

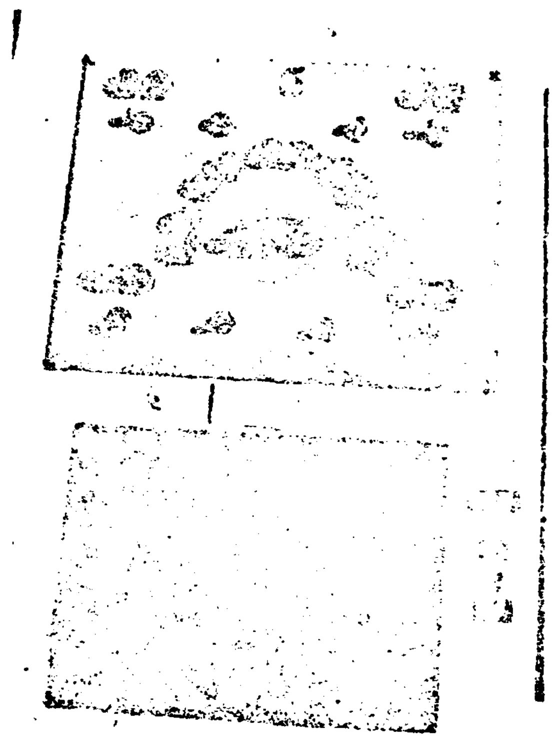


FIGURE 3-18. RUNWAY 5 AND RUNWAY 23 APPROACH LIGHT CONTROL PANELS AND RUNWAY 32 REIL CONTROL SWITCH AT LOCAL CONTROL

b) Description

The Runway End Identifier Lights (REIL) for runway 32 are controlled by an on/off switch between the Field Lighting Control Panel and the runway 23 Approach Light Control Panel (Figure 3-13).

c) User

LC is the usual operator of this system. The lights are normally off and are turned on only when a pilot requests it, is having trouble seeing the approach end of the runway, or when requested by Airway Facilities (AF) for inspection.

3.2.3 Runway 5 Approach Light Control Panel (Figure 3-18)

a) Location (Figure 3-13)

LC

b) Description

This panel controls the runway 5 Simplified Short Approach Light System with Runway Alignment Indicator Lights (SSALR), The panel includes several on/off switches, an intensity control knob and indicator lights (in pairs for redundancy). Of the four on/off switches at the bottom of the panel, two turn on the Approach Light System (ALS) and Sequenced Flashing Lights (SFL) and the other two, labeled "auxiliary" are apparently nonfunctional. The large knob in the center of the panel adjusts the intensity of the approach lights over 5 steps. In the upper corners of the panel are red alarm lights for the ALS and SFL. Below these are two "trouble switches" that turn off the aural alarms which signal a failure (the visual alarms remain on until the problem is corrected or the system is turned off). Near the top of the panel is a panel light intensity control knob and a reset switch. The step-5 lights have a 15-minute time limit to prevent overheating. The reset button reactivates the step-5 lights for another 15 minutes. The lower two steps of the ALS have green indicator lights while the upper three steps have amber, as do the on/off switches.

c) User

LC is the user of this panel. When runway 5 is in use, the system is operating between sunset and sunrise or when visibility is restricted. Intensities are determined according to the regulations in 7110.65B, posted at LC (Figure 3-17). Exceptions to the normal ALS intensity settings occur when a pilot requests a change in the setting or AF requests they be turned off for inspection.

When LC turns the panel on, the visual and aural alarm for either ALS or SFL may come on until the system warms up. If either does, he silences the buzzer with the trouble switches. When the alarm lights turn off, the trouble switches are returned to their normal positions. He then selects the desired intensity of the ALS. The pilot light intensity is not usually adjusted.

3.2.4 Runway 23 Approach Light Control Panel (Figure 3-18)

a) Location (Figure 3-13)

LC

b) Description

This panel controls the runway 23 Approach Light System with Sequenced Flashing Lights (ALSF-1). The panel includes two on/off switches for the ALS and SFL; a 5-step ALS intensity control knob; pilot lights in pairs for redundancy with a rheostat to adjust their intensity; and a timer reset button. The on/off switches have green indicator lights that show the power is on and all the intensity indicators are red except step 1, which has 1 amber and 1 red light.

c) User

LC uses the panel. It is used when runway 23 is in use, in a similar manner to the runway 5 SSALR controls. If LC turns off the buzzer when he initially turns the system on, he must return that switch to "on" when the system is warmed up to determine if the system is functioning properly. If the buzzer goes on, it is still malfunctioning (or warming up). If it does not go on, it is operating properly. There is no visual alarm associated with this panel.

3.2.5 ALS Engine Generator Remote Control Panel (Figure 3-19)

a) Location (Figure 3-13)

LC

b) Description

This panel includes an on/off switch and a red pilot light. The switch is to start and stop an auxiliary power source for the ALSF-1 on runway 23. The pilot light indicates the generator is operating.

c) User

This panel is not functional.

3.2.6 ATIS Recording Controls (Figure 3-20)

a) Location (Figure 3-13)

CC

b) Description

The ATIS Recording Controls are used to record and monitor the operation of the Automatic Terminal Information Service. The panel includes a microphone for making the recordings; function switches, to turn the unit on or off to record, indicator lights which show when the unit is on, recording, out of tape or malfunctioning, and a remote speaker for listening to the recording. The same message is used at Buffalo for both arriving and departing flights.

c) Users

FD is usually responsible for recording and updating the ATIS message, although sometimes the task is performed by the CIC or CD. The ATIS message is usually recorded hourly, however, an interim recording is required when the WSFO issues a Special Surface

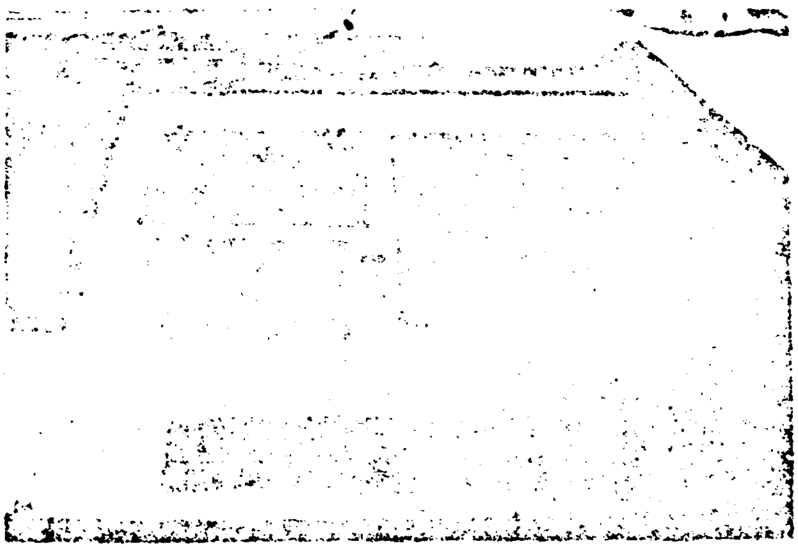


FIGURE 3-19. ALS ENGINE GENERATOR REMOTE CONTROL PANEL AT LOCAL CONTROL

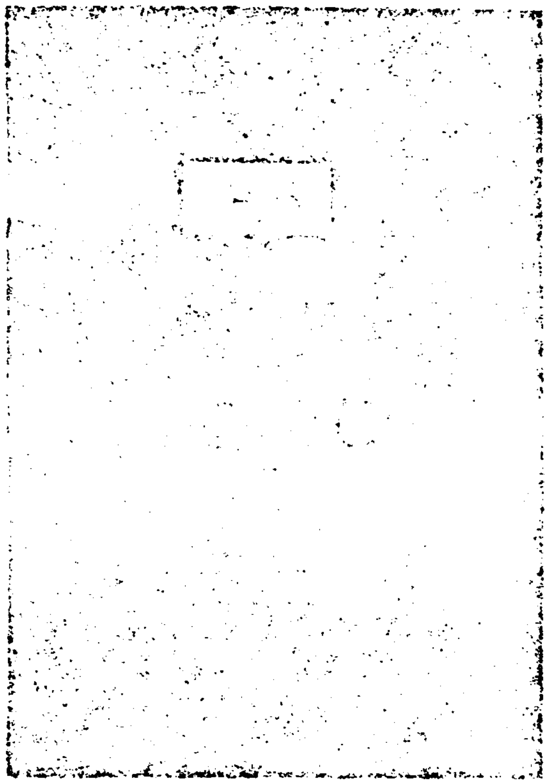


FIGURE 3-20. ATIS RECORDING CONTROLS AT CAB COORDINATOR POSITION

Aviation Weather Report (indicating significant changes from the previous report), the runway or approach in use changes, status of pertinent equipment changes, or relevant NOTAMs are cancelled or initiated.

Before recording the ATIS message, FD erases the previous message from the plexiglass board that provides the format for the recording (Figure 3-9). New information is then written on the board with a grease pencil. This provides a simple reference for the Cab controllers and reduces the chances of omitting important information when making the new recording.

Information for the ATIS is obtained as follows: The ATIS code letter is derived alphabetically, choosing the subsequent letter whenever a new message is recorded. Time on the ATIS is on the hour, unless an interim recording is necessary. For the hourly ATIS recordings, time may be omitted from the written record, but it is recorded on the tape. Weather conditions, usually consisting of ceiling and precipitation information, are obtained from the SA or SP messages, as are visibility, temperature, altimeter, and wind. Under VFR conditions, both the weather conditions and visibility sections may be blank on the written form. In this case, a statement is recorded that weather conditions are "better than 5000 and 5", referring to ceiling in feet and visibility in miles, respectively. The approach in use is obtained from the CIC or LC. The arrival and departure runways are recorded only if they differ from that to which the instrument approach is made. NOTAMs that are recorded are obtained from the NOTAM board at the CC position. On the written form, only an abbreviated version of the NOTAM is used to serve as a reminder to record the full text.

After FD writes the information on the board he records the message then listens to it using the attached speaker to make sure it is operating properly.

CD and the Arrival Radar controllers need the ATIS code letter to verify pilot acknowledgements on initial contact. All controllers communicating with pilots, need to know what significant deviations exist between the ATIS and actual conditions so they can provide pilots with updated information. Controllers learn what is on the ATIS by direct communication with FD, by reading the written record at the CC position, or looking at a radar display which shows the ATIS code, altimeter setting and approach and runway in use.

3.2.7 Control Panel for Backup FAA Microphone (Figure 3-21)

a) Locations (Figures 3-13 and 3-14)

CD

GC

LC

DEP-W

ARR-W

ARR-E

DEP-E

ER (2 panels)

b) Description

These panels are located at every radio equipped position in the Cab and TRACON. They provide a backup to the TELCO equipment if communications become difficult because of a malfunction or if maintenance is working on the system. Each panel has an on/off switch and green and red indicator lights, showing whether the TELCO or the FAA lines, respectively, are in use. When the switch is "on", the FAA lines are activated.

c) Users

These panels are not used or checked regularly by the controllers or supervisors. The panels require special microphone jacks which are not kept in the Cab or TRACON. Many of the pilot lights are apparently inoperative.

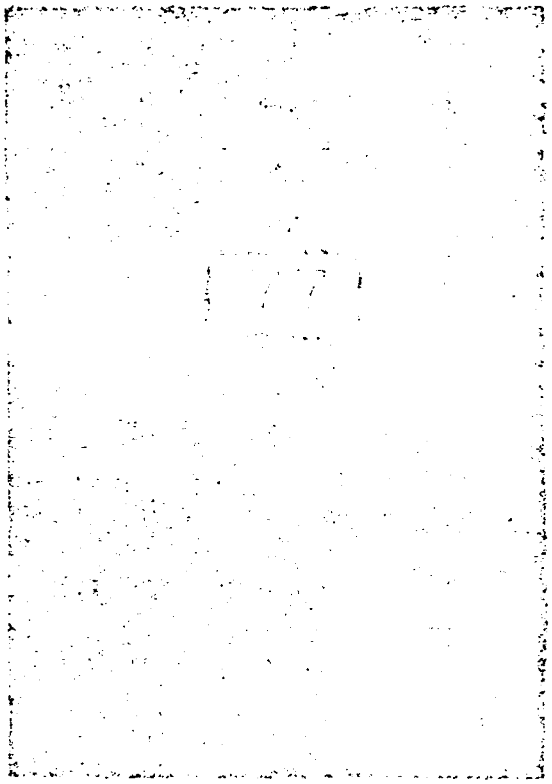


FIGURE 3-21. CONTROL PANEL FOR BACKUP FAA MICROPHONE AT LOCAL CONTROL

3.2.8 Standby Selector Panel for FAA Frequencies (Figure 3-22)

a) Locations (Figures 3-13, 3-14)

CC

TC (TRACON Coordinator)

b) Description

These panels are used to select backup transmitting and receiving channels for the FAA radio frequencies used in air-ground communications by the controllers. Backup channels are used when communications over the regular system are difficult to understand and when requested by AF. The panel in the Cab covers the frequencies most commonly used by the Cab controllers (LC, CC, CD) and the panel in the TRACON covers the frequencies most commonly used by TRACON radar controllers.

c) Users

Panels tend to be operated by the CIC or TC, upon request from a controller having difficulty communicating over the regular equipment. Otherwise, he may ask any available controller to select the standby frequency, or he may do it himself.

3.3 MONITOR PANELS

The following panels are used to monitor some of the equipment and operations at Buffalo. These are located at the CC position and behind the CD and LC positions in the Cab and at ARR-W and behind the Watch Supervisor's (WS) desk in the TRACON, as shown in Figures 3-23 and 3-24. For each monitor panel, a description of the equipment is given, as well as a description of the action taken when a malfunction occurs.

A supervisor learns of an equipment malfunction through an alarm or through notification by maintenance or a controller. If conditions warrant it, he then notifies the other supervisor. Then, they both inform their affected controllers. The WS usually reports the failure to maintenance and logs the outage on Form 7230-4 (Figure 3-4). Certain outages are recorded on the

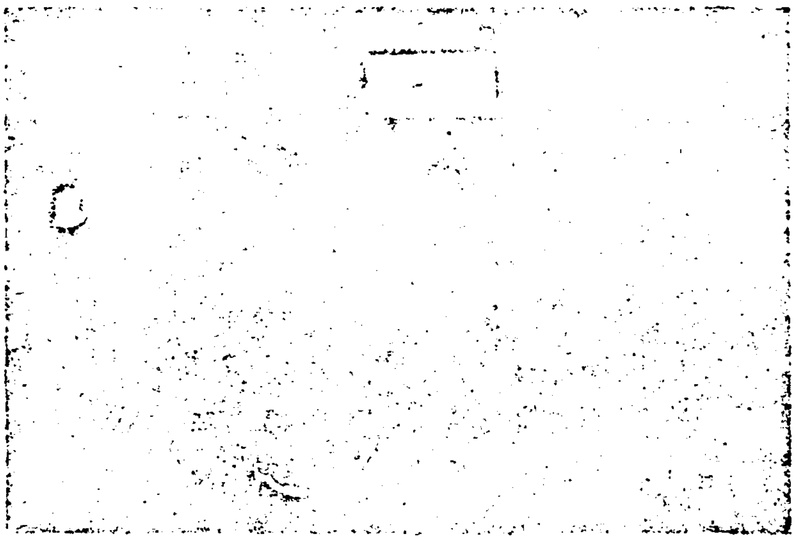
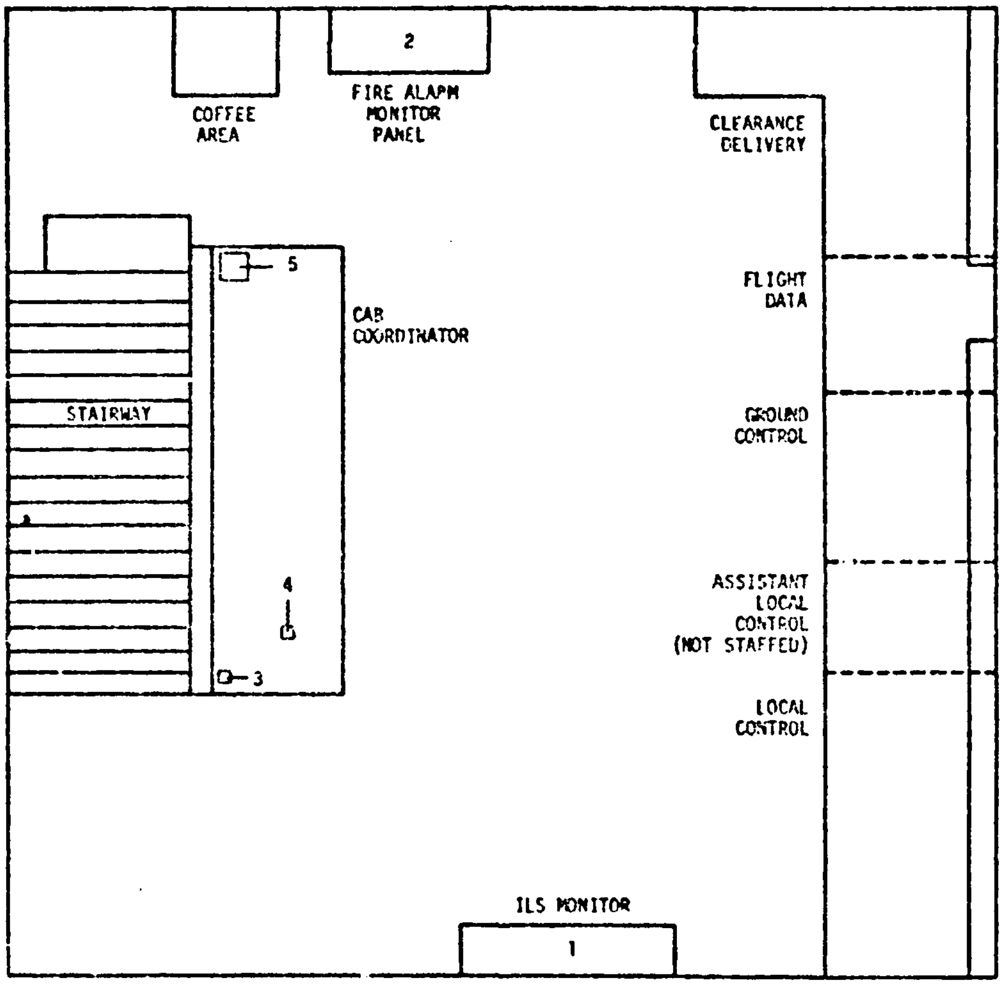


FIGURE 3-27. STANDBY SELECTOR PANEL FOR FAA FREQUENCIES AT CAB COORDINATOR POSITION



1. ILS MONITORS AND CONTROL PANELS
2. FIRE ALARM MONITOR PANEL
3. VOT PANEL
4. RECORDER STATUS PANEL FOR AIR/GROUND COMMUNICATIONS
5. MSAW CONTROL PANEL

FIGURE 3-23. LOCATION OF MONITOR PANELS IN THE CAB

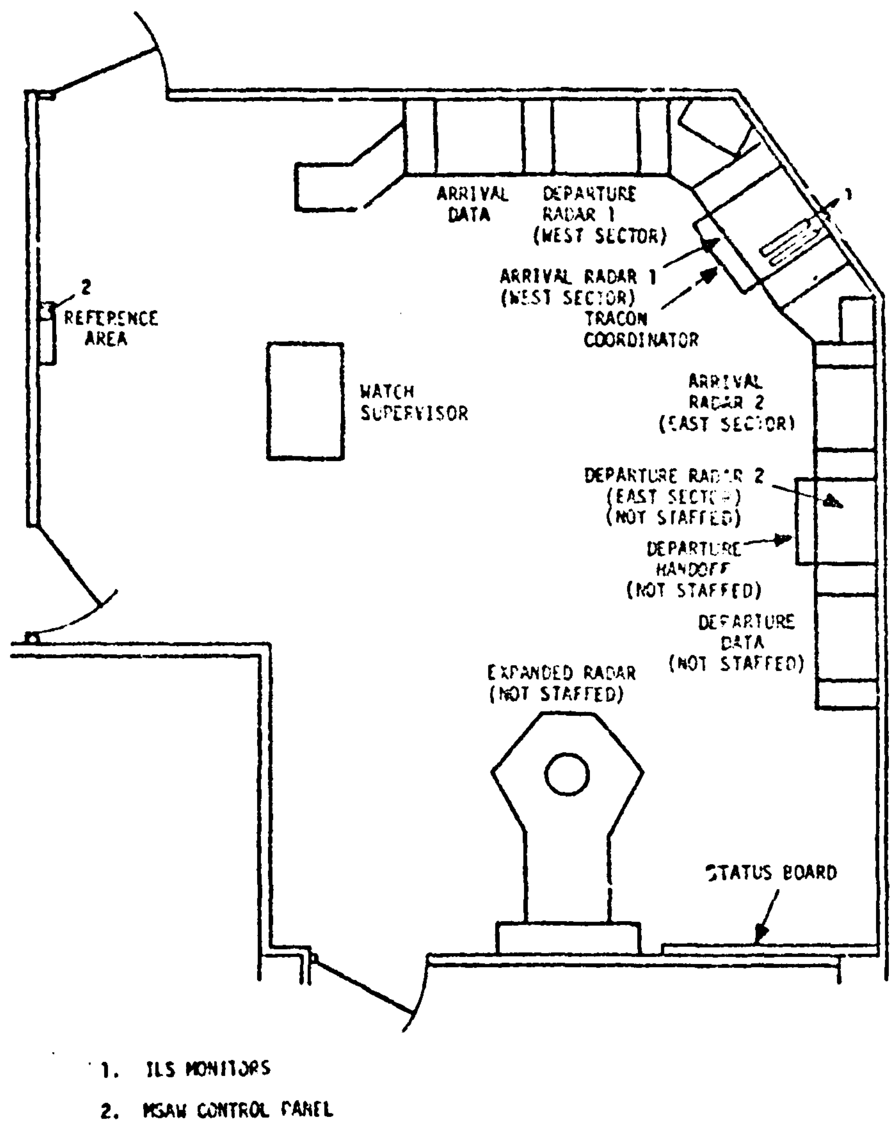


FIGURE 3-24. LOCATION OF MONITOR PANELS IN THE TRACON

Cab log as well. An "E" is usually typed in the margin of the form next to an equipment failure entry. Another "E" is typed in the margin next to a "Restored to Service" (RTS) entry. Sometimes the "E's" are initialled by maintenance on the TRACON log, usually at the end of a shift. The Cab log, however, is not initialled by maintenance.

3.3.1 ILS Monitors and Control Panels (Figures 3-25, 3-26)

a) Locations (Figures 3-23 and 3-24)

Behind LC

ARR-W

b) Description

The ILS monitor and control system for runways 5 and 23 consist of 2 large control panels behind LC in the Cab and 2 status panels at ARR-W in the TRACON.

The green ILS panel near LC is used to activate the ILS for the runway in use, and monitor and control the ILS on runway 5. Near the top of the panel is a two position switch that turns on the Localizer for the selected runway (FAA regulations prohibit simultaneous operation of ILS systems on opposite ends of runways and turning off the Localizer has the effect of cancelling the ILS approach). The panel has indicator lights that show which system is on (inoperative during our study). It also has status lights that show whether the various components of the runway 5 ILS are operating; the top row of orange lights indicate that they are on and operating properly and the bottom row of red lights show that the particular component is off. This panel has a dialing system to activate the standby components of runway 5 ILS and a telephone to communicate with maintenance personnel at the field sites. The small panel at the upper right corner of the main unit indicates the source of the incoming call.

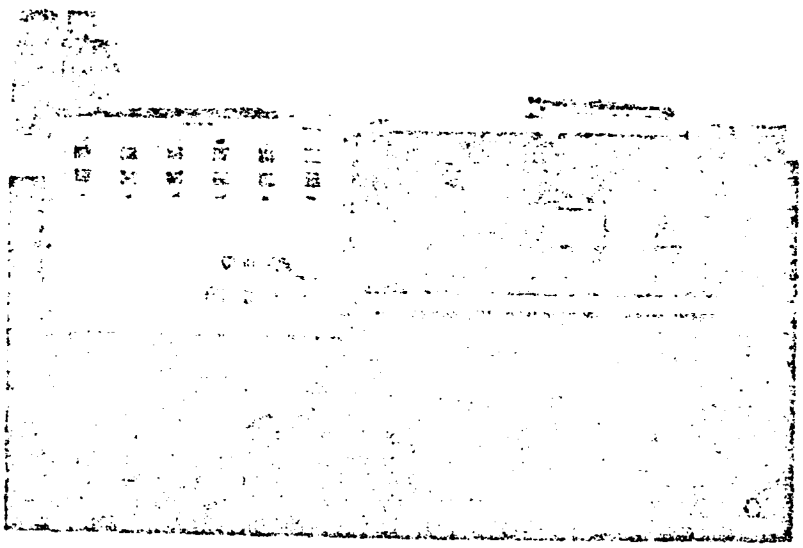


FIGURE 3-25. ILS MONITORS AND CONTROL PANELS BEHIND LOCAL CONTROL

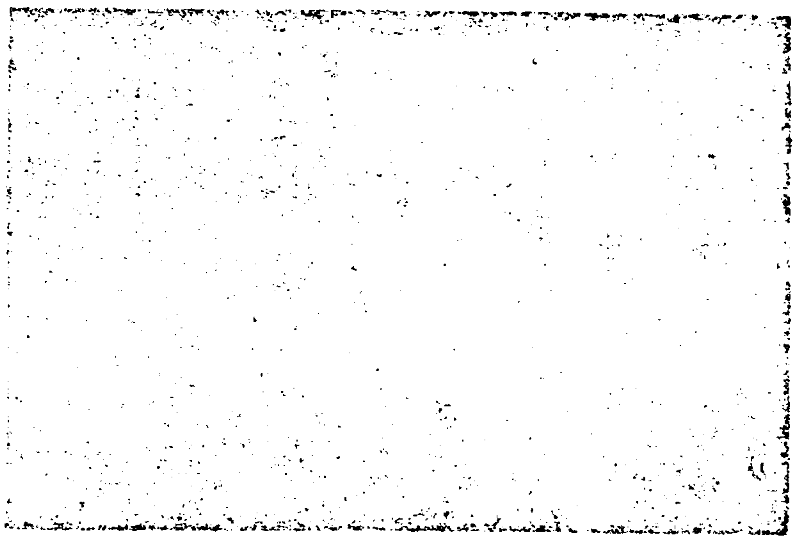


FIGURE 3-26. ILS MONITOR PANELS

The white panel gives status information on the runway 23 ILS. The panel includes 2 rows of status indicators, a bulb test button, a dimmer switch for the indicator lights, an aural alarm with volume control, and a power switch. The top row of indicator lights are composed of three lights for each component of the ILS. These are green, indicating normal operation; amber, indicating that the standby component is activated; and red, indicating that the component is off. The lower row of status lights flash an amber light if a malfunction occurs. The runway 23 ILS automatically activates the standby components when the main one fails. When this occurs, the upper indicator for the component will show amber (standby) and the lower one will flash amber (abnormal). An alarm will sound, which can be silenced by pushing the abnormal indicator light, which is also a switch. The flashing however, will not stop until the system is fixed. If both the main and standby fail, the red light (off) will go on as will the abnormal light and the aural alarm. Again, the alarm can be silenced but the light continues to flash. The bulb test button activates all the indicator lights as a filament test. The dimmer adjusts the intensity of these lights. The volume control is apparently not used or is otherwise ineffective as the aural alarm has a makeshift noise filter on it. The power switch is always on.

The two monitors at ARR-W in the TRACON are approximately 3 1/2 inches wide and 10 inches long. The one on the left is for runway 23, but it is not functional. The other gives status information for each component of the runway 5 ILS. A green light indicates that the component is operational, a red light indicates that it is not.

c) Users

LC and the CIC are the users of the ILS monitors in the Cab. Either one of them, but usually LC, selects the ILS for the proper runway. No further operation is required unless an alarm sounds. When this occurs, LC observes what component is out, and silences the alarm. He then notifies the CIC. When runway 23 is in use, operations are not affected unless the standby system does not engage properly. When runway 5 is in use and a component fails, operations are affected, at least temporarily, while the standby component is dialed in manually by LC or the CIC. Furthermore, in many cases, this feature of the runway 5 ILS control panel is not used, and AF is notified to turn on the standby component. When a failure occurs, the CIC notifies the WS of the outage, who notifies AF. The supervisors notify their affected controllers, and both log the outage on Form 7230-4. The WS also writes the outage on the status board. If the standby component is not activated, losing a portion of the ILS raises landing minimums. Losing a marker beacon has a slight effect, losing the glide slope has a much larger effect and an outage of the Localizer cancels the approach.

The runway 5 monitor panel in the TRACON is infrequently observed. If an outage is noticed, ARR-W observes the status board to see if it has been previously detected and to verify the panel. If it is not on the status board he reports it to the WS or asks LC for a verification. The WS and CIC are notified, and they take the appropriate action.

3.2.2 Fire Alarm Monitor Panel (Figure 3-27)

a) Location (Figure 3-23)

Behind CD

b) Description

The Fire Alarm Monitor Panel is a large panel (approximately 1 x 3 feet) that has an aural alarm and visual indicators that are activated by smoke detectors, sprinklers, and fire alarms located in the terminal buildings. On the panel, the east terminal is delineated with lights identifying various parts of the building. Other airport structures are identified by a single light next to the name of the building. There is also a silence switch for turning off the aural alarm.

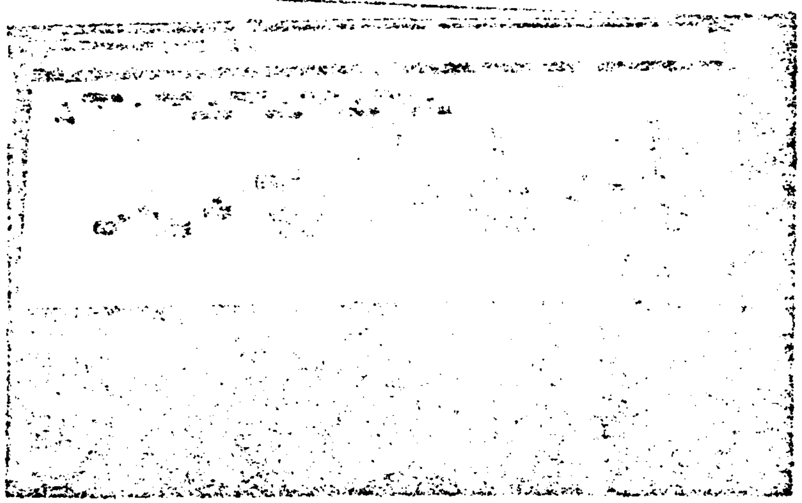


FIGURE 3-27. FIRE ALARM MONITOR PANEL BEHIND CLEARANCE DELIVERY

c) User

The CC uses this panel. It is virtually ignored unless the alarm goes off, in which case the alarm is silenced by depressing the switch. If it is not a test (which occurs daily about noon), fire personnel are notified. The alarm light remains on until the fire personnel resets the system at the source.

3.3.3 VOT Panel (Figure 3-28)

a) Location (Figure 2-23)

CC

b) Description

The VOR test facility (VOT) panel is used to broadcast the ATIS message and give pilots a means to check their VOR receivers. The panel has status indicator lights, green and red for normal and alarm, respectively. It also has a buzzer, a reset switch, a power switch and a blackout switch. The panel is always on, except when it is turned off because of failure or a request from maintenance. The blackout switch turns off the transmitting capabilities of the unit and is left "off" for normal operations.

c) Users

The CIC uses the panel. No action is necessary unless AF requests a change or the alarm is activated. When the latter occurs, the panel is turned off and AF is notified. The CIC informs the WS of the outage. The CIC also informs CD because the VOT frequency is used to transmit the ATIS to aircraft on the ground. Both supervisors log the outage on Form 7230-4.

3.3.4 Recorder Status Panel for Air/Ground Communications (Figure 3-29)

a) Location (Figure 3-23)

CC

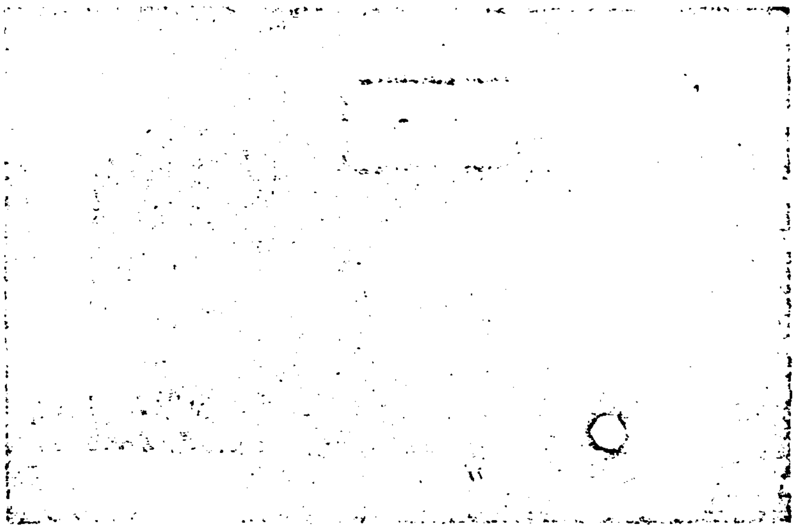


FIGURE 3-28. VOT PANEL AT THE CAB COORDINATOR POSITION

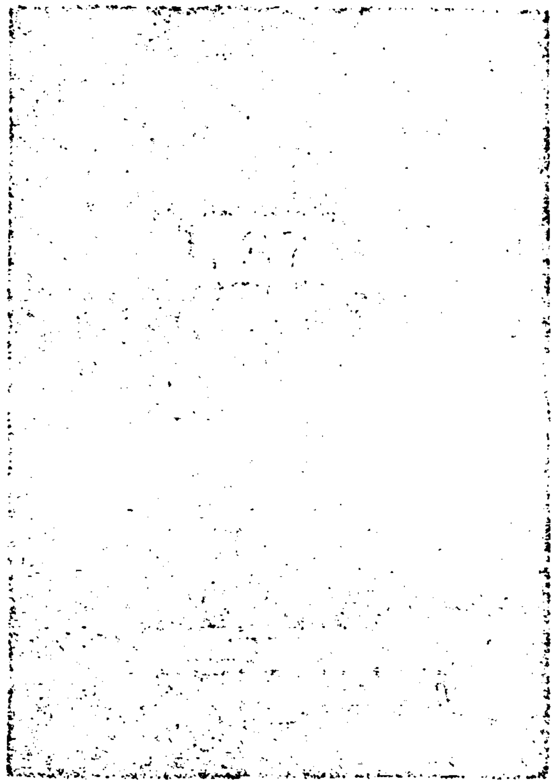


FIGURE 3-29. RECORDER STATUS PANEL FOR AIR/GROUND COMMUNICATIONS AT CAB COORDINATOR POSITION

b) Description

This panel monitors the system used to record controller/pilot communications. There are two recorders, one starts automatically when the other fails or runs out of tape. Each recorder has a green, a yellow, and a red indicator light that indicate the system is functioning properly, is ready to record, or has malfunctioned, respectively. There is also a buzzer and light that indicate a failure and a "LO/HI" switch that controls the volume of the recording.

c) User

The CIC monitors the panel by occasionally checking the pilot lights, making sure the active recorder is in the "Safe" status and the other is "Ready". If either indicate a failure, AF is notified. Otherwise, no operation of the panel is required unless the alarm goes off, indicating a malfunction. When this happens, the buzzer is turned off, and the WS is notified, who in turn calls AF. The outage is logged on Form 7230-4 in both the Cab and TRACON.

3.3.5 <u>MSAW Control Panel (Figure 3-30)</u>

a) Location (Figures 3-23 and 3-24)

CC

Behind WS

b) Description

The Minimum Safe Altitude Warning (MSAW) Control Panel is part of an alarm system that indicates when terrain clearance minimums are violated within the terminal area. The system also has a conflict alert feature that triggers the alarm when aircraft separation minimums are violated. The system provides an aural alarm of a potential collision or low altitude problem, allowing adequate time for controllers to respond. Flashing data blocks on the radar display call attention to the particular aircraft involved.

FIGURE 3-30. MSAW CONTROL PANEL AT CAB COORDINATOR POSITION

The panel includes a volume control knob, an on/off switch, a test button for the alarm speaker and red and green indicator lights. The green light indicates the system is on and operating properly while red indicates a malfunction. The speaker for the MSAW control panel is located next to it in the Cab, and to the right of the Departure Data position in the TRACON.

c) User

The WS and CIC are responsible for seeing that the unit remains on and is operating properly. They observe the panel at least once during their shift. If a long time passes without hearing the alarm, they may push the test button to check it. This is usually not the case, as the alarm often sounds several times during a shift. The unit is turned off only upon a request from maintenance. The volume control is rarely adjusted.

When the alarm sounds the radar controller and LC check their radar displays to see which aircraft are affected. The controller responsible for the aircraft assesses the validity of the alarm, and alerts the pilot of the situation and advises him of appropriate corrective action if necessary.

3.4 SUMMARY

The contents of this section are summarized in Tables 3-1 and 3-2 which illustrate the distribution of tower equipment among the controller positions in the Cab and TRACON, and the access of controllers to this equipment. Equipment provided with automatic status monitoring is also indicated.

The Buffalo Tower has a standard complement of equipment for a Level III tower. There are, however, several significant aspects of the equipment that should be noted. First, there are as many as five controller positions, with equipment, that are not regularly staffed. These include Expanded Radar, Departure Data, Departure Radar-2, Departure Handoff and Assistant Local Control.

TABLE 3-1. CAB EQUIPMENT DISTRIBUTION AND CONTROLLER ACCESS

EQUIPMENT	CC	LC	GC	FD	CD
TIME AND WEATHER INFORMATION					
CONSOLE CLOCK	X	(X)	(X)	X	(X)
ANALOG ALTIMETER	O				
DIGITAL ALTIMETER		(X)	(X)	X	
WIND INSTRUMENTS		(X)	(X)		
✓RVR PANEL		(X)			
CONTROL PANELS					
FIELD LIGHTING CONTROL PANEL		(X)			
RUNWAY 23 REIL CONTROL SWITCH		(X)			
✓RUNWAY 5 APPROACH LIGHT CONTROL PANEL		(X)			
✓RUNWAY 23 APPROACH LIGHT CONTROL PANEL		(X)			
ALS ENGINE GENERATOR REMOTE CONTROL PANEL		O			
✓ATIS RECORDING CONTROLS	O			X	
CONTROL PANEL FOR BACKUP FAA MICROPHONE		O	O		O
STANDBY SELECTOR PANEL FOR FAA FREQUENCIES	(X)	X	X		X
MONITOR PANELS					
✓RUNWAYS 5 AND 23 MONITORS AND CONTROL PANELS	X	(X)			
✓FIRE ALARM MONITOR PANEL	X				O
✓VOT PANEL	(X)				
✓RECORDER STATUS PANEL FOR AIR/GROUND COMMUNICATIONS	(X)				
✓MSAW CONTROL PANEL	(X)				

O LOCATION
X USER
✓ AUTOMATIC MONITORING
⌴ SHARED EQUIPMENT

TABLE 3-2. TRACON EQUIPMENT DISTRIBUTION AND CONTROLLER ACCESS

EQUIPMENT	WS	AD	DR-1	AR-1	TC	AR-2
TIME AND WEATHER INFORMATION						
CONSOLE CLOCK	X	(X)	(X)	(X)	X	(X)
ANALOG ALTIMETER						O
DIGITAL ALTIMETER			(X)	(X)		(X)
WIND INSTRUMENTS			(X)	(X)		(X)
✓RVR PANEL				(X)		(X)
CONTROL PANELS						
CONTROL PANEL FOR BACKUP FAA MICROPHONE			O	O		O
STANDBY SELECTOR PANEL FOR FAA FREQUENCIES			X	X	(X)	X
MONITOR PANELS						
✓RUNWAY 5 MONITOR PANEL				(X)		
RUNWAY 23 MONITOR PANEL				O		
✓MSAW CONTROL PANEL	(X)					

O LOCATION
X USER
✓ AUTOMATIC MONITORING
└─┘ SHARED EQUIPMENT

Some equipment at active controller positions, such as the ALS Engine Generator Remote Control Panel at LC in the Cab and the runway 23 ILS Monitor Panel at ARR-W in the TRACON, are non-functional. AF plans to connect the Generator Panel in the near future. The ILS Monitor Panel has apparently been useless since the runway 23 ILS was converted to a solid state system, but was never removed from the console.

Other equipment, such as the runway 5 ILS Monitor Panel at ARR-W, the fire alarm monitor panel, and the analog altimeters, are rarely used. Still other pieces of equipment, such as the runway 5 ILS Monitor and Control Panel in the Cab, appear quite awkward to operate.

Finally, there is a great deal of posted paper at the controller positions in the Cab and TRACON. These pieces provide instructions and necessary information for operating equipment such as the runway and approach light systems, the FDEPs as well as landing minimum information, NAVAID frequencies and various charts. This paper may be used by any controller, however, the journeyman controllers refer to it much less than the developmentals (controllers being trained and not yet qualified at all the positions), of which Buffalo has a large number.

4. STATUS INFORMATION

The sources of and controller requirements for information on operational status are presented in this section with a discussion of NOTAMs and other procedures for determining and disseminating such information on equipment in the following categories:

- Weather Equipment and Clocks
- NAVAIDS (Visual NAVAIDs and Radio NAVAIDs)

The equipment in the tower is checked by means of aural and visual alarms, visual inspection, and comparison with other pieces of equipment. These checks are formally made three times a day during the Watch Check (WC) and at other times by controllers using and monitoring the equipment. Airway Facilities (AF) and the Niagara Frontier Transportation Authority (NFTA) share responsibility for checking certain pieces of equipment. The WC is conducted by each Watch Supervisor (WS) and Controller in Charge (CIC) at the beginning of their shifts. The equipment checked includes the following: all clocks, wind instruments, altimeters, the Recorder Monitor Panel, the VOT panel, the ATIS Recording Controls, the MSAW Control Panel, and the ILS Monitor Panels. The individual controllers check the equipment at their positions and report any malfunctions to their supervisor.

In the Cab, the CIC relays information concerning equipment failures to the WS, who reports the problem to AF or the organization responsible for repairs. Both the WS and CIC inform their affected controllers. All equipment outages are logged on the TRACON Form 7230-4 by the WS and most outages affecting Cab operations are also logged on the Cab Form 7230-4 by the CIC.

In the TRACON, the WS reports equipment malfunctions to the responsible maintenance organization and logs the outage. He notifies his affected controllers, and the CIC, if the Cab operations are affected. If notified, the CIC relays the information to the Cab controllers that are affected. Individual controllers may note the outage on a piece of scratch paper to use as a reference. Flight Data (FD) writes it on the ATIS board if it is of interest to pilots. Clearance Delivery (CD) may note it on a plastic flight strip holder (Figure 4-1) with a grease pencil. This is designed so it can be inserted in a flight strip box but it is usually placed above the radio panel at CD. Certain outages, such as NAVAID malfunctions, are written in grease pencil on a large plastic status board located in the TRACON as a reference for TRACON controllers (Figure 4-2).

The maintenance organization notifies the WS when the equipment has been repaired. Then, the WS makes a log entry that the equipment has been "Restored to Service" (RTS). Then he notifies his affected controllers and the CIC, if the Cab is affected. The CIC notifies his affected controllers. If he logged the original outage, he also logs the "RTS". Then, the controllers erase or discard the references concerning the malfunction.

When the WC is completed, the following notation is made on both logs: "Watch Check List Complete" (WCLC), along with entries concerning any malfunctioning euqipment.

4.1 CLOCKS AND WEATHER EQUIPMENT

The clocks and weather equipment in the Buffalo tower include the console and ARTS-III clocks; the analog, digital and ARTS-III altimeters; the wind instruments; and the RVR panels. The following is a description of how status of this equipment is determined and subsequently disseminated.

4.1.1 Console Clocks and ARTS-III Clocks

a) Status Determination

The status of the console clocks and the ARTS-III clocks are determined as part of the WC and also by controllers using them. This is done by comparing each time reading with an independent reference. A console clock can be checked by using a wristwatch, a console clock at another position, or the time on the radar displays. Likewise, the ARTS-III clock can be checked using a

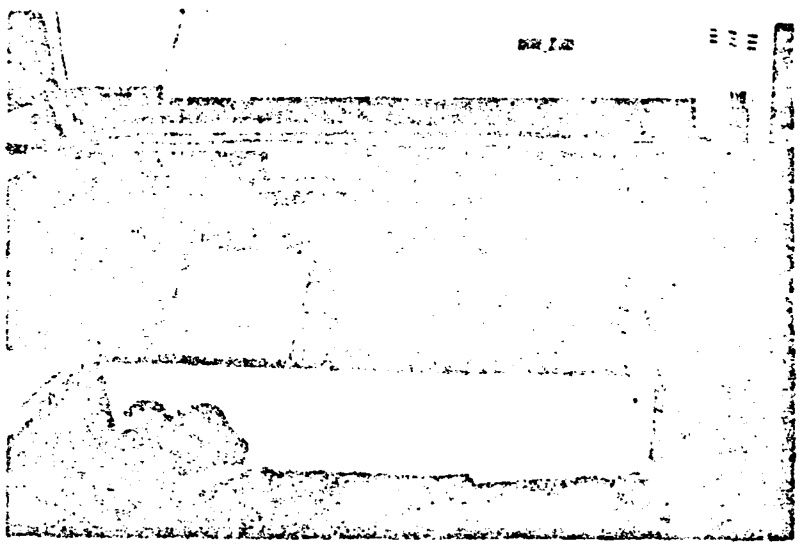


FIGURE 4-1. PLASTIC FLIGHT STRIP HOLDER FOR MESSAGES AT CLEARANCE DELIVERY

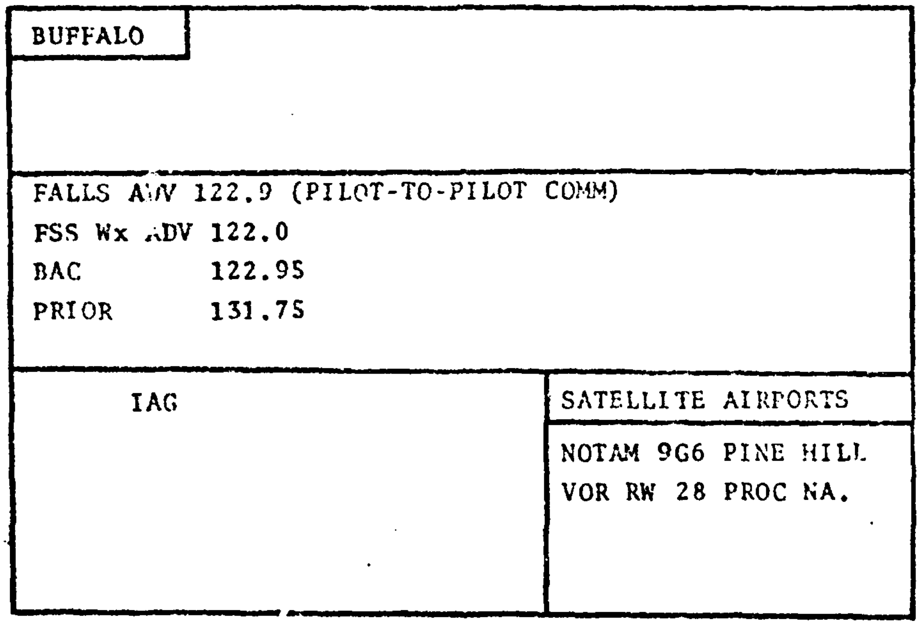


FIGURE 4-2. FORMAT OF STATUS BOARD IN TRACON

wristwatch or a console clock. Since time on the ARTS-III displays is from a single source in the computer, only one display needs to be checked to verify that they are all accurate. As well as verifying the time, the controllers observe the update rate of the seconds display to verify that the clocks are operating. Any console clocks that are incorect are reset by a superviser, if possible, otherwise AF is notified (the console clocks at the Arrival Radar positions can only be reset by AF, the others in the Cab and TRACON can be reset by a supervisor). The clocks at Arrival Data (AD), Departure Radar 1 (DEP-W), Departure Radar 2 (DEP-E), Departure Data (DD), and the Expanded Radar (ER) also buzz and show a red flag when they fail.

The ARTS-III clock is reset every day after the ARTS is returned to service during the midshift. This is performed by the ARTS technicians in the equipment room. Once or twice a week, the WS calls the WWV radio time service to obtain the exact time, which is subsequently used to verify the ARTS and TRACON clocks.

b) Status Information Requirements

When an independent failure of a console clock occurs in the Cab, the information is needed by the CC, WS and controllers that use the equipment. When it occurs in the TRACON, the information is needed by only the WS and controllers that use the equipment.

Information concerning the failure of all the console clocks or the ARTS-III clock is needed by both supervisors and all controllers.

c) Status Information Dissemination

When a Cab controller notices the outage of his console clock he reports it to the CIC, who notifies his affected controllers and the WS. The WS notifies AF and logs the outage. If the CIC notices the outage, he notifies his affected controllers and the WS. Once again, the WS notifies AF and logs the outage. The independent failure of a console clock is usually not logged in the Cab but the status information is passed on to relieving personnel if the problem remains uncorrected. In the TRACON, the same procedures apply for the failure of a single clock with the exception that the Cab is not notified.

When all the Cab and/or TRACON console clocks stop or are erroneous (a rare occurrence caused by power fluctuations or failures), the supervisor who first becomes aware of the problem informs the other and they disseminate the information to the controllers. The WS reports the outage to AF. The outage is logged in the Cab and TRACON. When the ARTS-III clock fails, the same action is taken as when all the console clocks fail.

Unless a power failure occurs (during which most equipment is out until the standby power system is engaged) there is always a backup source for time information, either the ARTS-III clock or another console clock.

4.1.2 Analog, Digital and ARTS-III Altimeters

a) Status Information

The status of the analog and digital altimeters is determined as part of the WC and by controllers using them. The controllers cross-check their altimeters with another instrument, the SA weather report or the ARTS-III reading. Any altimeter is considered out of service if it is off by 0.02 inches or more.

Flight Data (FD) enters the altimeter reading onto ARTS. He does this hourly, using the altimeter reading from the SA message, or more often if an SP message is received with a different altimeter reading, or if the altimeter reading changes by 0.02 inches. Thus, FD compares the actual and ARTS-III altimeter readings periodically to make sure the latter is current.

b) Status Information Requirements

Information requirements concerning the independent failure of an altimeter are the same as those for a console clock.

The failure of all the altimeters is only remotely possible because the analog instruments operate independently of each other. The failure of the digital instruments or the ARTS-III altimeter reading, however, would require that the supervisors and all controllers be notified.

c) Status Information Dissemination

Outages of the altimeter instruments are disseminated in the same way as the console clocks (Section 4.1.1). They are repaired by AF, and logged on Form 7230-4 as are console clocks.

FD notifies the CIC if the ARTS-III altimeter reading malfunctions (such as being unable to enter an updated figure). The CIC informs the Cab controllers and the WS, who notifies his controllers and the ARTS technicians. Both supervisors log the outage. If a radar controller notices an ARTS altimeter error (usually a reading more than 0.01 inches from the current), he notifies the WS. The WS notifies the CIC, who tells FD to update the reading.

Backup sources for the altimeters include another altimeter, the ARTS-III display, and the WSFO weather reports. Conceiveably, all the digital altimeters could fail because of a power failure and the analog altimeters, at the Cab Coordinator (CC) and Arrival Radar-East (ARR-E) positions, would still be operative.

4.1.3 Wind Direction and Velocity

a) Status Determination

The status of the analog wind instruments are checked as part of the WC and at other times by controllers using them. Their status is determined by observing the indicators to see if they are moving, by cross-checking instruments to see if they are consistent, by making sure the readings are similar to those on the weather reports, and by the Weather Service Forecast Office's (WSFO) daily checks. The latter is done by the WSFO telephoning FD and making sure the Cab instruments correlate with the WSFO's.

Since the controllers continuously use the instruments, they tend to know immediately if a malfunction occurs, usually because of a sudden and unwarranted indicator change .

b) Status Information Requirements

When a single wind instrument fails, the status information is needed by the controllers that use the instrument, their immediate supervisor, and the WS.

When multiple instruments fail, the information is needed by all controllers that use wind information and both supervisors.

c) Status Information Dissemination

Controllers report the failure of a single wind instrument to their supervisor. In the Cab, the CIC notifies the WS, who reports it to AF. Both supervisors log the outage. In the TRACON, the CIC would not be notified but the WS would log the outage and notify AF.

When all the wind instruments fail (usually due to icing or high winds), the supervisor that first notices the problem notifies the other. They both inform the controllers that use the instruments and the WS notifies AF and the WSFO. Both supervisors log the outage.

Until the malfunction is repaired, the WSFO relays wind speed and direction readings every 15 minutes to the Cab. Usually, FD receives the information which he relays to Arrival Data (AD) in the TRACON. They disseminate the information to their supervisors and the other controllers.

Other backup sources for wind information include the SA weather report and the wind sock at centerfield.

4.1.4 Runway Visual Range (RVR)

a) Status Determination

The status of the RVR system is established by AF and controllers using the equipment. AF checks the system daily and calls the CIC and WS to verify the visibility readings on the three displays. While AF is checking the system, the displays show a "T" indicating that it is in the test mode. Controllers also check the system as they use it, making sure that the indicator lights show the proper setting and day/night mode. An "E" is displayed if there is an error in the system. Local Control (LC) also checks the readings to make sure that they are consistent with what he can actually see. Arrival Radar-West (ARR-W) and Arrival Radar-East (ARR-E) do this to a lesser extent, checking the readings against the weather messages and tower visibility readings.

Most of the time it is obvious when a failure occurs; e.g., the surface visibility may be several miles while the display indicates a few thousand feet RVR. These problems often occur in winter, when blowing snow clogs the lenses of the transmissometers.

Usually, only one transmissometer fails at a time. When this occurs, just the single RVR is put out of service, the other two remaining functional. Landing minimums for the airport are controlled by the touchdown RVR and either one of the midrange and rollout (if all three are provided, one of the latter two is used as an advisory; the other two are controlling). Thus, the RVR can not be used without the touchdown value and either one of the other two.

b) Status Information Requirements

When the touchdown RVR malfunctions during marginal visibility conditions, the information is needed by FD (to record on the ATIS), CD (to inform departing aircraft that do not have the ATIS), ARR-W, ARR-E, and the supervisors. If it malfunctions during periods of good visibility, the information is needed by only the supervisors, LC and the Arrival Radar positions.

Information concerning failures of either the rollout or midpoint RVRs is needed by only the supervisors, LC and the Arrival Radar positions. If they both fail at once, however, the status information requirements would be the same as for the failure of the touchdown RVR.

When an independent RVR panel malfunctions during good visibility conditions, the information is needed by the controller who normally uses the equipment, his supervisor, and the WS. During marginal visibility conditions, the positions with the operating panels must also be notified, to coordinate relaying RVR values to that position, or his aircraft.

When all the RVR panels fail, the status information requirements are the same as when the touchdown component fails.

c) Status Information Dissemination

When AF detects an RVR malfunction, they report it by telephone to the CIC and WS, who notify their affected controllers. The outage is logged in the Cab and TRACON.

When LC notices an RVR malfunction, he notifies the CIC, who reports it to the WS. The WS informs ARR-W, ARR-E (if visibility conditions are marginal), and AF. AF verifies the outage, then it is logged on the Cab and TRACON Form 7230-4s. The other controllers are notified as necessary, depending on whether the failure is to the single panel or one of the transmissometers and the current visibility conditions.

When an Arrival Radar controller notices an RVR malfunction, he notifies the WS, who notifies the CIC (if conditions are marginal) and AF. The CIC notifies LC. Again, AF confirms the outage and it is logged on both Form 7230-4s. The other controllers are notified when the touchdown RVR is out or both the midrange and rollout RVRs are out, and visibility conditions are marginal.

Other backup sources for surface visibility information include reference objects on the field and the Visibility Reference chart (Figure 4-3) showing the distance to each one. This is used by LC whenever visibility goes below 4 miles (See Section 6.2.1).

4.2 NAVAIDs

Radio and Visual NAVAIDs are discussed in this section according to their status determination, controller requirements for status information and the subsequent dissemination of the

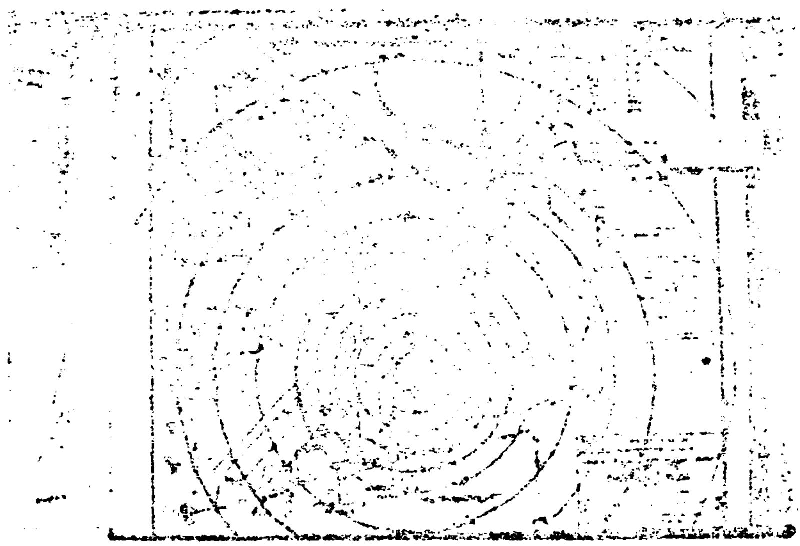


FIGURE 4-3. VISIBILITY REFERENCE CHART

information. The NAVAIDs include the runway and taxiway lights, the approach lights, the Instrument Landing System (ILS), and the VORTACs near Buffalo.

4.2.1 Visual NAVAIDs

The visual NAVAIDs include the following light systems at Buffalo airport (Figure 4-4):

Runway 23: High Intensity Runway Lights (HIRL)

Centerline Lights (CL)

Touch Down Zone Lights (TDZ)

Approach Light System with Sequenced Flashing Lights (ALSF-1)

Runway 5: High Intensity Runway Lights (HIRL)

Centerline Lights (CL)

Touch Down Zone Lights (TDZ)

Simplified Short Approach Light System with Runway Alignment Indicator Lights (SSALR)

Runway 32: Medium Intensity Runway Lights (MIRL)

Runway End Identifier Lights (REIL)

Visual Approach Slope Indicator - Left Side of Runway (VASI-L)

Runway 14: Medium Intensity Runway Lights (MIRL)

Taxiway Lights

a) Status Determination

The status of the visual NAVAIDs at Buffalo are determined through visual observations and the monitoring of status panels by controllers, maintenance checks by the NFTA and AF, and through pilot reports.

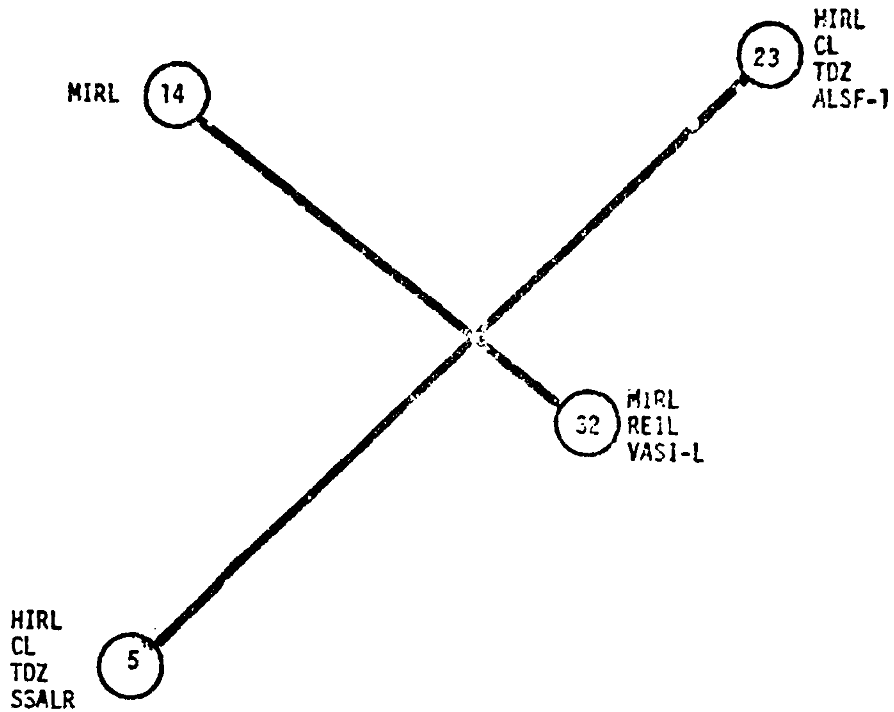


FIGURE 4-4. VISUAL NAVAID LOCATIONS AT BUFFALO

When a malfunction is noticed, minor repairs may be made immediately. Long term outages which reduce the usefulness of the NAVAID require a NOTAM (Section 4.5). NAVAID outages are logged on Form 7230-4 in both the Cab and TRACON.

The following is a description of how the status of visual NAVAIDs is obtained.

1) HIRL, MIRL, and Taxiway Lights

These NAVAIDs are checked daily by the NFTA. They radio Ground Control (GC), who relays the request to have the lights activated to LC. NFTA initiates a NOTAM if outages are not immediately repaired. LC also checks the lights when they are initially turned on and periodically while they are in use. Occasionally, pilots may report outages of these NAVAIDs to GC or LC.

2) CL, TDZ

The NFTA also checks the CL and TDZ lighting systems daily, again contacting GC to have them turned on. Since these lights are flush with the runway surface and directional in nature, they can not be seen from the tower. Status information on these NAVAIDs occasionally comes from pilot reports, who usually notify LC.

3) ALSF-1, SSALR

These approach light systems are checked regularly by AF. They radio GC, who relays the information to LC to have them activated. LC also monitors them when they are on, using the aural and visual alarms on the control panel. Pilots occasionally report outages to LC.

4) REIL

These lights are checked regularly by AF, who contact GC to have LC turn them on. The lights are also checked occasionally by LC or CC by turning them on and looking at them. Pilots sometimes report outages to LC.

5) VASI-L

The status of the VASI-L is determined daily by AF. Since the unit is always on, AF does not have to contact the tower to have it activated. This system is not visible from the tower. Pilots occasionally report VASI-L outages to LC.

b) Status Information Requirements

Table 4-1 shows a summary of controllers requiring status information of the visual NAVAIDs and the ILS (Section 4.2.2) at Buffalo.

In the Cab, the CIC needs status information on all visual NAVAIDs, to be aware of landing minimums, traffic flow and other limitations resulting from an outage. LC needs status information of all the visual NAVAIDs because aircraft under his control use them. He has to be aware of what visual NAVAIDs are available as landing minimums and what useable runways are affected. GC needs status information on the HIRL, MIRL, and taxiway lights because aircraft under his control use them and he needs status on the CL, TDZ, REIL, and VASI-L to anticipate the movement of ground vehicles working on these NAVAIDs. FD needs the status on all the visual NAVAIDs for the ATIS. CD needs the status of the HIRL, MIRL, taxiway lights, CL, and TDZ light systems to inform departing aircraft that do not have the ATIS.

In the TRACON, the WS needs status information of all the visual NAVAIDs to be aware of the overall operations of the facility. The Arrival Radar controllers (ARR-W and ARR-E) need the status of the ALSF-1 and SSALR because they monitor aircraft using the NAVAID. They also need status on the HIRL, MIRL, CL, and TDZ light systems for informing approaching aircraft that do not have the ATIS and to determine landing minimums. ARR-E also needs status of the VASI-L as aircraft under his control may use the NAVAID when approaching runway 32. The TC needs the status of the same visual NAVAIDs as ARR-W to coordinate traffic flow from the ARTCC.

TABLE 4-1. NAVAIDS AT BUFFALO AIRPORT AND CONTROLLERS INTERESTED IN THEIR OPERATIONAL STATUS

NAVAID	CC	LC	GC	FD	CD	WS	AD	DEP-W	ARR-W	ARR-E	TC
Runway 5-23 HIRL	X	(X)	(X)	X	X	X			X	X	X
Runway 5-23 CL	X	(X)	X	X	X	X			X	X	X
Runway 5-23 TDZ	X	(X)	X	X	X	X			X	X	X
Runway 23 ALSF-1	X	(X)		X		X			(X)	(X)	X
Runway 5 SSALR	X	(X)		X		X			(X)	(X)	X
Runway 14-32 MIRL	X	(X)	(X)	X	X	X			X	X	X
Runway 32 REIL	X	(X)	X	X		X					
Runway 32 VASI-L	X	(X)	X	X		X				(X)	
Taxiway Lights	X	(X)	(X)	X	X	X					
ILS	X	(X)		X	X	X	X		(X)	(X)	X

○ WORKS WITH AIRCRAFT U[illegible]G NAVAID

X NEEDS STATUS INFORMATION ON NAVAID

c) Status Information Dissemination

When AF or NFTA discover a malfunction, they inform GC and/or the WS. If they notify GC, he relays the information to the CIC. The CIC notifies the WS and they inform their affected controllers. AF of NFTA calls the FSS to issue a NOTAM. The outage is logged in the Cab and TRACON on Form 7230-4. When they notify the WS directly, he relays the information to the CIC and they take the appropriate action.

When a controller learns of an outage, either through a pilot report, status panel or visual observation, he notifies his immediate supervisor. The latter notifies the affected controllers and logs the outage. The WS calls either AF or NFTA, depending on which organization is responsible for the NAVAID.

4.2.2 ILS

The runway 5 ILS includes the following components: the localizer (LOC), the glide slope (GS), the compass locator (LOM), the outer marker (OM), and the middle marker (MM). The runway 23 ILS includes these and also an inner marker (IM). Figure 4-5 shows the location of the marker beacons and Buffalo VORTAC.

a) Status Determination

All of the ILS components are monitored by the equipment discussed in Section 3.3.1. Additionally, AF checks the system regularly, notifying the CIC or WS of any malfunctions. Occasionally, pilots may report a failure to LC or an Arrival Radar controller, in which case a verification is obtained from another aircraft.

b) Status Information Requirements

In the Cab, the CIC needs status information for the same reasons as with the visual NAVAIDs. LC requires status information on the ILS because he monitors aircraft using it. FD requires status information for the ATIS recording.

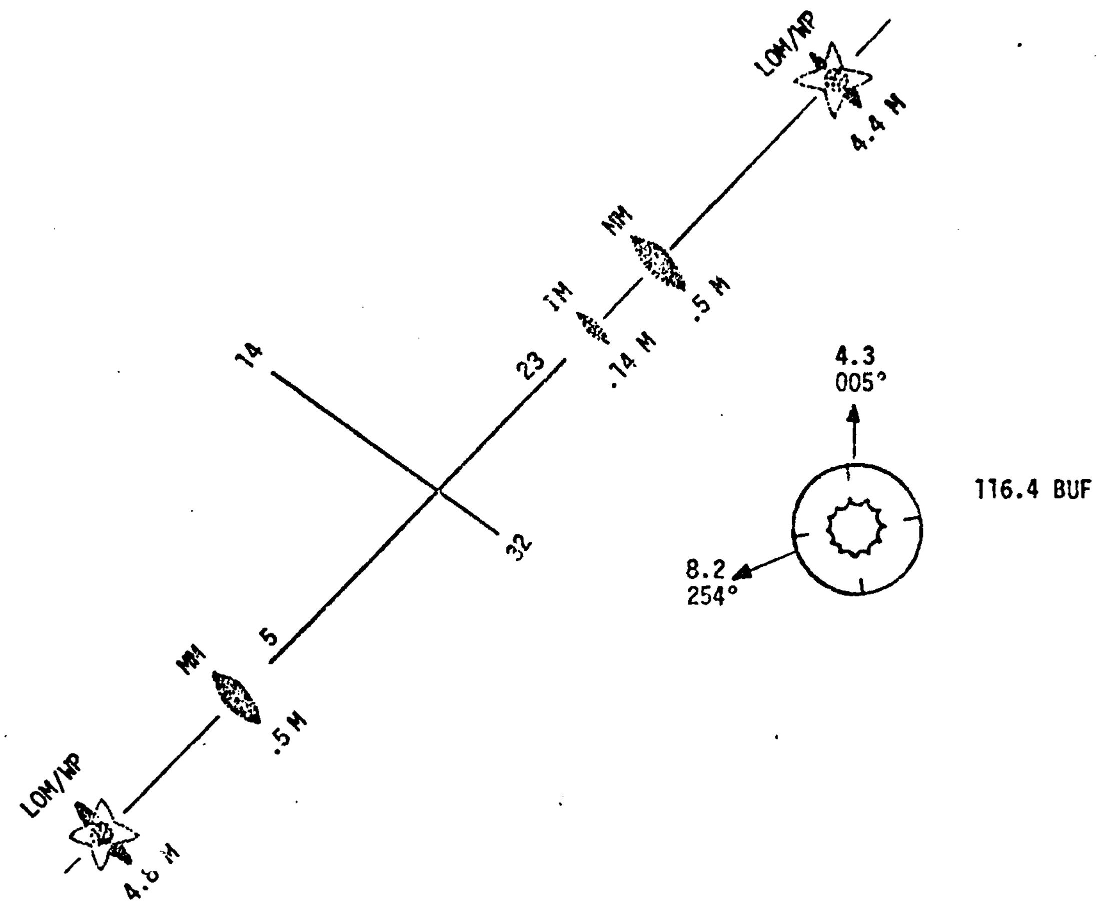


FIGURE 4-5. LOCATION OF MARKER BEACONS AND BUFFALO VORTAC

In the TRACON, the WS needs the status of the ILS to be aware of the overall facility operation. AD needs the ILS status because he gives clearances for aircraft departing secondary airports that may use the ILS to land at Buffalo. The Arrival Radar controllers monitor aircraft using the LOC, GS and LOM portions of the ILS. They and the TC need status information on all the components, however, as landing minimums are affected by outages. The AR controllers also need status information on the ILS to advise approaching aircraft that may not have ATIS information.

c) Status Information Dissemination

When AF detects an outage of any ILS components, they inform the WS and the FSS. The WS informs the CIC. They inform the affected controllers and log the outage (the FSS issues a NOTAM).

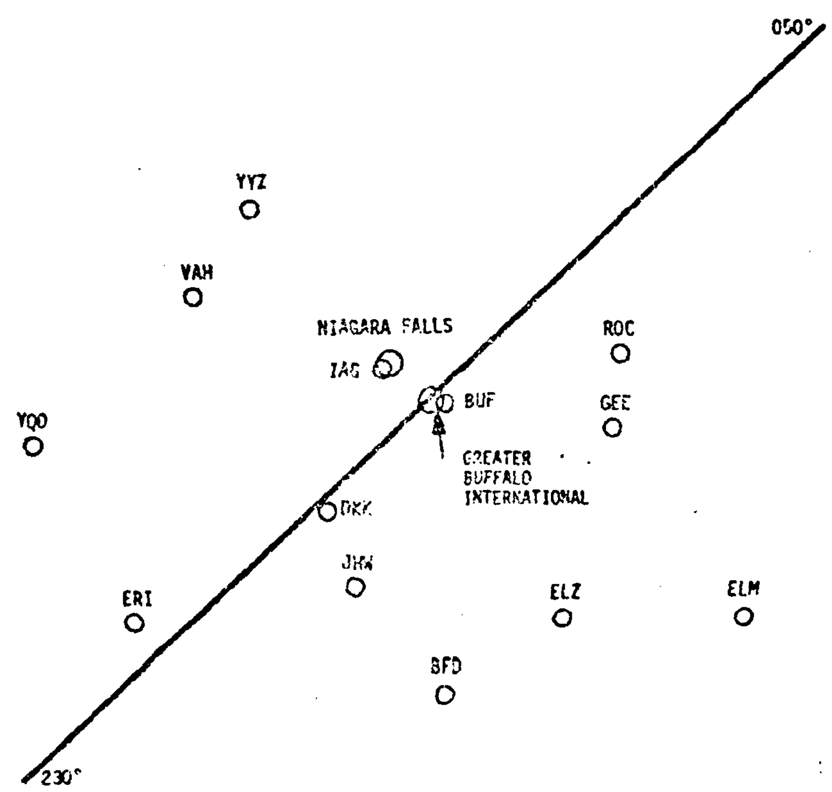
When a controller notices a malfunction, he notifies his supervisor, who notifies the other supervisor. The supervisors inform the affected controllers and log the outage. The WS notifies AF to have the malfunction repaired.

4.2.3 Area Radio NAVAIDs

The area radio NAVAIDs (Figure 4-6) include the Buffalo VORTAC (BUF), the Niagara TACAN (IAG) and several other VORTACs within approximately 100 miles of the airport.

a) Status determination

The status of the area VORs and TACANs is determined via NOTAMs from the FSS and reports from the ARTCC, Niagara Tower, AF and pilots. The FSS monitors the BUF and Dunkirk (DKK) VORTACs; Niagara Tower monitors the IAG TACAN; AF checks the BUF VORTAC; and the ARTCC relays information on the others. Occasionally, status information comes from pilots reporting difficulty in receiving a particular NAVAID. When this happens, controllers try to get a confirmation from another aircraft.



TACANs/VORs SURROUNDING BUFFALO

1 INCH = 30 NAUTICAL MILES

FIGURE 4-6. AREA RADIO NAVAIDS

b) Status Information Requirements

All of the staffed controller positions as well as the supervisors need status information on the BUF VORTAC because of its importance as a navigational reference for arrival routes, departure routes, missed approaches and holding patterns as well as broadcasting the ATIS message.

Due to their importance in defining navigational fixes for entering and departing the Buffalo Terminal Area, the status of certain VORs and TACANs outside the Terminal Area are of interest to TRACON controllers. These NAVAIDs are listed in Table 4-2 and indicate the TRACON controllers interested in their operational status. Most controllers, however, vector aircraft approaching and departing Buffalo using compass headings and therefore, do not rely heavily on VORs and TACANs and so, operationally do not need to know the status of these NAVAIDs. Nevertheless, the information is useful for advisories to pilots.

AD needs status information on all the VORTACs/TACANs shown in the Table because he gives clearances for aircraft at satellite airports. The departure routes may require amending because of radio NAVAID malfunctions. DEP-W needs status information on all the VORTACs because he may give aircraft clearances to any of them. He does not need status information on the IAG TACAN, however, as it is used by military aircraft approaching Niagara. The Arrival Radar controllers need status information only on the NAVAIDs within their respective airspace, with the exception of BUF and DKK, which are in the East Sector but are needed by both ARR-W and ARR-E. The TC needs status information on all the VORs in order to establish routes of traffic flow and coordinate with the radar controllers and the ARTCC.

c) Status Information Dissemination

When a NOTAM is received (NOTAMs are discussed in detail in Section 4.3) concerning a radio NAVAID outage, FD in the Cab and AD in the TRACON remove them from the electrowriters and give them to their supervisors. If the outage concerns the BUF VORTAC, the

TABLE 4-2. VORTACs/TACANs NEAR BUFFALO AND CONTROLLERS INTERESTED IN THEIR OPERATIONAL STATUS

VORTAC/TACAN	AD	DR-1	AR-1	AR-2	TC
NIAGARA (IAG)	✓		✓		✓
DUNKIRK (DKK)	✓	✓	✓	✓	✓
JAMESTOWN (JHW)	✓	✓		✓	✓
BRADFORD (BFD)	✓	✓		✓	✓
ERIE (ERI)	✓	✓	✓		✓
WELLSVILLE (ELZ)	✓	✓		✓	✓
GENESEO (GEE)	✓	✓		✓	✓
ROCHESTER (ROC)	✓	✓		✓	✓
ELMIRA (ELM)	✓	✓		✓	✓
ALYMER (YQO)	✓	✓	✓		✓
TORONTO (YYZ)	✓	✓	✓		✓
ASH (VAH)	✓	✓	✓		✓

supervisors inform all their controllers, and log the outage on Form 7230-4. The WS or AD also post information on the TRACON status board. Other VORTAC outages are disseminated to the affected TRACON controllers (Table 4-2) and posted on the status board.

When a TRACON controller learns of a radio NAVAID outage through a pilot, he reports it to the WS. The WS relays the information to the FSS, AF, his affected controllers and the CIC if it concerns the BUF VORTAC. He logs it on Form 7230-4 and either he or AD post the information on the status board.

4.3 NOTAMs

NOTAMs are received from the FSS on the electrowriter. The information contained in NOTAMs concerns radio and visual NAVAID outages, equipment outages, and airfield hazards. NOTAMs are sent to notify the controllers of routine outages for maintenance as well as unexpected malfunctions.

They may be initiated by AF, NFTA, the WS or FSS. When the WS initiates a NOTAM, he telephones the FSS and gives the necessary information. The FSS then officially issues the NOTAM on the electrowriter. Usually, the WS knows of a pending NOTAM before it is issued as the tower is in contact with the organizations that initiate them. Often, an outage is brought to the attention of someone in the Cab or TRACON, then relayed to the WS before the official NOTAM is issued.

NOTAMs usually include an airport identifier (some NOTAMs received at Buffalo pertain to Niagara, Rochester or some other airport), a class code (not of use to controllers), NOTAM number, effective time and date, approximate expiration time and date, a text describing the outage or hazard, the letters "FSS", and the date and time issued.

The NOTAM shown on the left side of Figure 4-7 is translated as follows: (The other NOTAM in Figure 4-7 was taken over the telephone by FD when the electrowriter was out of service. It

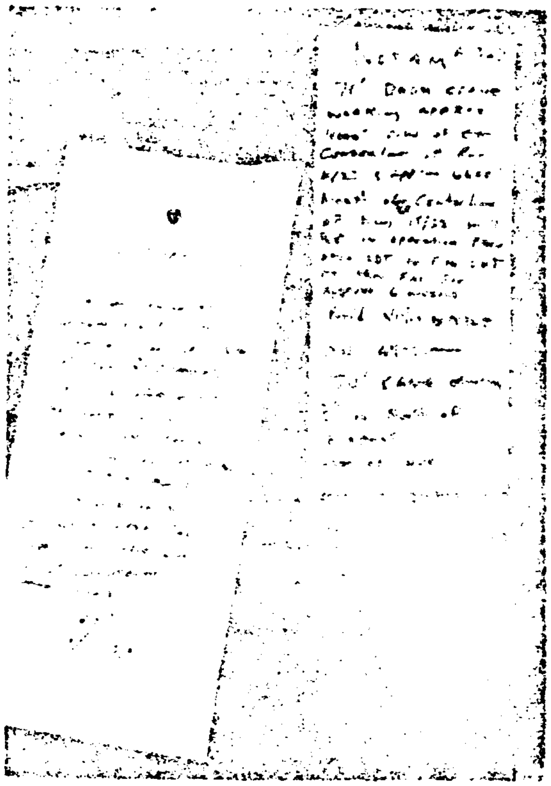


FIGURE 4-7. NOTAMS AT THE CAB COORDINATOR POSITION

describes the location of a 70-foot crane operating near the airport. At the end of the message is an abbreviated text of the NOTAM for the ATIS recording.

BUF - The NOTAM is for the Buffalo airport.

NOTAM "L" - Indicates it is a local NOTAM, which tends to be of an advisory or "nice to know" nature (NOTAM "D" tends to be more critical in nature, and concerns other areas).

A-326 - It is NOTAM Number 326.

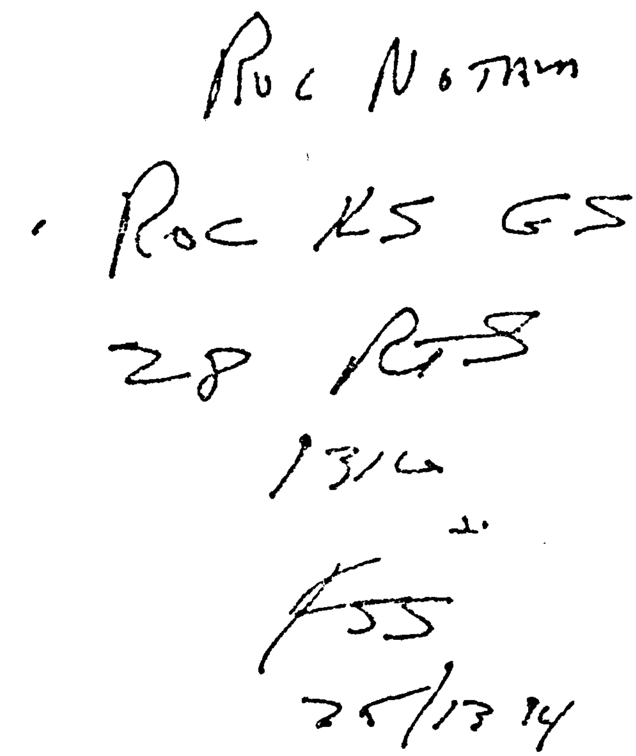
Text - Effective at 0800 EST Monday 6/16/80 United Airlines Gate number 15 will be closed for rehabilitation. The closed portion will be marked with orange and white log barricades.. (portion unreadable). All escorts to be provided by NFTA radio vehicles. This work to be completed in 7 weeks.

FSS 6/13/(time unreadable) - Issued by the FSS on 6/13/80 at (time).

Portions of a NOTAM that are unreadable are generally ignored if the text of the message is understandable, otherwise the FSS is called for the information.

NOTAMS are in effect until a cancellation notice is received over the electrowriter from the FSS. Figure 4-8 shows a NOTAM indicating the Rochester runway 28 ILS Glide Slope has returned to service.

In the CAB, FD removes NOTAMs from the electrowriter and notifies the CIC. If necessary, FD records the information on the ATIS. He places the NOTAM on the NOTAM Board (Figure 4-9) at the CIC position, which has separate areas for airfield notices, NAVAID outages or area notices. Either the CIC or FD notify the affected Cab controllers. Sometimes, a controller may write the NOTAM information on a piece of paper or the flight strip holder for messages (see Section 4.0) and keep it at his position for reference (Figure 4-10 shows an abbreviated text of the NOTAM concerning repairs to gate 15). When the cancellation is received, FD removes it from the electrowriter, informs the CIC and removes the original



RUC NOTAM

ROC KS GS

28 RGS

1316

FSS

25/1314

FIGURE 4-8. NOTAM CANCELLATION FROM FSS

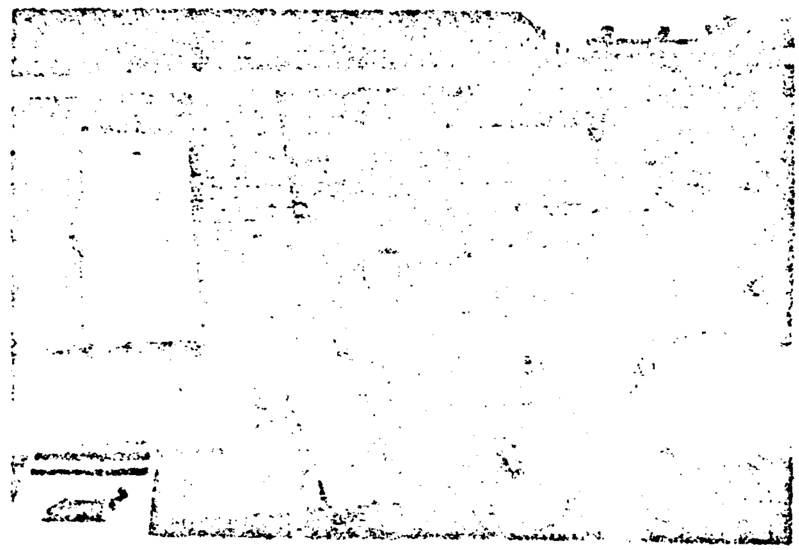


FIGURE 4-9. NOTAM BOARD AT THE CAB COORDINATOR POSITION

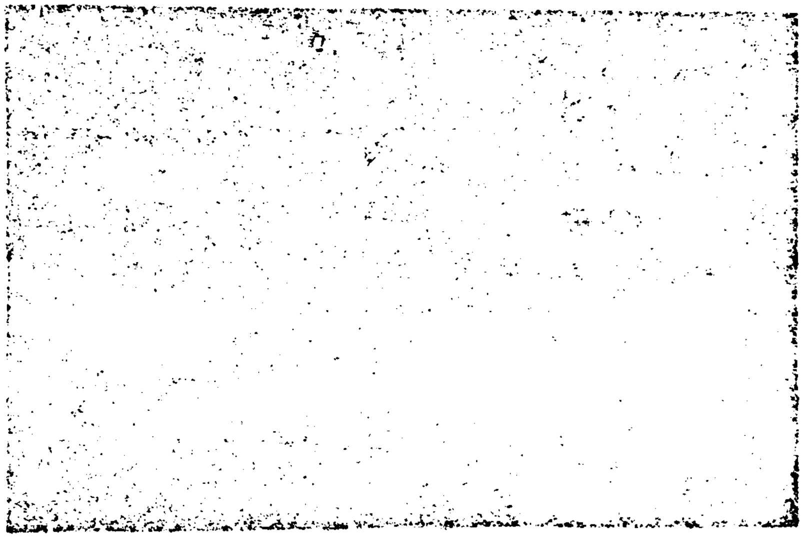


FIGURE 4-10. NOTE AT GROUND CONTROL

NOTAM. Either the CIC or FD notify the affected controllers. The cancellation and the original notices are discarded. If it was on the ATIS, a new message is recorded. Handwritten references to the NOTAM are erased or discarded.

In the TRACON, AD removes the NOTAM from the electrowriter and notifies the WS. Either of them inform the affected controllers and write the NOTAM on the status board (Figure 4-2). The WS clips the NOTAM on a clipboard kept at the desk and logs the outage on Form 7230-4, if it pertains to the Buffalo Area. When the cancellation is received, AD removes the message, informs the WS and erases it from the status board. Either of them inform the affected controllers. The NOTAM and cancellation notice are discarded.

4.4 SUMMARY

The status of equipment and NAVAIDs at Buffalo is determined through regular equipment checks made by controllers, supervisors, AF, NFTA, WSFO, and the FSS. Status is also determined by controllers using the equipment and pilots navigating with the radio and visual NAVAIDs.

Controller requirements for operational status are based upon position responsibilities, the equipment used and airspace allocations. Dissemination of status information is primarily made by the supervisors verbally informing the affected controllers and posting the information for reference in the Cab and TRACON. These procedures are similar to those used at the Albuquerque, Atlanta, and Boston towers.

5. CURRENT FLIGHT DATA SYSTEM

OVERVIEW

A brief description of the national flight data system and a detailed description of the flight data system at the Buffalo Air Traffic Control Tower as of July 1980 is described in this chapter. Specific areas covered include:

- Flight data equipment and layout.
- Flight data analyses and processing procedures. This section includes an analysis of each type of flight strip and how it is processed from controller position to position.
- Summaries of on-site observations conducted at the Buffalo Tower Cab and TRACON which describe present flight data layouts and flight strip loads by controller position.
- Flight data record keeping which includes a description of how flight data is tallied from primary sources (flight strips, scratch pads, counters) and totalled on both local and national (FAA) data forms.

Flight data equipment at Buffalo is typical for an ARTS III Tower. The Cab contains 2 FDEP units (1 spare), a Conrac and a BRITE. The TRACON has 2 FDEP units (1 spare) and is equipped with four radar positions of which 3 are regularly used. Flight strip drop tubes are not used at Buffalo, so departure flight strips are machine printed in both the Cab and TRACON.

Flight strip processing at Buffalo includes mounting strips in plastic holders and placing them in custom designed flight strip bays and wooden boxes located at the controller positions. In the TRACON, flight strip bays are located at AD, DEP-W, ARR-W and ARR-E wooden boxes are located at AD for advance proposals, and the two approach control positions (for Stage III arrival strip preparation and Stage III overflights). A scratch pad is used at the AD position for general note taking and to record flight data coordination requirements.

In the Tower Cab, the only flight strip bay is located at the Assistant Local Control (AL) position; departure strips (IFR and stage III) are placed in the bay by GC and removed by LC after processing and put in the flight strip bin at AL. Wooden flight strip boxes are located at CD and FD. Scratch pads are also used extensively in the Cab and are located at CD, FD, GC (VFR departure flights) and LC (arrival sequence). VFR non-Stage III flights are logged on a mechanical counter at the LC position. Flight strips are not completed for such flights, rather, aircraft identification information is logged on a scratch pad by either GC (departures) or LC (arrivals).

Flight strip mix for a one day (Friday, April 25, 1980) sample in the TRACON was:

Air Carrier	38%
Air Taxi	9%
General Aviation	46%
Military	7%

A relatively small percentage (14%) of these strips were hand-printed.

Manual notations on Buffalo strips are common. In the Cab, these include checkmarks (indicating coordination compliance) and initial aircraft instruction (e.g., altitude). Manual notations in the TRACON are more varied depending upon the type of flight. One important procedure involves the use of red pens to indicate or highlight certain flight data (e.g., a departure airport other than Buffalo).

Transfer of control of flights from Buffalo to the Toronto Center in Canada must be done by telephone. The Canadian air traffic control network is presently connected to the U.S. system via voice communications only. (Future plans are to integrate the two systems on a computer network.) Flights departing Buffalo for Toronto require the FD controller in the Cab to call the Toronto Center with an approval request. Such action is indicated by a third checkmark on the departure flight strip. Flights departing Toronto for Buffalo are called in to the Cleveland ARTCC by Toronto Center. The Cleveland Center may then generate an arrival strip to the Buffalo TRACON in U.S. format. These so-called "Toronto proposals" are stored in the wooden flight strip box at AD in the TRACON since they are usually generated well in advance of flight arrival time. The Toronto Center also verbally coordinates these flights with the Buffalo TRACON.

The Cleveland ARTCC may also be contacted by DEP-W relative to clearing departing aircraft to an altitude above the terminal area limit (10,000 MSL). This procedure eliminates the need to level off the aircraft prior to the Center authorizing a higher altitude.

5.1 PURPOSE AND DEVELOPMENT OF THE NATIONAL FLIGHT DATA SYSTEM

The purpose of the National Flight Data System is to provide air traffic controllers with the information necessary to safely and efficiently control flights operating at FAA controlled airports and in FAA controlled airspace. Such information is called "flight data" and includes the aircraft identification, aircraft type and equipment, radar beacon code assigned, the planned route of flight, and selected operational data such as altitude, groundspeed, and scheduled arrival or departure time.

First generation air traffic control systems primarily relied upon the voice radio link with pilots for the receipt of flight data. It was common practice for controllers to maintain this flight data on blackboards and scratch pads. This initial system was gradually improved as a result of technological advances in the fields of communications, radar and navigation.

The current air traffic control system is based on a nationwide computer network containing the flight data on flights that plan to fly in FAA controlled en route airspace and have filed flight plans. The primary source of flight data is the flight plan which a pilot files prior to takeoff; these flight plans provide the computer network with a data base on filed aircraft operations throughout the nation.

Each en route center in the country has a computer unit (9020 NAS Stage A) for the storage and processing of flight data affecting their airspace jurisdiction. This unit is part of the national computer network and is used to exchange flight data with other en route centers and with its own client TRACONs and control towers. In air traffic control towers, the Cab and TRACON facilities are connected to the network via Flight Data Entry and Printout (FDEP) units (Figure 5-1). These FDEPs function as flight data computer terminals and allow for the transmission and receipt of flight data.

Controllers receive flight data from the FDEP units in the form of machine printed paper strips (1" by 8") called flight progress strips or "flight strips." These strips are machine generated approximately thirty minutes before the corresponding flight is expected to come under the control of a Cab or TRACON facility. These machine printed strips are easily separated from the flight strip roll on the FDEP unit and distributed to the appropriate controllers for air traffic control activities. Each FDEP unit also has a keyboard which enables the controllers to access the computer stored flight data base to request, modify, or add flight data.

For flights without a machine printed flight progress strip (e.g., VFR flights), controllers use the voice radio link with pilots to obtain the flight data necessary for control purposes. The controller hand prints this data on either a blank flight strip or a paper scratch pad. Controllers depend upon radio communications with pilots to supplement, confirm, or modify all forms of flight data including machine printed or hand printed flight strips or scratch pad data.

Controllers also receive limited flight data from the radar surveillance displays located in both the Cab and TRACON.

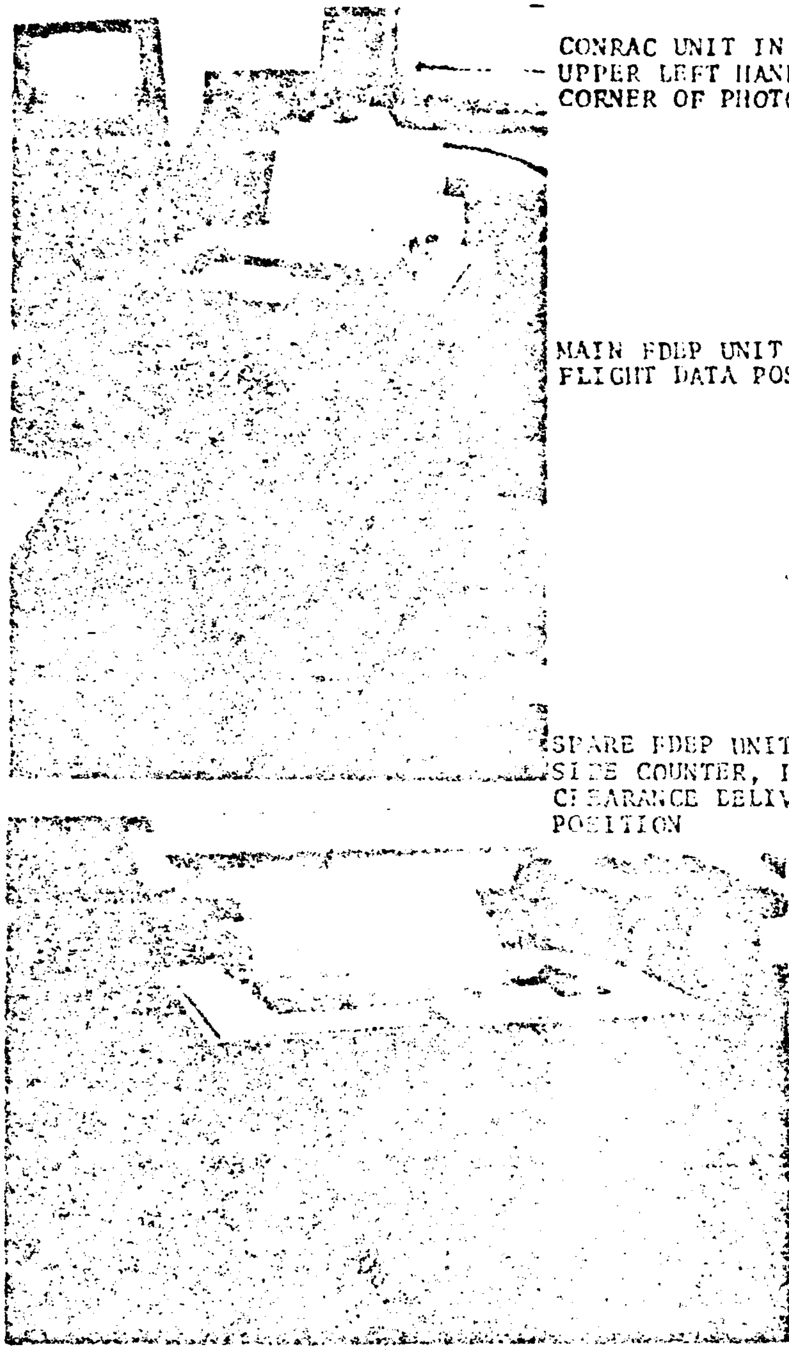


FIGURE 5-1. FDEP UNITS IN BUFFALO TOWER CAB

In addition to maintaining flight data, controllers use flight strips and scratch pads to maintain other traffic management information, such as noting how a flight is to be controlled or noting that a particular instruction has been issued to the pilot. Controllers may also use blank flight strips to record pilot weather reports (PIREP) or aircraft emergency information. Paper scratch pads may be used by Cab controllers to write down the aircraft identification of certain flights. Arrival flights may be listed on a scratch pad to provide a reference for both the sequence of arrivals and subsequent taxiing instructions; VFR departure flights may be listed on a scratch pad for aircraft identification reference in the absence of machine printed or hand printed flight strips.

A Flight Data Display (FDD) is currently being designed to replace the paper flight strips with electronically displayed flight data.

5.2 FLIGHT DATA EQUIPMENT AND LAYOUT

The air traffic function at the Buffalo Tower is supported by flight data equipment located in both the Cab and TRACON; the layout of these facilities and the location and function of the equipment therein is described below.

5.2.1 Tower Cab

Flight data equipment in the Cab includes two FDEP units, one Conrac unit, and one BRITE radar unit (Figure 5-2).

The main FDEP unit (Figure 5-1) is equipped with a keyboard and is located at the Flight Data (FD) position. This unit generates machine printed flight strips for all filed departures for Buffalo and secondary airports in the terminal area (approach control area). A spare FDEP unit without a keyboard is located on the side counter to the left of the Clearance Delivery (CD) position; this spare unit is used during an outage of the main FDEP.

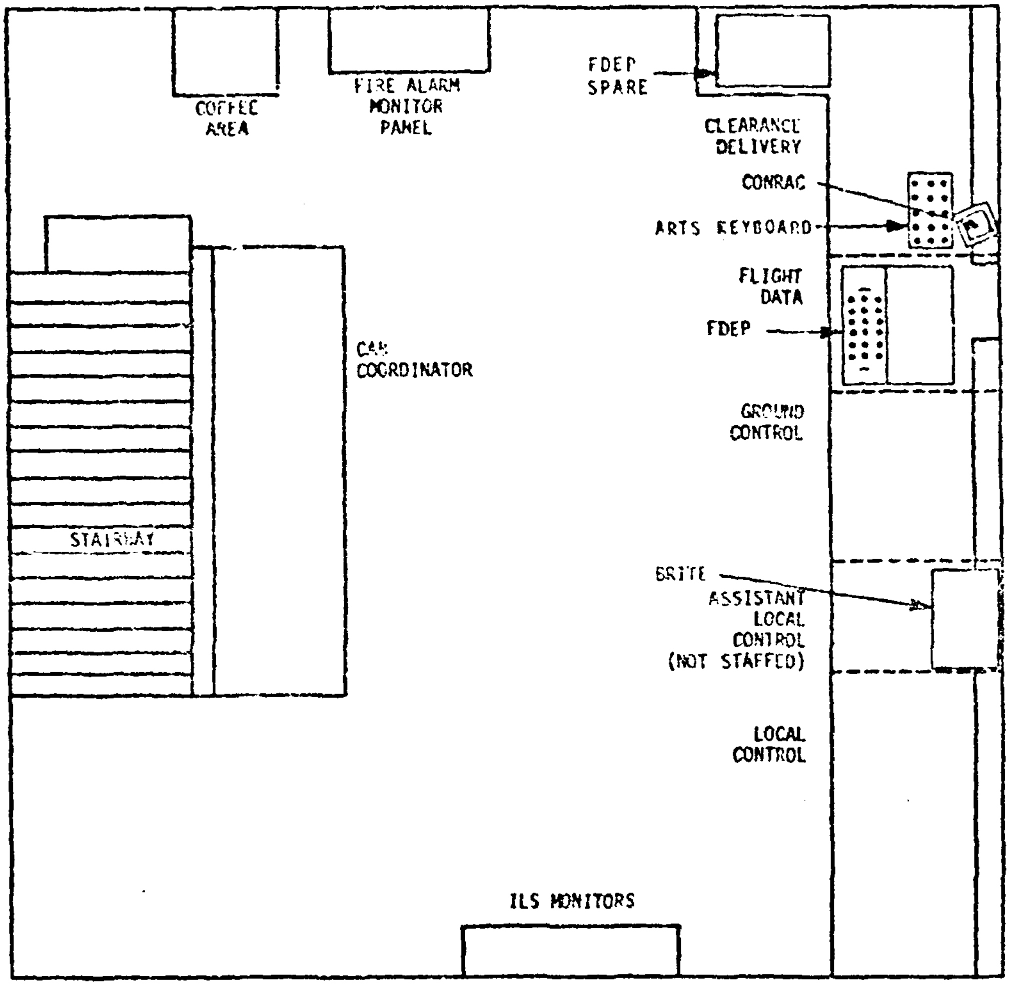


FIGURE 5-2. LAYOUT OF FLIGHT DATA EQUIPMENT IN TOWER CAB

To the left of the main FDEP unit is an ARTS keyboard and the Conrac display. The Conrac serves two principal flight data functions. First, the Conrac provides a video display of the primary radar targets and associated ARTS data blocks (Section 5.3.4) within a set radius of the ASR (usually 20 miles). Second, it displays the radar beacon codes assigned to Stage III departure flights; individual codes are assigned by the ARTS computer and displayed on a "preview area" on the screen following a requested entry on the ARTS keyboard by CD. CD communicates the code to the pilot of the Stage III departure. The code is entered on the aircraft transponder by the pilot, usually following takeoff. The beacon code enables the ARTS system to identify an aircraft through radar interrogation. Stage III departure flights processed in the Cab on the ARTS keyboard and the Conrac appear on the radar surveillance screen tab list of the Departure Controller in the TRACON; the tab list data includes an alphabetical letter, the aircraft identification, and the beacon code assigned.

A third unit of flight data equipment in the Cab is the BRITE radar (Figure 5-3) suspended above the Assistant Local Control position on a track. The BRITE radar screen displays radius of the ASR. (The radius can be varied from 20 miles to 60 miles.) The BRITE display is referenced frequently by Local Controller (LC) to determine separation between IFR arrivals and departures, and between successive IFR departures. LC will also reference the BRITE when Approach Control in the TRACON notifies the Tower on the sequencing of arrival flights. The BRITE unit also has a tab list which displays the aircraft identification of the last three instrument operation flights which have landed at Buffalo. The tab list flight data provides a reference for Ground Control (GC) when issuing taxiing instructions to arrivals.

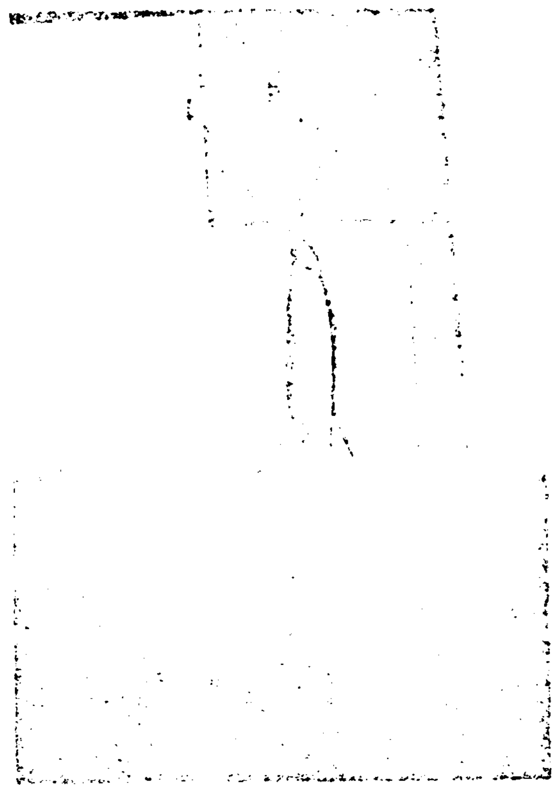


FIGURE 5-3. BRITE RADAR AT ASSISTANT LOCAL CONTROL

5.2.2 TRACON

Flight data equipment in the Buffalo TRACON (Figure 5-4) includes two FDEP units and the ARTS Plan View Displays (PVD's) at the radar positions.

The main FDEP unit (Figure 5-5) is located on the counter just to the left of the Arrival Data (AD) position. This FDEP unit generates machine printed flight strips for all IFR filed operations (arrivals, departures, and overflights) for Buffalo and secondary airports in the terminal area. A spare FDEP unit without a keyboard is usually stored at the Departure Data position (DD) which is not staffed. In the event of an outage of the main FDEP the spare unit is moved over to the same position next to AD. Arrival Data is responsible for tending the FDEP.

Flight data in the TRACON is also displayed on the ARTS Plan View Display equipment. Each instrument operation beacon target on the radar screen is tagged with a so called ARTS "data block." This data block displays flight data regarding aircraft identification[1], altitude, and ground speed; flight data on ground speed and aircraft type is alternated within boundaries of terminal radar. The ARTS data block tracks the beacon target and is connected to it via a short "leader" line. Controllers at each radar position may vary the size of the data block within a specified range to suit their personal preference.

The PVDs also display "tab list" flight data near the perimeter of the radar screen. IFR flight strip data transmitted from the ARTCC (Cleveland) to the TRACON is processed through the local ARTS system; this processing results in each such flight being tab listed on the appropriate PVD (DEP-W, ARR-W, or ARR-E). Tab list data includes an alphabetical letter, aircraft identification and assigned beacon code.

[1]The letter "H"/may also appear in the data block to designate the aircraft as heavy; this heavy aircraft indicator helps controller determine special handling requirements.

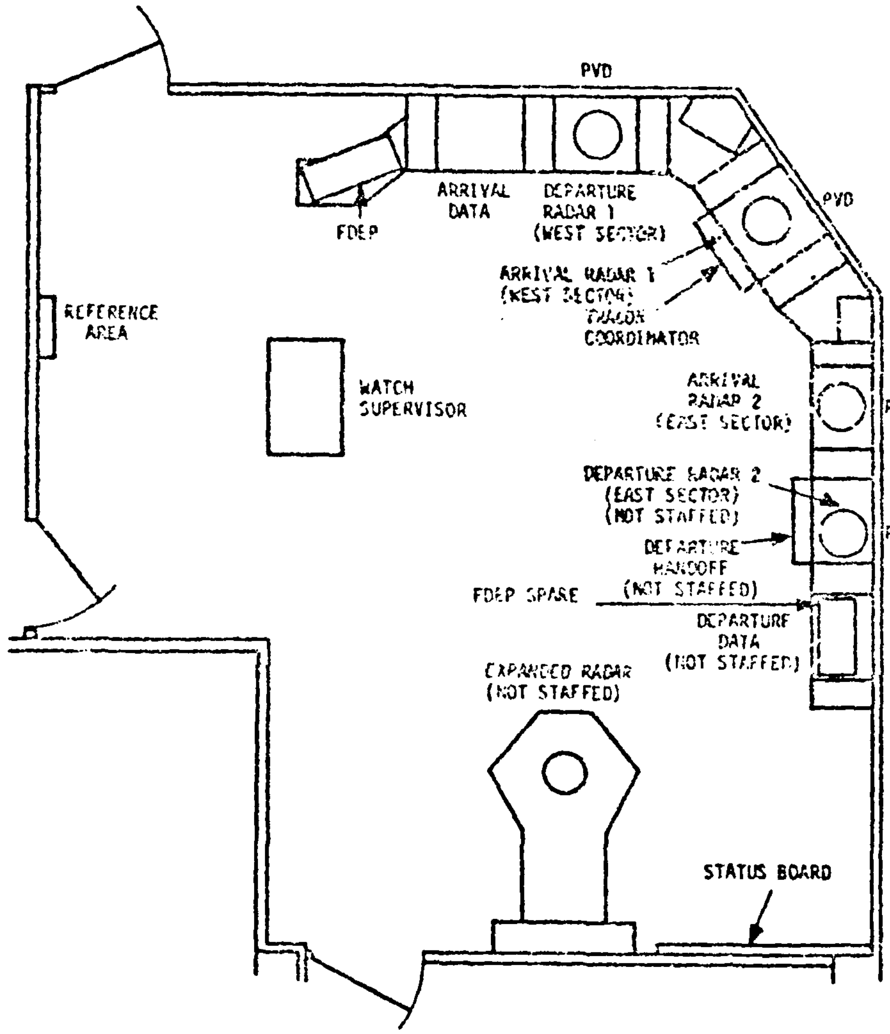


FIGURE 5-4. LAYOUT OF FLIGHT DATA EQUIPMENT IN TRACON

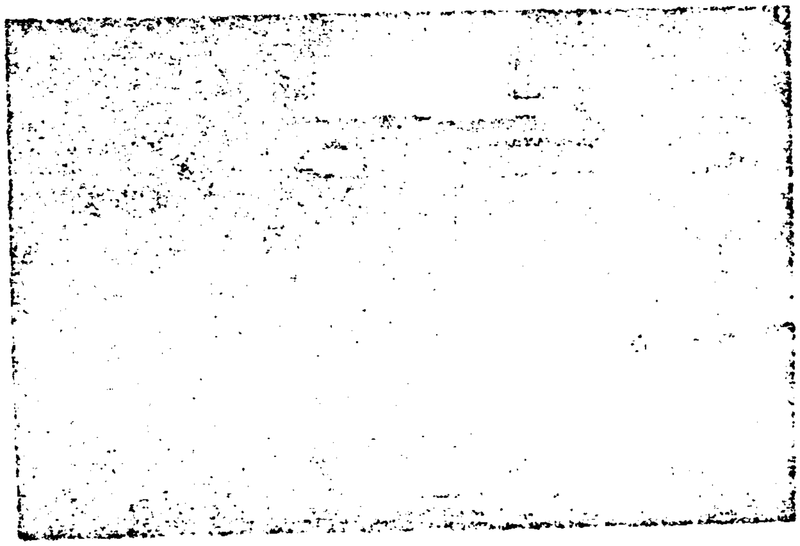


FIGURE 5-5. FLIGHT DATA ENTRY AND PRINTOUT (FDEP) UNIT IN TRACON

5.3 FLIGHT DATA ANALYSES AND PROCESSING

5.3.1 General Flight Data Information on Buffalo

Flight data is primarily maintained in the Tower Cab and TRACON by means of flight strips. These rectangular paper strips provide an individual data base reference on the flights requiring air traffic control service in the Buffalo terminal area.

Flight data is also maintained on paper scratch pads (5" by 7"); these pads enable controllers to make notes on operational flight data or flight data coordination requirements. In the Tower Cab, scratch pads are used by controllers at the CD, FD, GC and LC positions; in the TRACON, a scratch pad is used frequently at the AD position.

In general, flight strips can be organized according to format and form. The basic flight strip types regarding format are:

- o arrival flight strips;
- o departure flight strips;
- o overflight flight strips.

Flight strip format varies since operational flight data most important to the controller varies with the type of flight. For example, on an arrival flight strip, the coordination fix is important for planning the handoff procedure with the en route center; on a departure flight strip, the controller is more concerned with the scheduled departure time, requested altitude and preferred departure route; on an overflight flight strip, the controller is concerned with the type of aircraft and its altitude and route of flight through the terminal area. These three basic formats are presented in detail in the following sections.

Flight strip form refers to whether the strip is machine printed by the FDEP or hand-printed by the controller. The typical sources and form of the flight strips processed at Buffalo are summarized in Table 5-1. Flight strips printed by the FDEP units are generally for flights with IFR filed flight plans; hand-printed

TABLE 5-1. SOURCES AND FORM OF STANDARD FLIGHT STRIPS BY TYPE OF FLIGHT AT BUFFALO

	Departures		Arrivals		Overflights	
	Cab	TRACON	Cab	TRACON	Cab	TRACON
IFR Filed	Machine Printed by FDEP	Machine Printed by FDEP	Not Received or filled out. lists on scratch pad	Machine Printed by FDEP	Not received or filled out	Machine Printed by FDEP. Can be two strips.[1]
VFR Stage III (Non-filed)	Hand printed by CD controller with information provided by pilot call-in. Data includes aircraft identification, type, altitude, and direction of flight. CD uses Conrac to assign beacon code to flight. Data input on ARTS keyboard.	Hand printed by AD controller with information called down by FD in Cab. AD coordinates strip with Departure Controller.	Not received or filled out. LC lists on scratch pad.	Hand printed by TRACON Approach Controller with information provided by pilot call-in. Controller assigns beacon code using ARTS. AD controller could write strip if it was a call-in from Niagara.	Not received or filled out.	Hand printed by TRACON Approach Controller with information provided by pilot call-in. Controller assigns overflight beacon code using ARTS. AD controller could write strip if it involves coordination with nearby Tower.
VFR Non-Stage III	No flight strip completed. GC will log flight on scratch pad for taxiing. LC will reference pad for takeoff clearance. LC will log flight on mechanical counter.	Not received or filled out. No radar service provided. Primary target identified on radar by non-discrete beacon code-1200.	Not received or filled out. LC lists on scratch pad. LC will log flight on mechanical counter.	Not received or filled out. No radar se[illegible]ice provide Primary [illegible]get identified [illegible]n radar by non-discrete beacon code-1200.	Not received or filled out. Pilot must talk to Tower if within Airport Traffic Area. (Fig. 2-6)	Not received or filled out. No radar service provided. Primary target identified on radar by non-discrete beacon code-1200

[1]One strip for Approach control and for Departure Control for informational purposes

strips are generally for VFR Stage III flights without a filed flight plan.

In addition to format and form, flight strips also vary according to the nature and extent of the manual notations made on the strips by the controllers. Such notations are made to facilitate the air traffic control function and are made on both printed and handwritten strips. They include:

- o Noting changes to update the machine-printed flight data (e.g., changing the requested altitude (flight level) or destination airport).
- o Emphasizing information critical to the handling of the flight even though it is already printed on the flight strip (e.g., special coordination fixes are sometimes emphasized on arrival flight strips).
- o Noting critical information to be used in the handling of flight (e.g., the type of approach to be made to Buffalo, or that the flight is a Niagara arrival).
- o Noting that required interfacility coordination has been completed (e.g., tower-en route coordination or coordination with Toronto Center).
- o Noting that required inter-controller coordination has taken place (e.g., a radar termination notation is made when a flight is handed off to the ARTCC or to the Tower for a visual approach).
- o Noting that a particular instruction has been issued to the pilot (e.g., permission from Cleveland Center to clear departure to an altitude above terminal area limit (10,000 MSL).
- o Noting information for other than controller purposes such as for traffic counting or incident reconstruction (e.g., radar surveillance approach).

Examples and explanations of manual notations for both printed and handwritten flight strips are presented later in this section.

Flight strips are not machine-printed or hand-printed for non-Stage III VFR flights; however, such flights are recorded on a scratch pad in the Cab by either GC (departures) or LC (arrivals) to facilitate radio communications (Figure 5-6). Since the number of non-Stage III flights is not recorded on flight strips, the LC controller keeps a record of these VFR flights on a mechanical counter located at the LC position.

An important aspect of the physical processing of flight strips at Buffalo involves the controllers using plastic holders, stationary console flight strip bays, portable custom designed wood flight strip boxes and standard flight strip storage bins. The location of this flight data equipment in the Cab and TRACON is presented in Figures 5-7, and 5-8 respectively. Flight strip drop tubes are presently not used at Buffalo; however, they have been approved for installation when funds become available.

Both machine-printed and hand-printed strips are inserted into plastic holders which permit the stacking of the strips in the bays and boxes. The regular bays are constructed into the console equipment and serve as flight strip holding areas. In the Cab, there is only one flight strip bay (9 strip capacity) located at the Assistant LC position and used by the LC controller (see Figure 5-9); in the TRACON, there are three active flight strip bays located at AD (17-strip capacity), DEP-W (17-strip capacity), and ARR-W/ARR-E (a shared bay). The departure and arrival bays are divided into "pending" and active sections by a movable strip separator. The AD bay is similarly divided into Buffalo and non-Buffalo departures.

The wooden flight strip boxes are mobile and are custom designed for a capacity of eight strips, and tilted slightly for visibility (Figure 5-10). In the Cab, flight strip boxes are located at CD and FD; with the FD box shared with GC. In the TRACON, the flight strip boxes are located at AD, DEP-W, ARR-W and ARR-E. In this facility, the boxes serve more of a secondary function in terms of providing an alternative storage location for

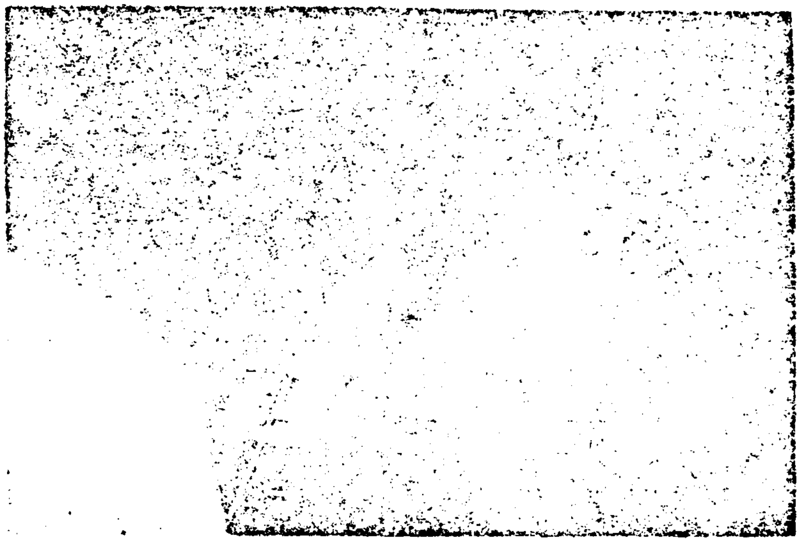


FIGURE 5-6. SCRATCH PAD DATA AT GROUND CONTROL - ASSISTANT LOCAL POSITIONS

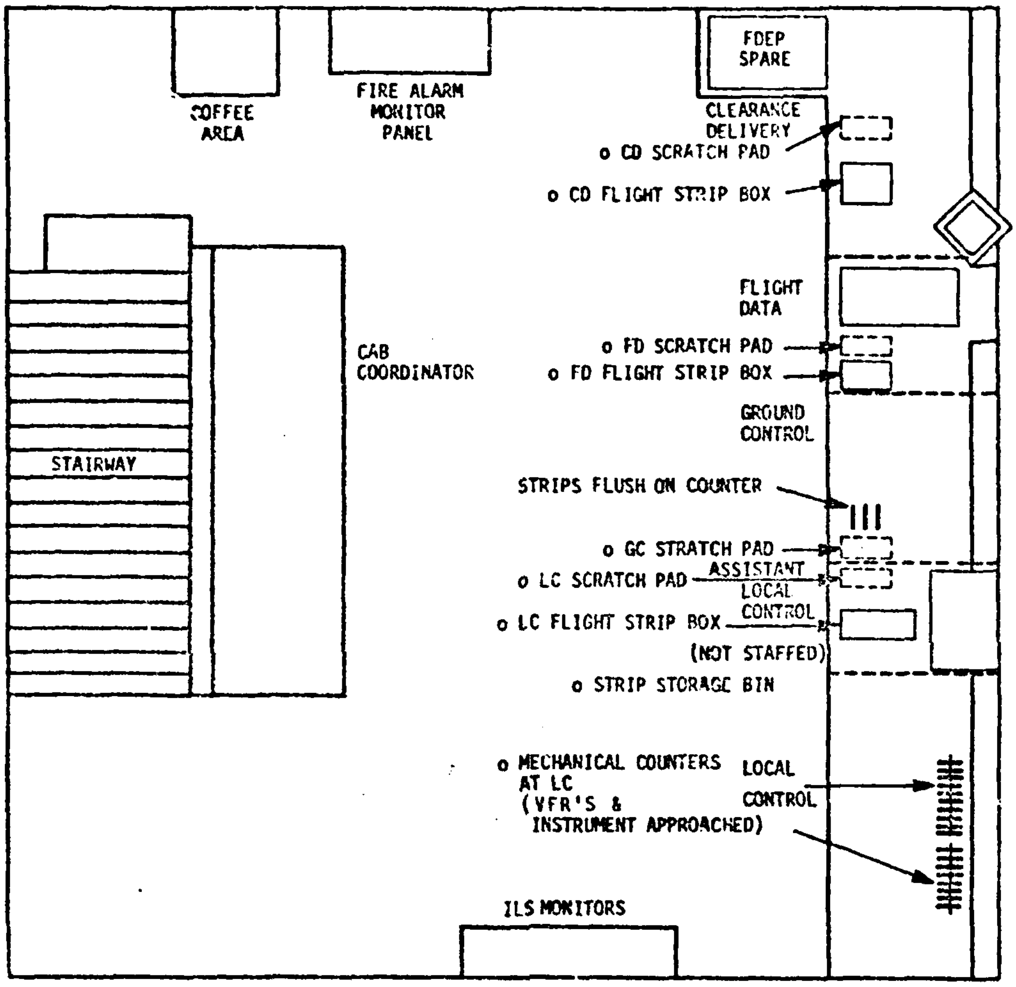


FIGURE 5-7. FLIGHT DATA PROCESSING EQUIPMENT IN TOWER CAB

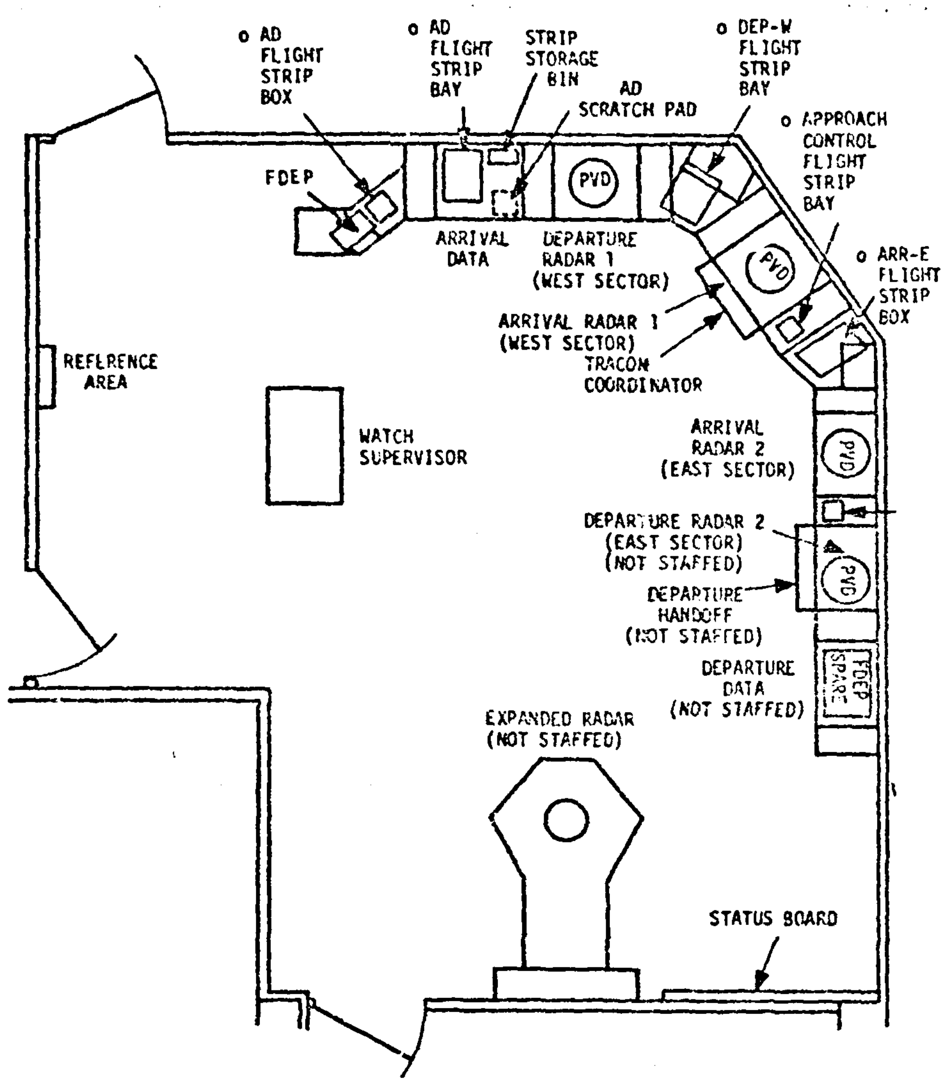


FIGURE 5-8. FLIGHT DATA PROCESSING EQUIPMENT IN TRACON

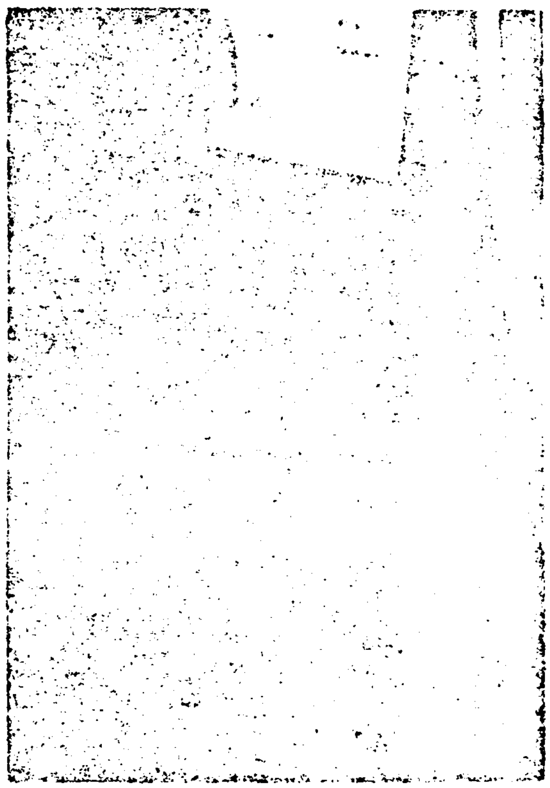


FIGURE 5-9. FLIGHT STRIP BAY AT ASSISTANT LOCAL POSITION IN TOWER CAB (STORAGE BIN BELOW)

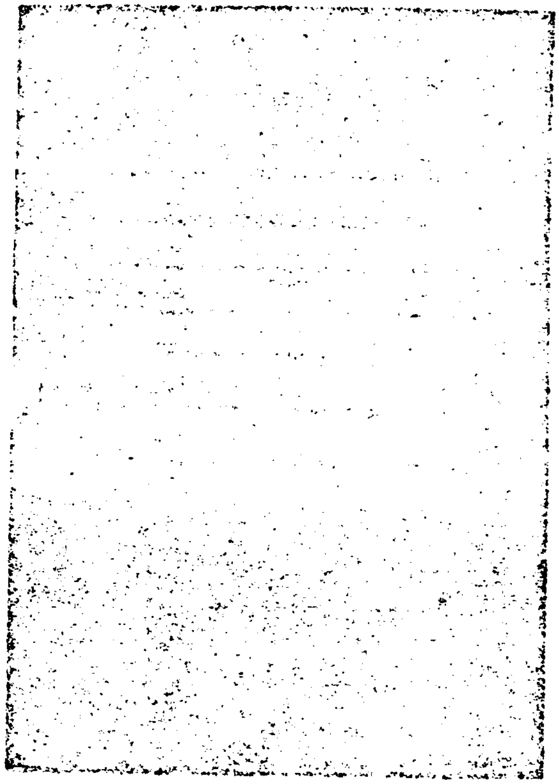


FIGURE 5-10. WOOD FLIGHT STRIP BOX AT THE FLIGHT DATA POSITION IN THE CAB WITH STRIPS IN PLASTIC HOLDERS

particular flight strip needs. (For example, storage for early Toronto proposals at AD, storage for blanks for Stage III write ups, and overflight strips storage.)

Once a flight strip is processed, it is stored in a flight strip bin. In the Cab, the storage bin is located just below the bay at AL (Figure 5-11); these strips are removed only once a day for counting. In the TRACON, all processed strips are returned to the bin at AD (Figure 5-11); the Watch Supervisor collects and counts these strips hourly.

5.3.2 Typical Flight Strip Load in Buffalo TRACON

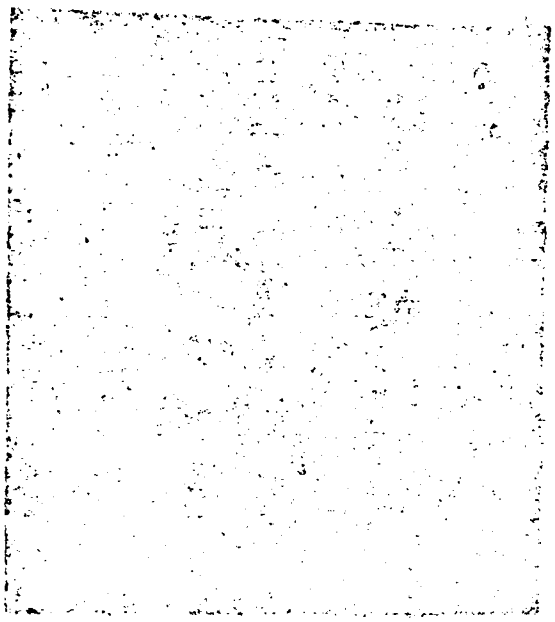
Detailed analyses of Buffalo flight strip content and processing are better understood if placed in the context of the typical daily flight strip load in the Buffalo TRACON. Table 5-2 presents a summary breakdown of daily flight strip processing at Buffalo by:

- o Operations category (air carrier, air taxi, general aviation and military).
- o Type of flight (arrival, departure, overflight).
- o Airport (Buffalo, Niagara, or other secondary airports).
- o Form of flight strip (machine-printed or hand-printed).

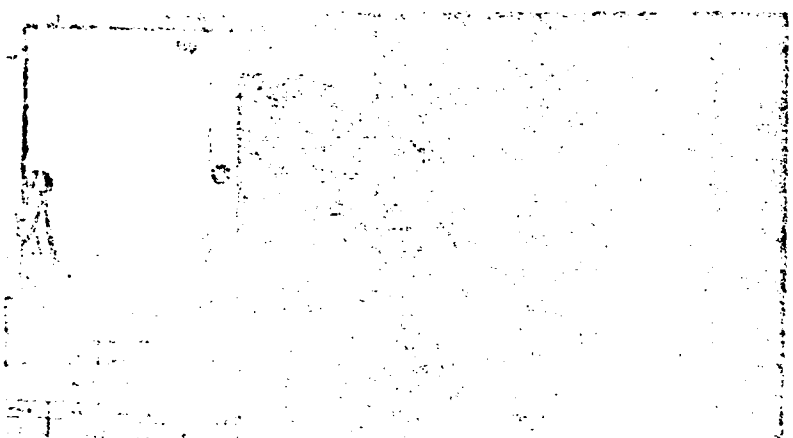
On a typical weekday (Friday, April 25, 1980), the Buffalo TRACON processes approximately 500 flight strips with roughly 86% machine-printed and 14% hand-printed. The percentage mix of flight strips by operations categories is as follows:

Air Carrier	38%
Air Taxi	9%
General Aviation	46%
Military	7%

Landings and departures at Greater Buffalo International Airport account for about 70% of the total flight strip load; the remaining 30% is split about evenly between overflights and secondary airport arrivals and departures. Niagara represents approximately



CAB ASSISTANT
LOCAL CONTROL
POSITION



TRACON ARRIVAL
DATA POSITION

FIGURE 5-11. STORAGE BINS FOR PROCESSED FLIGHT STRIPS IN CAB AND TRACON

TABLE 5-2. FLIGHT STRIP BREAKDOWN FOR THE BUFFALO TRACON FOR A SAMPLE WEEKDAY[1] WITH VFR FLYING CONDITIONS

	Air Carrier			Air Taxi			General Aviation			Military			Totals			Grand Total	%[3]
	A[2]	D	O	A	D	O	A	D	O	A	D	O	A	D	O		
Primary Airport Greater Buffalo International																	
o Machine printed	91	91		20	20	3	46	51	45				157	162	48	367	73%
o Hand printed	3		6	2			16	5	16	2		5	23	5	27	55	11%
Secondary Airport Niagara																	
o Machine printed				1	1		14	15		10	14		25	30		55	11%
o Hand printed							11	1		1			12	1		13	3%
Other Secondary Airports																	
o Machine printed							4	7					4	7		11	2%
o Hand printed							1	1					1	1		2	-
Totals	94	91	6	23	21	3	92	80	61	13	14	5	222	206	75	503	100%
	19%	18%	1%	5%	4%	1%	18%	16%	12%	3%	3%	[illegible]	44%	41%	15%	100%	
Percent of Grand Total		38%			9%			46%			7%			100%		100%	100%

[1] Friday, April 25, 1980
[2] A = arrival; D = departure; O = overflight
[3] 86% of all flight strips are machine printed; 14% are hand printed
* Individual percentages do not total 100% due to rounding.

85% of secondary airport flight strip activity; Niagara air traffic is predominatly general aviation and military.

Daily flight strip processing in the TRACON is concentrated between 7:00 a.m. to 9:00 p.m. (Figure 5-12). The daily peak occurs between 3:30 p.m. and 5:30 p.m.; other intense flight strip processing periods are between 8:00 a.m. and 10:00 a.m. and between 7:00 p.m. and 8:00 p.m.

5.3.3 IFR Departures

The format and form of IFR departure flight strips and the nature of the manual notations are illustrated in the following:

Figure 5-13: Flight Strip Model for IFR Departures.

Figure 5-14: Typical TRACON Flight Strips for IFR Departure Flight Examples.

Figure 5-15: Buffalo TRACON IFR Departure Flight Strips Examples.

Table 5-3: Sample of Manual Notations on IFR Departure Flight Strips--TRACON.

Processing procedures for IFR departure flight strips are discussed below; the procedures are organized by controller activities.

Tower Cab

FD
- o IFR departure flight strip is generated by FDEP approximately 30 minutes prior to scheduled departure time.
- o FD separates strip from FDEP paper strip roll, inserts it in a plastic holder and either hands the strip to CD or places it directly in his flight strip box (Figure 5-16).

CD
- o CD awaits pilot's call for clearance.
- o When pilot calls in, CD provides clearance based on flight strip, e.g., "Cleared to JFK as filed, maintain altitude 100, expect flight level 230 10 minutes after departure." CD will also provide discrete beacon code and departure

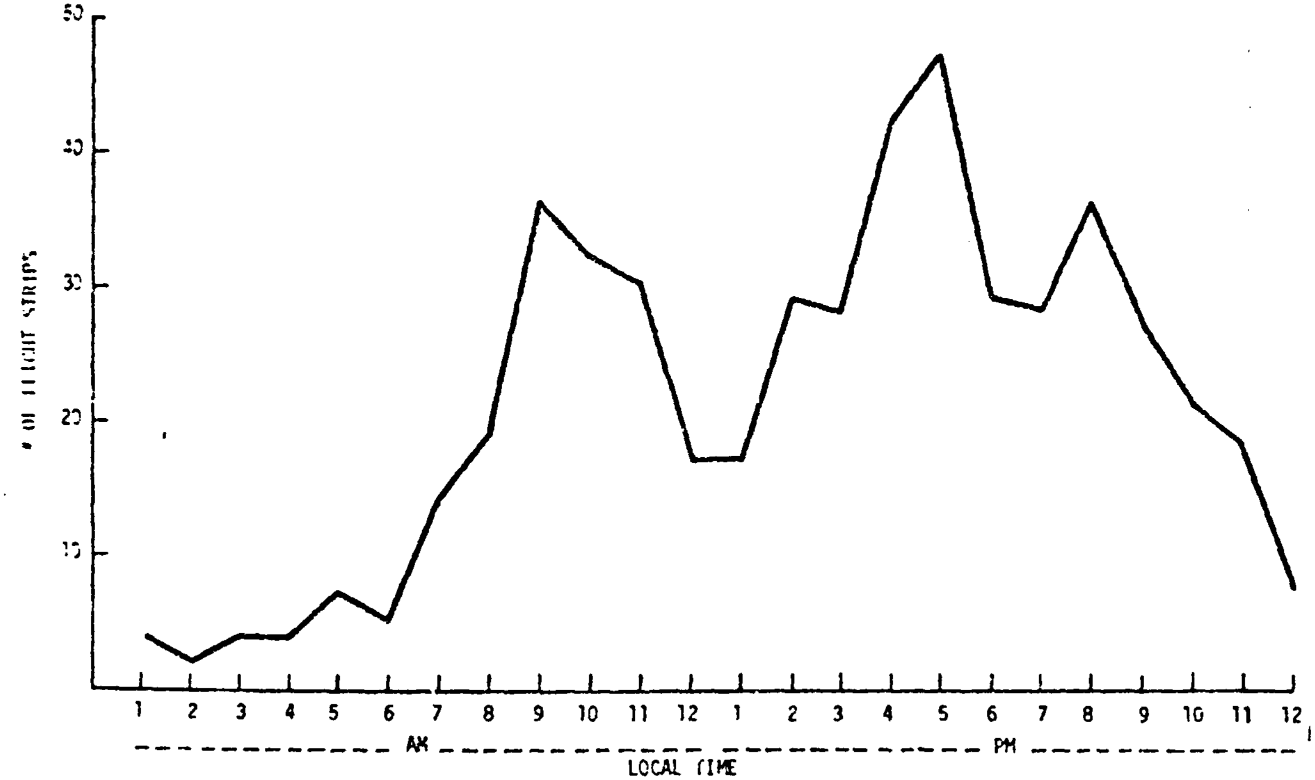


FIGURE 5-12. BUFFALO TRACON FLIGHT STRIP PROCESSING BY TIME OF DAY

1. 2. 2A.	5.	8.	9.	10.	11.	12.
3.	6.	8A.		13.	14.	15.
4.	7.		9A.	16.	17.	18.

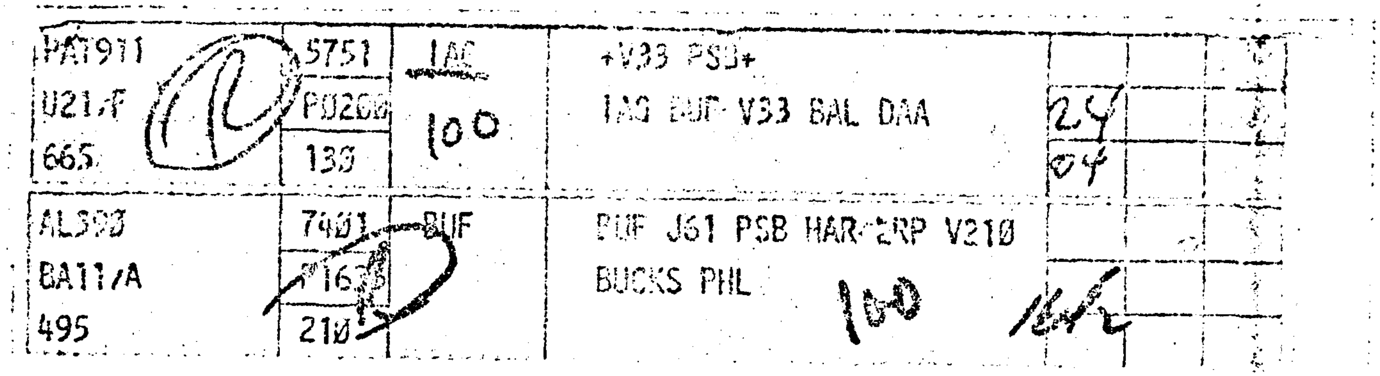
A. Machine Printed Information (National standardization of spaces 1. through 9A.)

1. Aircraft identification.
2. Revision number (FDEP locations only).
2A. Strip request originator. (At FDEP locations this indicates the sector or position that requested a strip be printed.)
3. Number of aircraft (if more than one), heavy aircraft indicator "H/" (if appropriate), type of aircraft and suffix indicating any special equipment.
4. Computer identification number, if required.
5. Secondary radar (beacon) code assigned.
6. Proposed departure time.
7. Requested altitude.
8. Departure airport.
9. Machine generated - Route, destination and remarks.
9A. Not used.

B. Hand Printed Information (Local facility directive specifies use of spaces 10. through 18.)

8. In red, underline departure airport if other than Buffalo.
9. For machine generated Strip-Altitude/altitude restrictions in the order flown, if appropriate.
9. For manually prepared strip-clearance limit, route altitude/altitude restrictions in the order flown, if appropriate and remarks.
9A. Not used.
12. Checkmark indicating clearance issued.
13. Takeoff runway (if different from active runway).
15. Checkmark (✓) indicating passed to Approach Control (Buffalo Tower only.)
16. Departure Time (TRACON only).
17. Assumed departure time. (CAB only, if required.)
18. Checkmark (✓) indicating assumed departure time forwarded to adjacent facility (if required).

FIGURE 5-13. FLIGHT STRIP MODEL FOR IFR DEPARTURES



PAT911	AL390	Aircraft identification
U21/F	BA11/A	Aircraft type/transponder equipment
665	495	Computer radar beacon code
5751	7401	Secondary radar beacon code
P0200	P1635	Proposed departure time
130	210	Requested Altitude (hundreds of feet)
IAG	BUF	Departure airport
+V33 PSB+...	BUF J61 PSB...	Preferred departure route (+...+) route and destination
100	100	Altitude assignment (hundreds of feet)
24		Takeoff runway
04	1642	Departure time
R	R	Radar service terminated

FIGURE 5-14. TYPICAL TRACON FLIGHT STRIPS FOR IFR DEPARTURES FROM BUFFALO

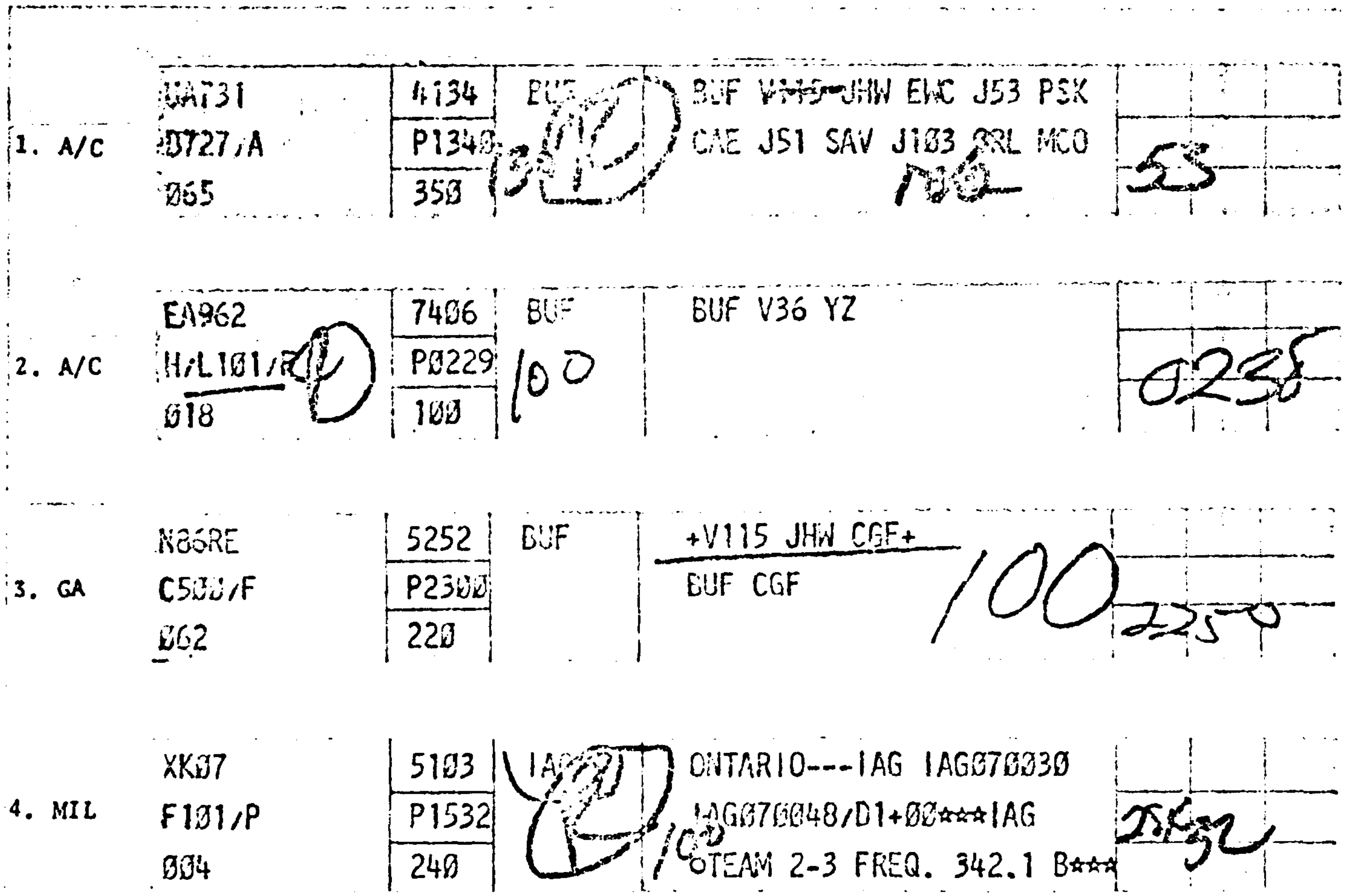


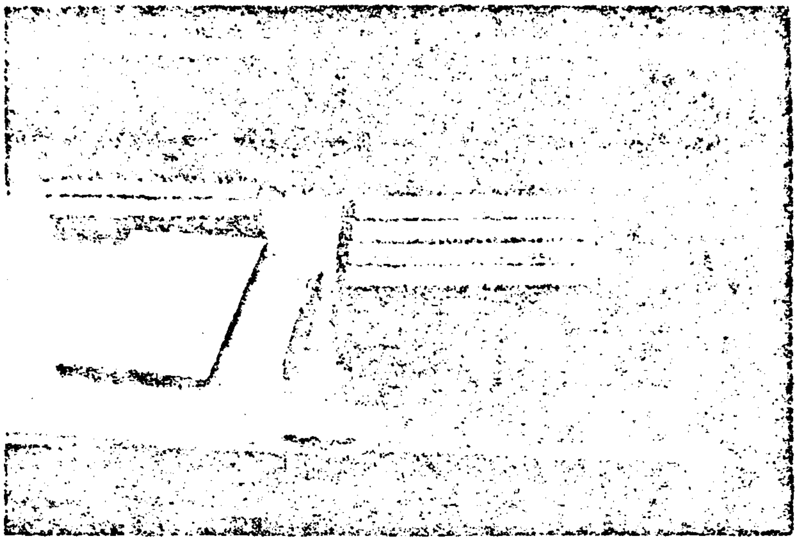
FIGURE 5-15. BUFFALO TRACON IFR DEPARTURE FLIGHT STRIP EXAMPLES

TABLE 5-3. SAMPLE OF MANUAL NOTATIONS ON IFR DEPARTURE FLIGHT STRIPS TRACON

Flight Strip Location	Manual Notation	Example Flight Strip	Meaning	Purpose	Written by	Extent Used
16 (Right side boxes)	53 0238 2250 32	1. 2. 3. 4.	Departure time	A record for the controller of what time radar service initiated	DEP-W	Routinely
13	28R	4	Takeoff runway	A record for the controller of use of a runway other than the active one	AD or DEP-W	Routinely for NIAGARA
9		1	V115 will not be used for departure route	A reminder to controller not to vector aircraft in this direction	AD or DEP-W	Seldom
9	+V115 JHW CGF+	3	Controller has directed aircraft to follow the PDR (+...+)	A record for the controller that he has given instruction	DEP-W	Seldom
9 9 8A	100 100 100	3 4 2	Initial altitude assignment of 10,000 feet MSL	A note to controller on what altitude a flight is cleared to	DEP-W	Routinely

TABLE 5-3. SAMPLE OF MANUAL NOTATIONS ON IFR DEPARTURE FLIGHT STRIPS TRACON (CONT.)

Flight Strip Location	Manual Notation	Example Flight Strip	Meaning	Purpose	Written by	Extent Used
9 8A	100 130	1 1	DEP-W has cleared flight for climb to 13,000 MSL; old altitude clearance is crossed out. DEP-W has coordinated this action with Cleveland Center	A record of altitude clearances for controller	DEP-W	Seldom
8	1AG	4	Departure airport (Niagara) underlined in red	A note to controller that departure airport is other than Buffalo	AD	Routinely
3 D	H/L101/F D	2 2	Flight is a "heavy" aircraft (L1011) departure-D	Controller highlighting important flight data for special handling	DEP-W	Common for heavy aircraft
8A 8A	R R	1 4	Radar service terminated	A note to controller that flight no longer under radar control	DEP-W	Routinely



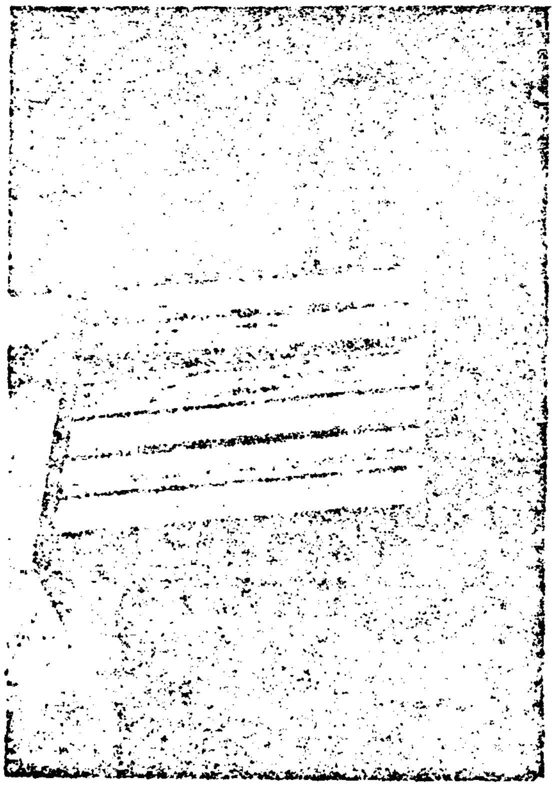


FIGURE 5-16. FLIGHT STRIP BOX USED AT CLEARANCE DELIVERY

control frequency. Pilot reads back clearance and usually states "have ATIS" with the letter identifier.

- CD notates the flight strip with a checkmark in block 12 (upper right-hand corner) indicating clearance has been issued. CD may also notate the strip with the initial cleared altitude level (60 or 100).

- CD then removes the strip from the box at CD position and places it in the flight strip box at the FD position (across the FDEP). (Figure 5-17).

FD
- Monitors the flight's taxi request to GC.

GC
- Monitors for, and responds to, flight's taxi request.

- GC will then cant the flight strip in the FD box so that one edge overlaps the side of the box (Figure 5-17). This is a signal for FD to call the AD controller in the TRACON as a notification that the aircraft is ready for taxi.

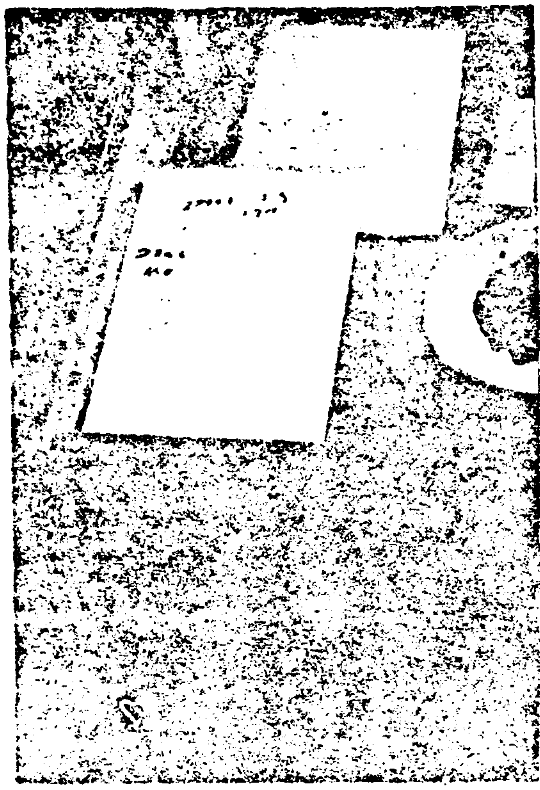
FD
- Observes canted flight strip and makes call to AD in TRACON.

- FD then notates the strip with a second checkmark in block 15; this checkmark indicates that notification has been performed (see Figure 5-17).

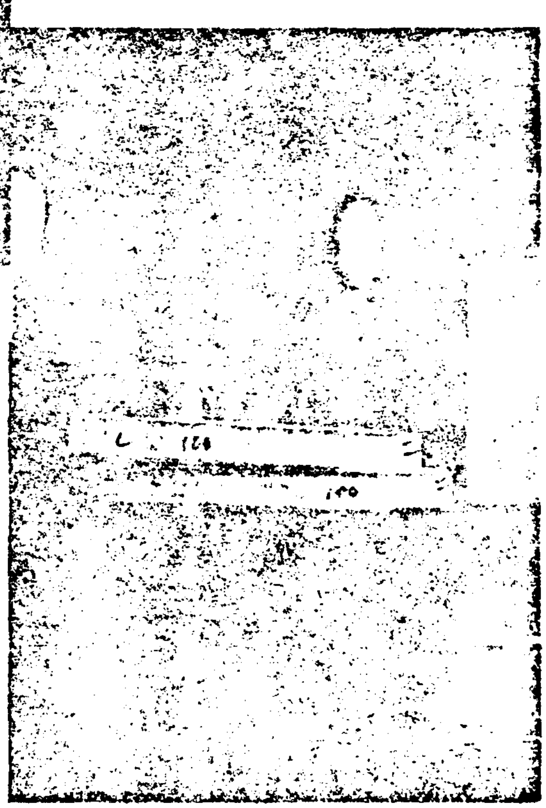
- FD may also be required to coordinate the flight with an adjacent facility; this coordination is indicated by a third checkmark located in block 18. This coordination is required for Buffalo IFR departures to Toronto; FD calls Toronto Center with a flight approval request.

GC
- GC observes the two (or three) checkmarks on the strip and removes it from the FD box. GC places the strip flush on the counter directly in front of his standing position (Figure 5-18). GC handles the taxi with the flight strip in this location.

- When the aircraft has been taxied and is approaching the set position for takeoff, GC will place the flight strip in the bay at the AL position (Figure 5-19).



SCRATCH PAD AT FD NEXT TO FDEP KEYBOARD



CANTED FLIGHT STRIP WITH TWO CHECK MARKS AT FD

FIGURE 5-17. FLIGHT STRIP BOX AND SCRATCH PAD AT FLIGHT DATA POSITION

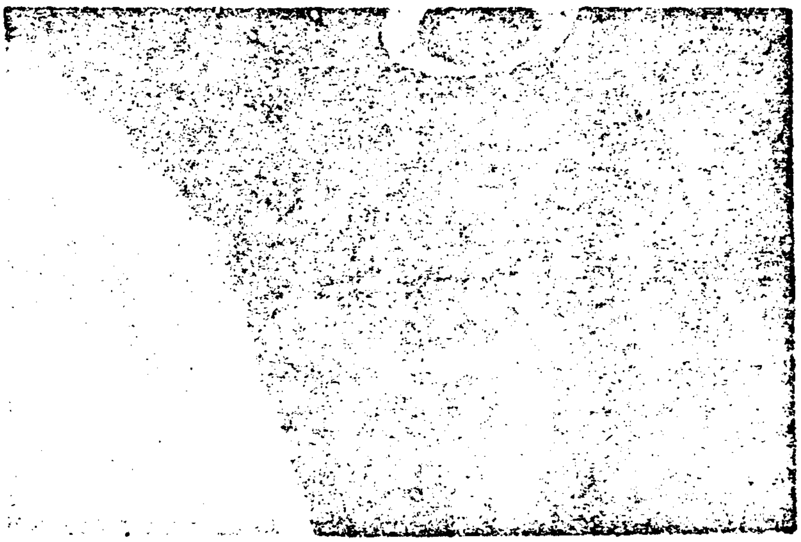


FIGURE 5-18. FLIGHT STRIPS FLUSH ON COUNTER AT GROUND CONTROL POSITION DURING AIRCRAFT TAXI

- During slow periods, GC may move the flight strip directly from the FD box into the bay at Assistant LC.
- GC does not make any manual notations on the flight strip.

LC

- Monitors aircraft taxi and looks for strip in bay at Assistant LC.
- Observes strip in bay and checks for the two manual (or three, if Toronto coordination was necessary) checkmarks.
- Clears aircraft for entering runway and for takeoff.
- When aircraft is rolling, LC calls off the flight to the Departure Controller in the TRACON.
- LC provides pilot with initial instructions and directs pilot to contact Departure Control.
- LC removes flight strip from bin and inserts it in the flight strip bin at the AL position. Flight strips accumulate in this storage bin all day.
- LC does not make any manual notations on the flight strips.

TRACON AD

- IFR departure strip is generated by FDEP approximately 30 minutes prior to scheduled departure time.
- AD separates the strip from the FDEP paper strip roll and reviews it for special marking requirements, e.g., non-Buffalo departures underlined in red in block eight. The strip is inserted in a plastic holder and placed in the flight strip bay at AD. The flight strip bay (Figure 5-19) has a capacity of 17 strips and is divided by a separator strip into a Buffalo departure section and a non-Buffalo departure section.
- AD will retain the flight strip in the bay until receiving the notification call from FD in the Cab relative to aircraft taxi.
- Upon receiving the call from FD in the Cab, AD scans the flight strip bay, removes the appropriate strip and places

AD-A107 874 TRANSPORTATION SYSTEMS CENTER CAMBRIDGE MA F/G 17/7

BUFFALO AIR TRAFFIC CONTROL TOWER OPERATIONS ANALYSIS.(U)

SEP 81 M S HUNTLEY, R L MUMFORD, R RUDICH

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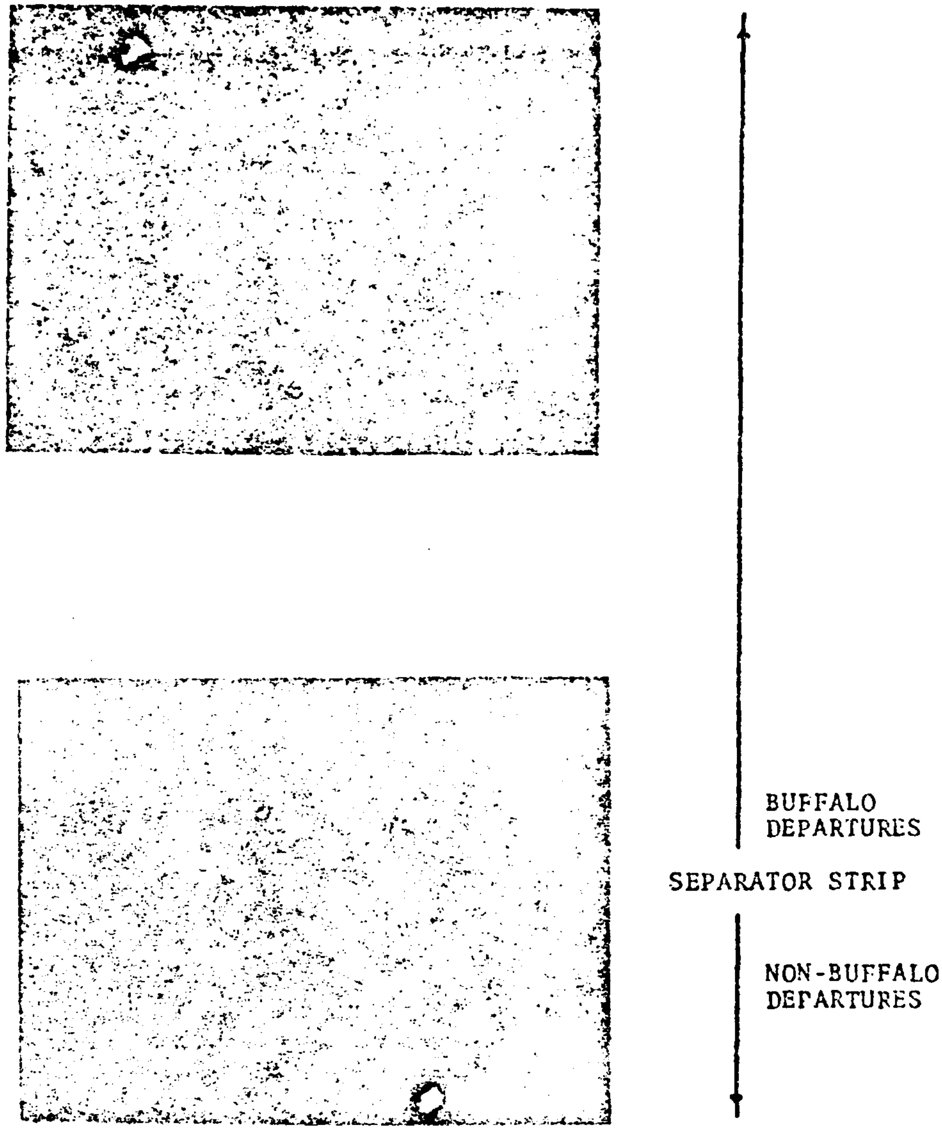


FIGURE 5-19. IFR DEPARTURE STRIPS IN TRACON IN BAY AT ARRIVAL DATA (FLIGHT DATA)

it in the "pending section" of the flight strip bay at the adjacent Departure Control position, DEP-W (Figure 5-20).

DEP-W

- o DEP-W reviews the flight strip in the pending section, time permitting, while working active departure strips stacked in the lower section of the flight strip bay.
- o When LC calls DEP-W and states the aircraft is rolling, DEP-W will move the strip from the pending section to the active departure section of the bay.
- o The pilot of the aircraft will contact Departure Control after takeoff and DEP-W will log the time of radar contact on the strip in block 16.
- o DEP-W will provide the aircraft with radar separation and departure vectors. IFR departures are usually handed off by DEP-W to the ARTCC or to a Tower En Route jurisdiction. DEP-W will sometimes coordinate with the Cleveland Center relative to clearing the departing aircraft to an altitude above the terminal area limit (10,000 MSL).
- o When the flight is handed off, DEP-W will notate the strip with the time of handoff and a radar service termination symbol (e.g., R).
- o DEP-W will remove the strip from the bay.

AD

- o AD collects the used flight strip and files it in the flight storage bin at AD (Figure 5-11).
- o AD delivers the storage bin strips to the Watch Supervisor each hour for counting.

5.3.4 IFR Arrivals

The format and form of IFR arrival flight strips and the nature of the manual notations thereupon are illustrated in the following:

Figure 5-21: Flight Strip Model for IFR Arrivals (TRACON only).

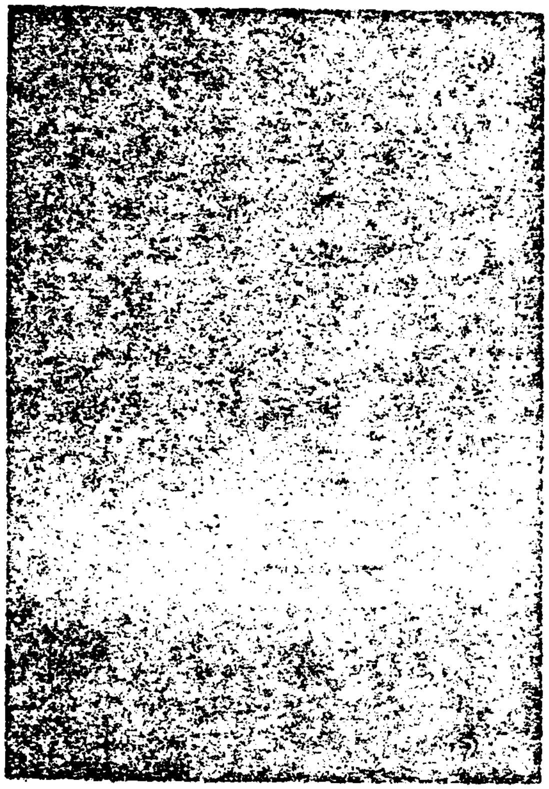
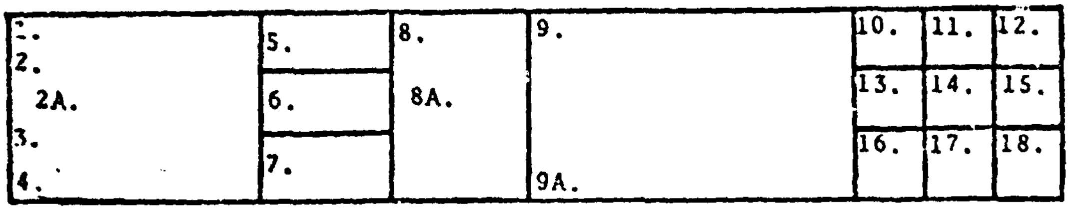


FIGURE 5-20. FLIGHT STRIP BAY AT DEPARTURE CONTROL POSITION (DEP-W) IN TRACON



A. Machine Printed Information (National standardization of spaces 1 through 9A.)

1. Aircraft identification.
2. Revision number (FDEP locations only).
2A. Strip request originator. (At FDEP locations this indicates the sector or position.)
3. Number of aircraft (if more than one), heavy aircraft indicator "H/" (if appropriate), type of aircraft and suffix indicating special equipment.
4. Computer identification number, if required.
5. Secondary radar (beacon) code assigned.
6. Previous fix (FDEP locations) or inbound airways.
7. Coordination fix.
8. Estimated time of arrival at the coordination fix of destination airport.
9.* Altitude (in hundreds of feet) and remarks.
9A. Destination Airport

B. Hand Printed Information (Local Facility Directive specifies use of spaces 10 through 18.)

1. Radar Operation
   - 9.* Altitude (in hundreds of feet) and remarks.
   - 9A. In red - draw a semi-circle around airport if destination other than Buffalo.
   - 10. Time of radar handoff.
   - 13. Checkmark (✓) to indicate information forwarded to appropriate tower.

*Buffalo TRACON arrival strips usually have a machine printed "IFR" in space 9; this is followed by handprinted altitude levels.

FIGURE 5-21. FLIGHT STRIP MODEL FOR IFR ARRIVALS (TRACON ONLY)

2. Non-radar or Inoperative Recorders

9A. In red - draw a semi-circle around airport if destination other than Buffalo.

10. Time of initial contact or time of transfer of control point.

11. Time over approach fix outbound.

12. Time aircraft began holding.

13. Checkmark (✓) to indicate information was forwarded to appropriate tower.

14. In time approaches, time to leave the approach fix inbound.

15. Holding information.

16. Time cleared for approach

17. Approach fix inbound.

18. If required: landing assured, missed approach, or low approach.

FIGURE 5-21. FLIGHT STRIP MODEL FOR IFR ARRIVALS (TRACON ONLY) (CONT.)

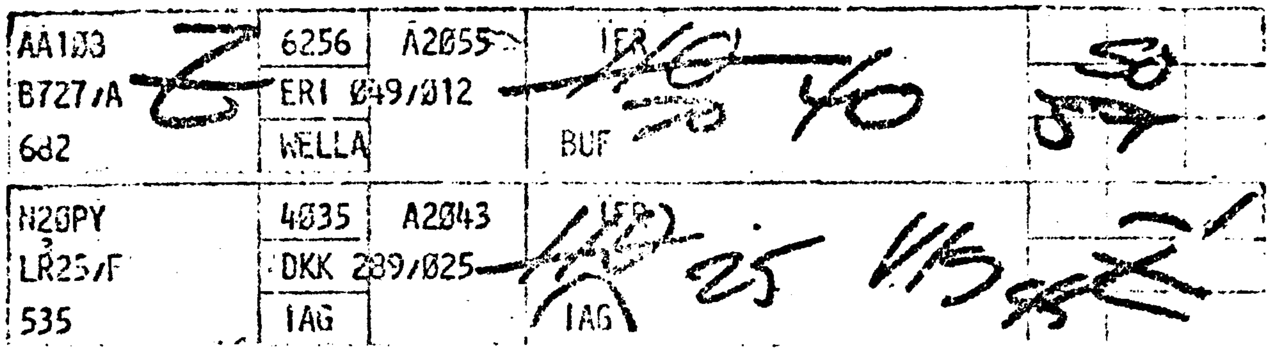
Figure 5-22:	Typical TRACON Flight Strips for IFR Arrivals to Buffalo.
Figure 5-23:	Buffalo TRACON IFR Arrival Flight Strip Examples.
Table 5-4:	Sample of Manual Notations of TRACON Arrival Flight Strips.

Processing procedures for IFR arrival flight strips are discussed below; the procedures are organized by controller activities.

TRACON
AD

- o IFR arrival strip is generated by FDEP approximately 30 minutes prior to the flight's scheduled arrival time at the coordination fix.
- o AD separates the strip from the FDEP paper strip roll and reviews it for special marking requirements, i.e., non-Buffalo arrivals overlined in red in block 9A. AD inserts the strip in a plastic holder and places it in the pending section of the flight strip bay serving the two approach controllers (Figure 5-24).
- o For arrival flight strips which are generated well in advance of scheduled arrival time, AD will use the wooden flight strip box at the AD position (Figure 5-5) next to the FDEP. So-called "Toronto proposals" are placed in this strip box.[1]

[1]The Toronto Center will call in Toronto departure flights heading for Buffalo to the Cleveland ARTCC. Cleveland Center will then generate a strip for this flight in standard U.S. arrival strip format. Toronto Center will also call the Buffalo TRACON (AD) for an approval request for such a flight.



AA108	N20PY	Aircraft identification
	3	Strip request originator
B727/A	LR25/F	Aircraft type/special equipment
682	535	Computer identification number
6256	4035	Secondary radar (beacon) code assigned
ERI 049/012	DKK 289/025	Previous fix (radial/miles out on radial)
WELLA	IAG	Coordination fix
A2055	A2043	Estimated time of arrival at the coordination fix
IFR	IFR	Remarks - IFR flight
Buf	IAG	Destination airport (semi-circle around IAG indicates airport other than Buffalo)
~~110~~-70 40	~~110~~-25	Altitude (slash indicates drop to lower altitude)
50		Time of radar handoff
57		Time radar service terminated
Z	Z	Flight transferred to tower/flight transferred to Niagara Tower with information forwarded
VIS 45		Cleared for visual approach at 2045

FIGURE 5-22. TYPICAL TRACON FLIGHT STRIPS FOR IFR ARRIVALS AT BUFFALO

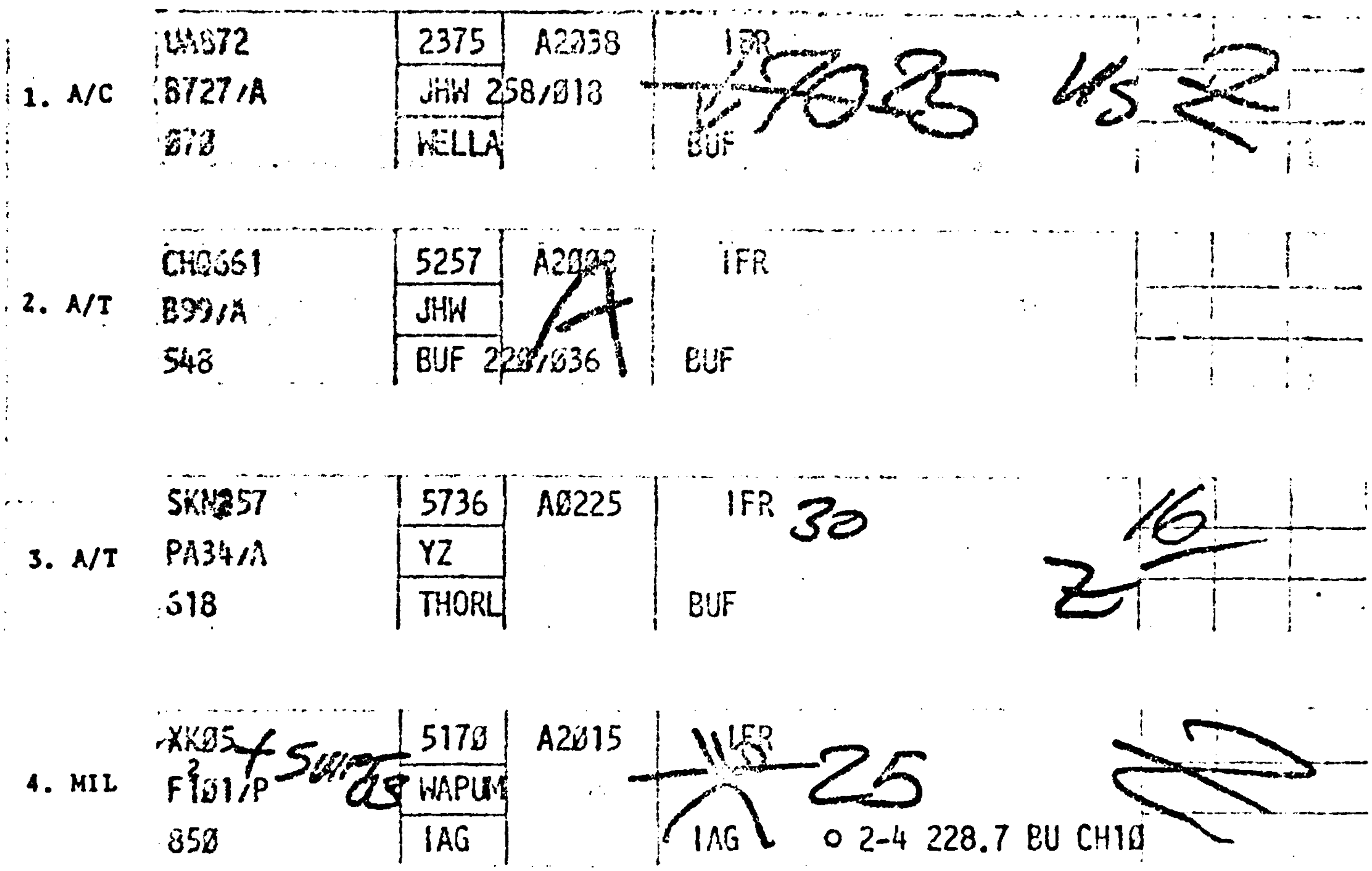


FIGURE 5-23. BUFFALO TRACON IFR ARRIVAL FLIGHT STRIP EXAMPLES

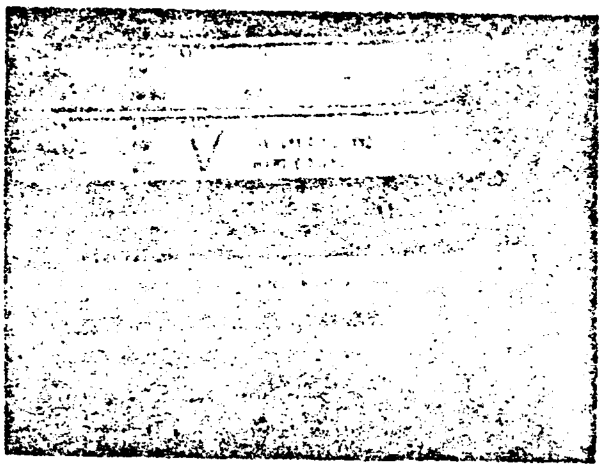


FIGURE 5-24. SINGLE FLIGHT STRIP BAY SERVING APPROACH CONTROL - SITUATED BETWEEN ARR-W AND ARR-E

TABLE 5-4. SAMPLE OF MANUAL NOTATIONS ON TRACON ARRIVAL FLIGHT STRIPS

Location on Flight Strip	Manual Notation	Example Flight Strip	Meaning	Purpose	Written by	Extent Notation Used
8	A	2	Arrival	A reminder to the controller that the flight strip is an arrival.	Approach Controller ARR-W	Controller dependent and not commonly recorded
9 9 9	~~70~~ 25 30 ~~210~~ 25	1 3 4	Altitude instructions (in hundreds of feet). Arrow also a reminder of aircraft decent.	A reminder to the controller that instruction was issued to pilot.	Approach controller ARR-W	Routinely
9	VIS	1	Cleared for visual approach	A reminder to the controller that instruction for visual approach issued to pilot.	Approach controller ARR-W	Routinely
14 9A 13	Z — Z Z	1 3 4	Flight transferred to tower	A reminder to the controller that flight transferred to the tower. #4 strip Z is for IAG Tower	Approach Controller ARR-W	Routinely
10	16	3	Time of radar handoff	A record for the controller of time assumed control.	TRACON coordinator* possible (pencil mark)	Routinely
1-2	X SWIFT 03	4	Aircraft identification call sign	Record of military call sign of aircraft for controller/pilot communications.	AD, ARR-W or Coordinator	Seldom
9A	(in red) ⌒	4	Indicates airport other than Buffalo	A marking to highlight landing airport other than Buffalo.	AD	Routinely

*Coordinator is constantly assisting approach controllers when position is staffed

Approach Controller[1] (ARR-W or ARR-E)

- ARR-W, say, will review the flight strip in the pending section of the bay, time permitting, while working active arrivals. Special note is taken of the coordination fix and scheduled arrival time at the fix.

- When the beacon target and ARTS data block for the flight appear on the PVD, ARR-W will scan the pending section of the bay for the strip and move it down to the active section. ARR-W will coordinate on ARTS handoff with the ARTCC or an adjacent Tower facility.[2] The pilot will call Buffalo Approach Control and ARR-W will notate the strip with the time of radar handoff.

- ARR-W will service the arrival flight with approach information, radar separation and approach vectors. The ARR-W controller will notate the strip with successive altitude instructions issued to the pilot. Approach altitudes frequently notated on the strip are 110, 70, 40 and 25; previous altitude assignments are usually crossed out on the strip.

- During the approach, ARR-W (or the Coordinator) will call LC in the Cab to state the arrival sequence. In the absence of arrival flight strips, LC depends upon monitoring the BRITE and logging the arrival sequence on a scratch pad.

- Once the flight is set up for an approximate eight-mile final with the runway in sight or the pilot visually trailing aircraft cleared for a visual approach, ARR-W will clear the flight for a visual approach and di-

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[1]Approach Controllers are assisted by a Coordinator during certain periods.

[2]Verbal coordination could also be used for certain tower-en route handoffs.

rect the pilot to contact the Tower. ARR-W will notate the strip with the time radar service was terminated and with a symbol (Z) to indicate the flight was handed off to the Tower.

- Either ARR-W or the Coordinator will remove the strip fro the bay and hand it to AD for storage in the flight strip storage bin at the AD position.

(IFR arrivals to Niagara are handled by the ARR-W controller. Standard procedure on these operations is to transfer the flight to the Niagara Tower (Local Control) five miles prior to the outer marker.)

Tower Cab

LC
- In the absence of arrival flight strips, LC depends upon monitoring the BRITE and logging the arrival sequence on a scratch pad.
- GC can reference the scratch pad arrival sequence or the BRITE tab list for taxi communications.

5.3.5 IFR Overflights

The format and form of IFR overflight flight strips and the nature of the manual notations thereupon are illustrated in the following:

Figure 5-25: Flight Strip Model for IFR Overflights (TRACON only).

Figure 5-26: Typical TRACON Flight Strips for IFR Overflights

Figure 5-27: TRACON IFR Flight Strips for Overflights

Table 5-5: Sample of Manual Notations on IFR Flight Strips for Overflights

Processing procedures for IFR flight strips for overflights are discussed below; the procedures are organized by controller activities.

<table>
<tr><td rowspan="3">1.
2.
2A.
3.
4.</td><td>5.</td><td rowspan="3">8.
8A.</td><td rowspan="3">9.
9A.</td><td>10.</td><td>11.</td><td>12.</td></tr>
<tr><td>6.</td><td>13.</td><td>14.</td><td>15.</td></tr>
<tr><td>7.</td><td>16.</td><td>17.</td><td>18.</td></tr>
</table>

A. Machine Printed Information (National standardization of spaces 1 through 9A.)

1. Aircraft identification.
2. Revision number (FDEP locations only).

2A. Strip request originator. (At FDEP locations this indicates the sector or position that requested a strip be printed.)

3. Number of aircraft (if more than one), heavy aircraft indicator "H/" (if appropriate), type of aircraft and suffix indicating any special equipment.
4. Computer identification number, if required.
5. Secondary radar (beacon) code assigned.
6. Coordination fix.
7. Overflight coordination indicator (FDEP locations only)
8. Estimated time of arrival at the coordination fix.
9. Altitude and route of flight through the terminal area.

9A. Not used.

B. Hand Printed Information (Local facility directive specifies use of spaces 10 through 18.)

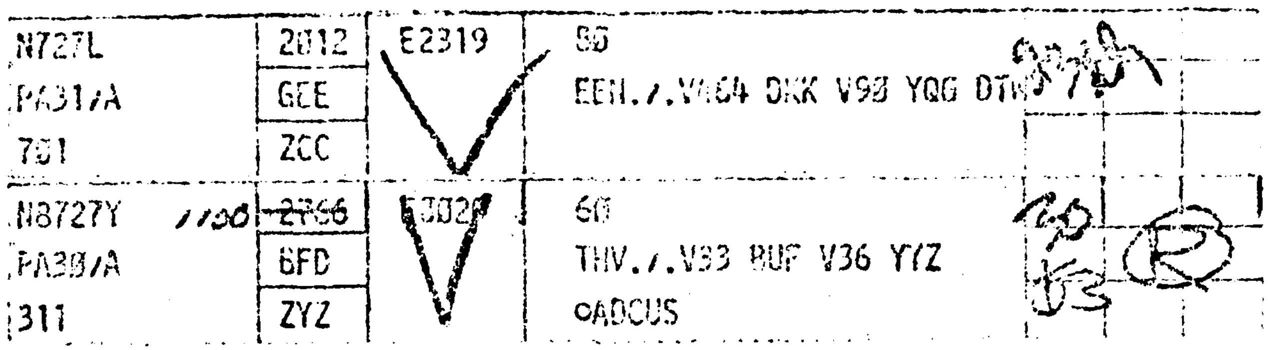
8. In red- A letter "V" (indicating an overflight).

10. Time radar handoff or radar contact from receiving facility.

13. Checkmark (✓) to indicate coordination has been accomplished with appropriate facility.

16. Time aircraft has been handed off to the next facility or time of transfer of control.

FIGURE 5-25. FLIGHT STRIP MODEL FOR IFR OVERFLIGHTS (TRACON ONLY)



N727L	W8727Y	Aircraft identification
PA31/A	PA30/A	Aircraft type/transponder equipment
701	311	Computer identification number
2012	2766	Secondary radar (beacon) code assigned
GEE	BFD	Coordination fix
ZCC	ZYZ	Overflight coordination indicator
E2319	E0020	Estimated time of arrival at the coordination fix
80	60	Altitude (in hundreds of feet)
EEN./.V464	THV./.V33	Route of flight through the terminal area
V	V	Indicates an overflight
2322	30	Time of radar handoff
	+	Indicates coordination has been accomplished with appropriate facility
	03	Time of transfer of control
	Ⓡ	Indicates Buffalo TRACON radar service terminated
	1100 ~~2766~~	Radar (beacon) code reassigned

FIGURE 5-26. TYPICAL TRACON FLIGHT STRIPS FOR IFR OVERFLIGHTS

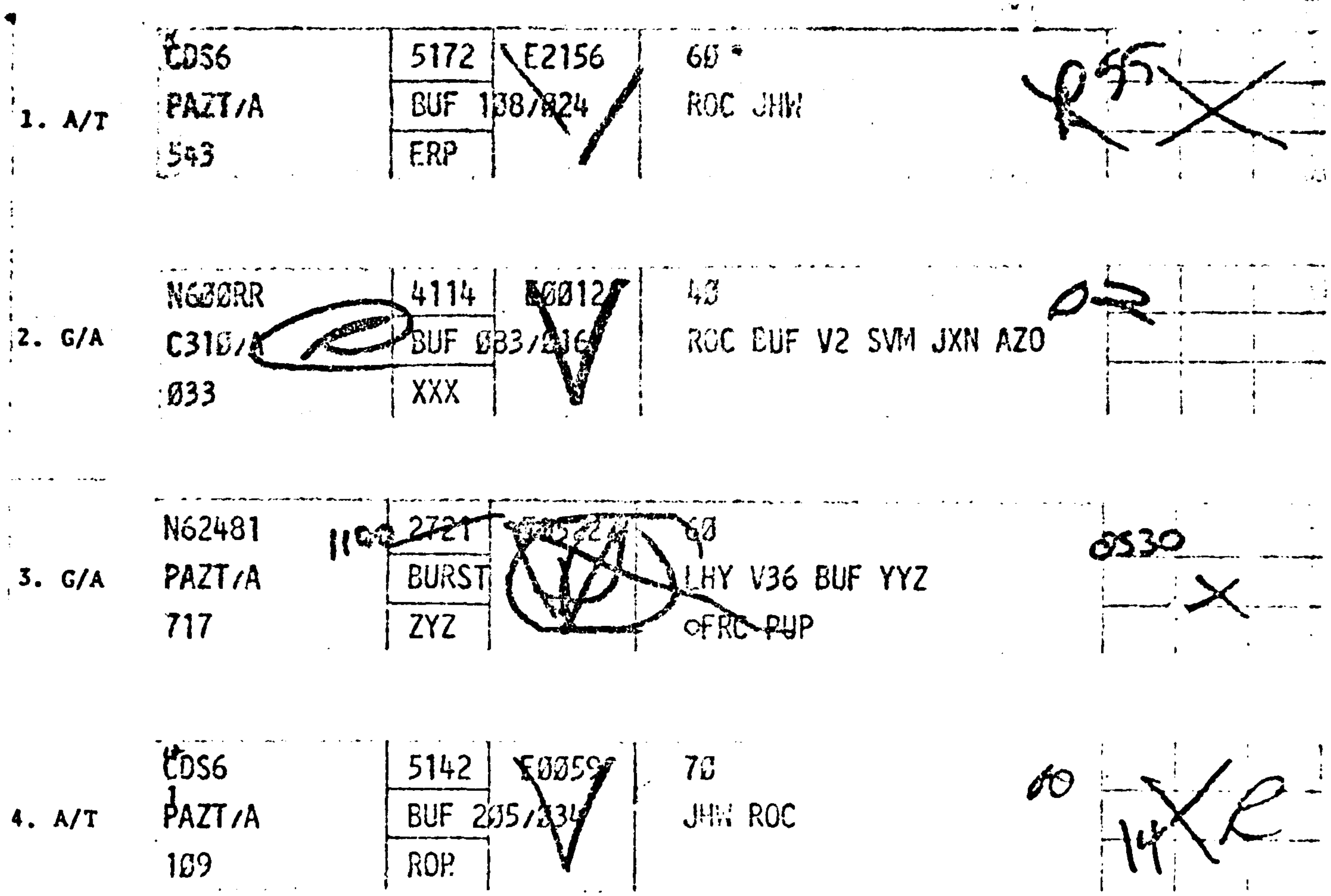


FIGURE 5-27. TRACON IFR FLIGHT STRIPS FOR OVERFLIGHTS

TABLE 5-5. SAMPLE OF MANUAL NOTATIONS ON BUFFALO IFR FLIGHT STRIPS FOR OVERFLIGHTS

Flight Strip Location	Manual Notation	Sample Flight Strip	Meaning Meaning	Purpose	Written by	Extent Used
8-8A		1 2 3 4	Symbol for IFR overflight	A marking to highlight the overflight strip for controller	AD	Routinely
10 10 10 9-14	55 02 0530 00	1 2 3 4	Time of radar handoff	A marking to indicate when controller assumed responsibility for overflight	Approach controller with sector ARR-E or ARR-W	Routinely
14 14 14	X X X 14	1 3 4	X to indicate coordination has been accomplished with appropriate facility	A confirmation of coordination for controller	Approach Controller with sector ARR-E or ARR-W	Routinely
2A 14	R R	2 4	Radar contract established	Radar status reference for controller	" "	Routinely
9 8-8A	R R	1 3	Radar service terminated	Radar status reference for controller	" "	Routinely
5	1100	3	Radar beacon code reassigned		" "	Seldom

TRACON
AD

- Two IFR overflight strips are generated by the FDEP approximately 30 minutes prior to the flight's estimated time of arrival at the specified coordination fix. Two strips are generated for each IFR overflight in order to provide one for the Approach Controller handling the flight and one for informational purposes for Departure Control.
- AD separates the strips from the FDEP paper strip roll and reviews the flight data. A large red "V" is entered on each strip to indicate IFR overflight.
- AD inserts the strips in plastic holders and places one in the pending section of the flight strip bay of the Approach Controller handling the flight (say ARR-E) and one in the corresponding location for DEP-W.

ARR-E

- ARR-E reviews the overflight flight strip, time permitting, with special notice taken of the aircraft's planned route and altitude through the terminal area.
- ARR-E coordinates a radar handoff using a procedure similar to that associated with an IFR arrival flight at Buffalo (Section 5.3.4). A similar notation is made on the overflight flight strip relative to time or radar handoff.
- ARR-E transfers control of the flight to an adjacent radar facility when the flight is approaching the boundary of the Buffalo Terminal Area. Handoffs to the ARTCC are accomplished through voice communication. Handoffs to Rochester are accomplished via ARTS. Handoffs to Erie Tower are accomplished through voice communication.
- ARR-E will notate the strip with the time of radar handoff and with an "X" to indicate coordination has been accomplished with the appropriate facility.

- o Following handoff, either ARR-E or the Coordinator will remove the strip from the bay and hand it to AD for storage in the flight strip storage bin at the AD position.

DEP-W o On observing the overflight primary target and data block on the PVD, DEP-W will move the strip from the pending section to the active section of his flight strip bay. The strip remains in the active section until it is serviced and handed off by ARR-E. This procedure enables DEP-W to be aware of overflights which might affect departure procedures.

- o AD will pick up the strip from DEP-W and store it similarly to the above.

5.3.6 Stage III Departures

The format and form of handprinted Stage III departure flight strips is illustrated in the following:

Figure 5-28: Flight Strip Model for Stage III Departures

Figure 5-29: Typical TRACON Flight Strips for Stage III Departures

Processing procedures for Stage III departure flight strips are discussed below, the procedures are organized by controller activities.

Tower Cab

CD o Pilot of departing aircraft calls CD and usually states "have ATIS," and provides flight data on aircraft identification, aircraft type, altitude and direction of destination of flight.

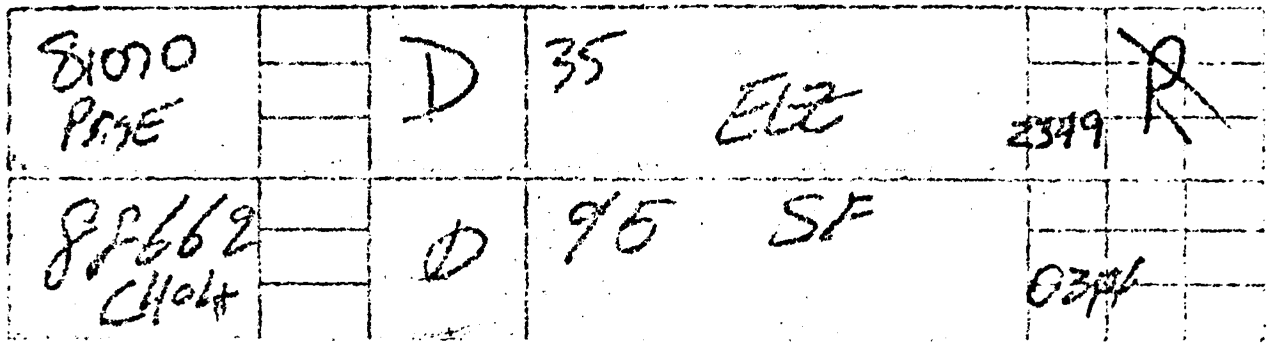
- o CD records flight data on either a scratch pad or on a blank flight strip in the wooden flight strip box at CD position.
- o CD enters flight data on ARTS keyboard in front of Conrac unit. Preview area on Conrac displays four digit radar

1. 2.	5.	8.	9.	10.	11.	12.
2A. 3.	6.	8A.		13.	14.	15.
4.	7.		9A.	16.	17.	18.

Hand Printed Information: (Specified by local facility directive).

1. Aircraft identification
3. Aircraft type
5. Beacon code assigned (Cab only, if requested)
7. Point of departure if other than Buffalo.
8. A letter "D" (indicating departure)
9. Altitude and destination of route of flight.
13. Takeoff runway (if other than active).
15. Checkmark (✓) indicating information was forwarded (Cab only)
16. Departure time (TRACON only).

FIGURE 5-28. FLIGHT STRIP MODEL FOR STAGE III DEPARTURES (CAB AND TRACON)



81070	86622	Aircraft identification
PASE	C404	Aircraft type
D	D	Indicates departure
35	95	Altitude (hundreds of feet)
ELZ	SE	Destination airport/direction of flight
2349	0344	Departure time
R		Radar service terminated

FIGURE 5-29. TYPICAL TRACON FLIGHT STRIPS FOR STAGE III DEPARTURES

beacon code to be entered on aircraft transponder. CD assigns transponder code. Pilot reads back.

- o CD tells pilot to contact GC when ready to taxi.
- o CD completes flight strip and places in inflight strip box at FD position.

FD GC LC
- o Subsequent procedures for the processing of the Stage III departure are almost identical to those for an IFR departure (Section 5.3.3). The only difference relates to FD providing the full flight data to AD in the TRACON to permit the completion of a Stage III departure strip.

TRACON

AD
- o AD will receive the flight data from FD in the Cab and complete a blank flight strip for the stage III departure. AD was observed filling out Stage III departure strips on blank strips stacked in the flight strip bay at the AD position.
- o AD's actions relative to DEP-W are the same as those performed for an IFR departure flight (Section 5.3.3).

DEP-W
- o Departure Controller's actions relative to a Stage III departure differ from an IFR departure only in two respects. First, the controller is providing separation to standards of 500 feet or 1.5 miles. Second, handoffs are seldom performed; with Stage III departures, radar service is usually terminated at the TRSA boundary. The pilot is usually directed to change frequency and squawk 1200 (VFR code).
- o DEP-W notates the flight strip with a radar termination symbol X and time.
- o Stage III departure strips are also collected by AD and stored in the bin at that position.

5.3.7 Stage III Arrivals

The format and form of hand-printed Stage III arrival flights is illustrated in the following:

Figure 5-30: Flight Strip Model for Stage III Arrivals (TRACON only).

Figure 5-31: Typical Flight Strips for Stage III Arrivals

Processing procedures for Stage III arrival flight strips are discussed below; the procedures are organized by controller activities.

TRACON

Approach Control
(ARR-W or ARR-3)

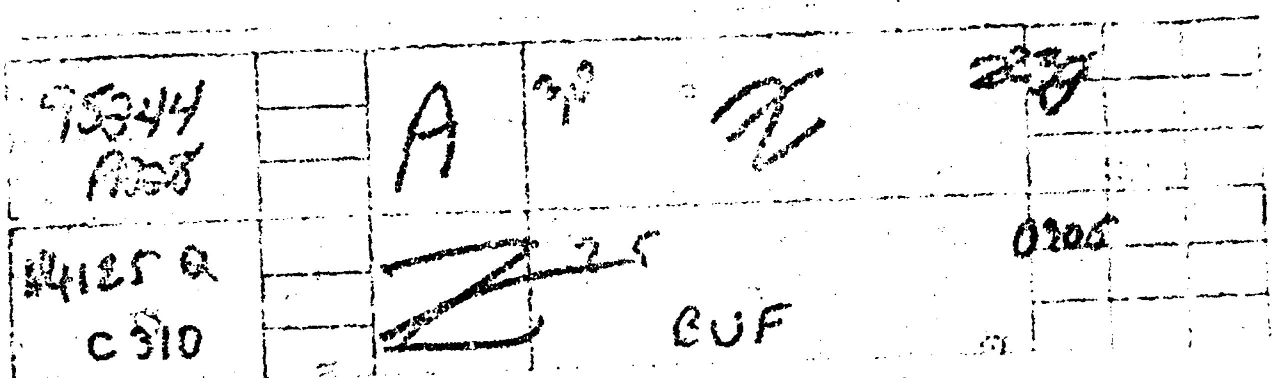
- o Pilot of Stage III arrival calls Buffalo Approach Control, say ARR-W.
- o ARR-W records flight data on blank flight strip located in the wooden flight strip box at the ARR-W position (Figure 5-32). Flight data recorded includes aircraft identification, aircraft type, altitude and position. ARR-W notates strip with arrival symbol (A) and time of radar contact.
- o ARR-W enters flight data on ARTS keyboard to obtain radar beacon code for flight. ARR-W assigns code to flight, "slews" the beacon target with his position identifier letter and hits the 'enter' button, then the full data block appears.
- o ARR-W moves flight strip from wooden box to active section of Approach Control flight strip bay; other strips are frequently rearranged when this occurs.
- o ARR-W services flight in a manner similar to an IFR arrival (Section 5.3.4) but to separation standards of 500 feet and 1.5 miles.

<table>
<tr><td rowspan="3">1.
2.
2A.
3.
4.</td><td>5.</td><td rowspan="3">8.
8A.</td><td rowspan="3">9.
9A.</td><td>10.</td><td>11.</td><td>12.</td></tr>
<tr><td>6.</td><td>13.</td><td>14.</td><td>15.</td></tr>
<tr><td>7.</td><td>16.</td><td>17.</td><td>18.</td></tr>
</table>

Hand Printed Information (Specified by local facility directive)

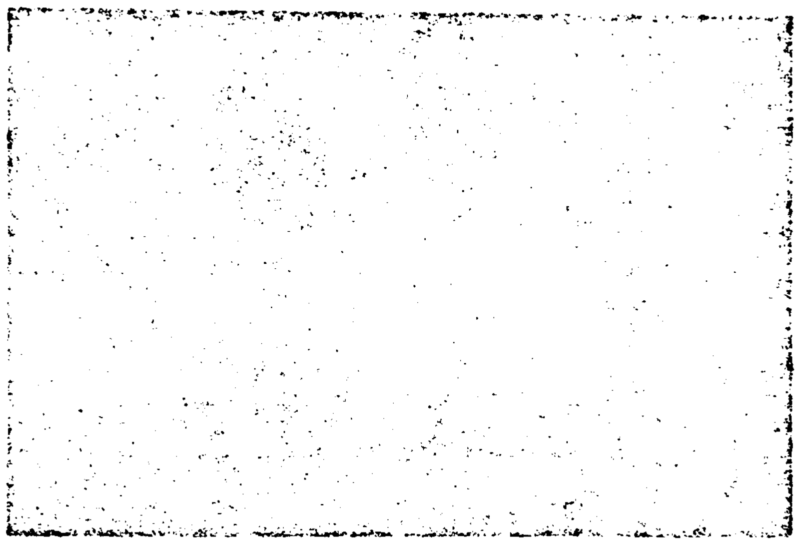
1. Aircraft identification.
3. Aircraft type.
8. A letter "A" (indicating an arrival).
9. Altitude.
10. Time of radar contact.
13. Checkmark (✓) to indicate information as forwarded to the tower.

FIGURE 5-30. FLIGHT STRIP MODEL FOR STAGE III ARRIVALS (TRACON ONLY)



95244	W4125Q	Aircraft identification
PA28	C310	Aircraft type
A		Indicates an arrival
30	2.5	Altitude (hundreds of feet)
2230	0905	Time of radar contact
✓		Checkmark to indicate information was forwarded to the tower.
Z	Z	Flight transferred to tower
	BUF	Arrival airport

FIGURE 5-31. TYPICAL FLIGHT STRIPS FOR STAGE III ARRIVALS



BOX IS FLUSH TO MAKE IT EASIER
TO WRITE UP BLANK STRIPS

FIGURE 5-32. EXAMPLE OF PORTABLE WOOD FLIGHT STRIP BOX USED IN TRACON

- ARR-W notes strip with symbol of transfer to Tower (Z) and checkmark to indicate information forwarded to tower.
- Processed flight strip picked up by AD for storage.

Note on AD

- AD does not get involved in completing Stage III arrival strips unless the Niagara Tower calls with a Stage III request going to Buffalo. In this case, AD would make the ARTS keyboard entry and assign the beacon code to the flight. Tab list data would appear on the PVD of the approach controller who is responsible for the flight.

Tower Cab

LC GC

- Activities of Cab Controllers are similar to those performed for an IFR arrival (see Section 5.3.4).

5.3.8 Stage III Overflights

The format and form of Stage III overflight strips is illustrated in the following:

Figure 5-33: Flight Strip Model for Stage III Overflights (TRACON only).

Figure 5-34: Typical TRACON Flight Strips for Stage III Overflights

Processing procedures for Stage III overflight strips are discussed below; the procedures are organized by controller activities.

TRACON Approach Control (ARR-W or ARR-3)

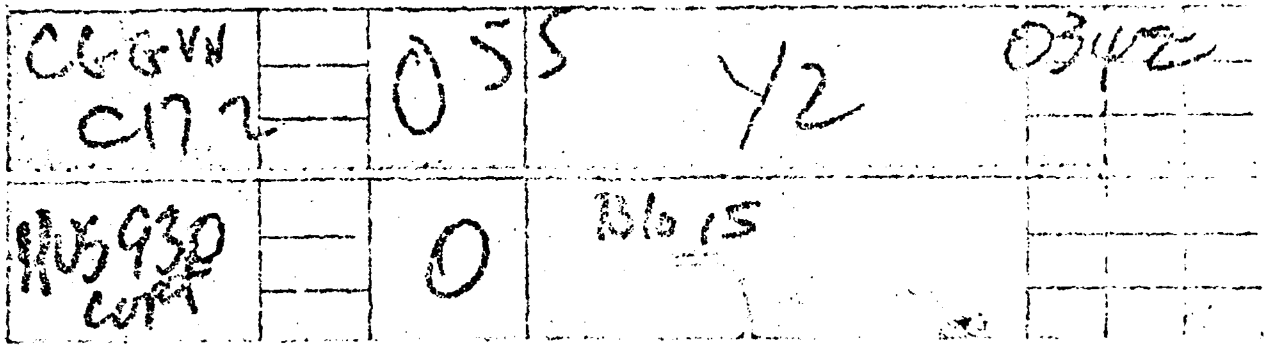
- Pilot of Stage III overflight calls Buffalo Approach Control, say ARR-W.
- ARR-W records flight data on a blank flight strip in the wooden flight strip box at the ARR-W position. Flight data recorded includes aircraft identification, aircraft

1. 2.	5.	8.	9.	10.	11.	12.
2A.	6.	8A.		13.	14.	15.
3. 4.	7.		9A.	16.	17.	18.

Hand Printed formation (Specified by local facility directives)

1. Aircraft identification.
3. Aircraft type.
8. A letter "O" (indicating overflight).
9. Altitude and route of flight if appropriate.
10. Time of radar contact.

FIGURE 5-33. FLIGHT STRIP MODEL FOR STAGE III OVERFLIGHTS (TRACON ONLY)



CGGVN	HUS930	Aircraft identification
C172	COPT	Aircraft type
0	0	Indicates overflight
55V2	Blo15	Altitude and route ("Blo" indicates below)
0342		Time of radar contact

FIGURE 5-34. TYPICAL TRACON FLIGHT STRIPS FOR STAGE III OVERFLIGHTS

type, altitude and route through terminal area. ARR-W notates strip with Stage III overflight symbol (O) and time of radar contact.

- ARR-W enters flight data on ARTS keyboard to acquire radar beacon code for flight. ARR-W assigns code to flight and slews the beacon target with his position identifier letter and hits the "enter" button to make the data block appear.
- In contrast to Stage III arrival strips, ARR-W leaves the Stage III overflight strip in the wooden flight strip box; the strip is not moved into the active section of the arrival flight strip bay. If the flight moves into ARR-E airspace, the strip is transferred to the wooden flight strip box at that position.
- ARR-W (and ARR-#, if necessary) services flights through TRSA with vectors and radar separation to Stage III standards of 500 feet and 1.5 miles.
- Stage III overflights are usually not handed off; radar service is terminated outside the TRSA. Controller may notate strip with radar termination symbol and time of radar termination.

(One important consideration with Stage III overflights is to keep the aircraft out of the Niagara airport control zone. The TRSA boundary is 12 miles from the tower while the Niagara airport is approximately 13 miles from it.

Tower Cab
- Stage III overflights are not coordinated with the tower.

5.3.9 Simulated Instrument Approaches

Simulated instrumented approaches have a special flight strip format which is illustrated in Figure 5-35.

Normally these flight strips are required when a pilot is practicing approaches while flying VFR. The pilot contacts

1. 2.	5.	8.	9.	10.	11.	12.
2A.	6.	8A.		13.	14.	15.
3. 4.	7.		9A.	16.	17.	18.

Hand Printed Information (Specified by local facility directive)

1. Aircraft identification.
3. Aircraft type.
9. Altitude

9A. In red - draw a semi-circle around airport if destination other than Buffalo.

9 Block. On the right side indicate the type of approach conducted with the following:

1. a letter "N" - indicating NDB approach.
2. a letter "I" - indicating ILS approach.
3. a letter "V" - indicating VOR approach.

10. Time of radar contact.
13. Checkmark (✓) to indicate information forwarded to appropriate tower.

FIGURE 5-35. FLIGHT STRIP MODEL FOR SIMULATED INSTRUMENT APPROACHES

Approach Control and requests a simulated instrument approach. The TRACON attempts to comply with these requests, traffic load permitting.

5.4 FLIGHT DATA PROCESSING OBSERVATIONS

This section presents summary results of observations of flight data processing in the Buffalo Tower Cab and TRACON. The purpose of the observations was to capture the layout of flight data and the typical flight data processing load by controller position.

The information is presented by a tabular summary of observation data followed by snapshot descriptions of typical flight data conditions in the Cab and TRACON. Qualitative observations complement the tabular and graphic information.

5.4.1 Tower Cab

Flight data processing information for the Cab is presented in the following:

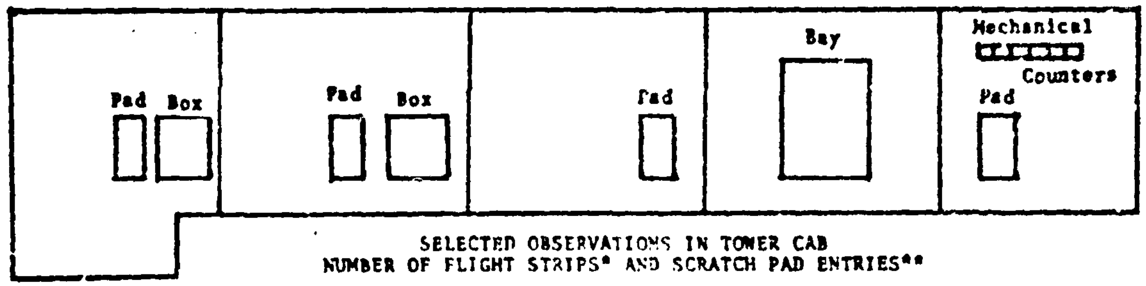
Figure 5-36: Observations of Buffalo Tower Cab Flight Data Load by Position.

Figure 5-37: Typical Flight Data Layout and Loading for Buffalo Tower Cab.

Figure 5-38 illustrates flight strips and scratch pads observed at each controller position.

The FD and CD positions carry a heavy static flight strip load, while the GC and LC positions carry a lighter but more frequently changing flight strip array. FD and CD review and prepare strips for use by the radar controllers. Their tasks include tending the FDEP, reviewing each flight strip, providing clearances, complying with flight coordination requirements, notating flight strips and monitoring flight strips prior to aircraft taxi and departure.

BUFFALO TOWER CAB LAYOUT, POSITIONS AND FLIGHT DATA PADS AND BOXES



SELECTED OBSERVATIONS IN TOWER CAB
NUMBER OF FLIGHT STRIPS* AND SCRATCH PAD ENTRIES**

Date	Day	Time (L)	CD Box	FD Box	GC Scratch Pad # entries	ASST LC	BAY	LC Scratch Pad # entries
Jun 18	Wed.	0900	3	2	-	2		1 active
Jul 22	Tues.	1600	4	3	1 active	3		1 active 2 inactive
Jul 23	Wed.	1740	2	1	1 inactive	2		1 active
Jul 25	Fri.	0828	2	1	1 inactive 1 flush strip	1		5 active 6 inactive
"	"	0855	2	2	1 active	2		2 active 2 inactive
"	"	0927	2	4	1 active 2 inactive	1		1 active active
"	"	0956	5	1	4 1 flush strip	1		1 inactive

*Includes machine printed and hand printed strips observed; does not include blank strips at positions.
**Inactive entries are those which are crossed out on a scratch pad.

FIGURE 5-36. OBSERVATIONS OF BUFFALO TOWER CAB FLIGHT DATA LOAD BY POSITION

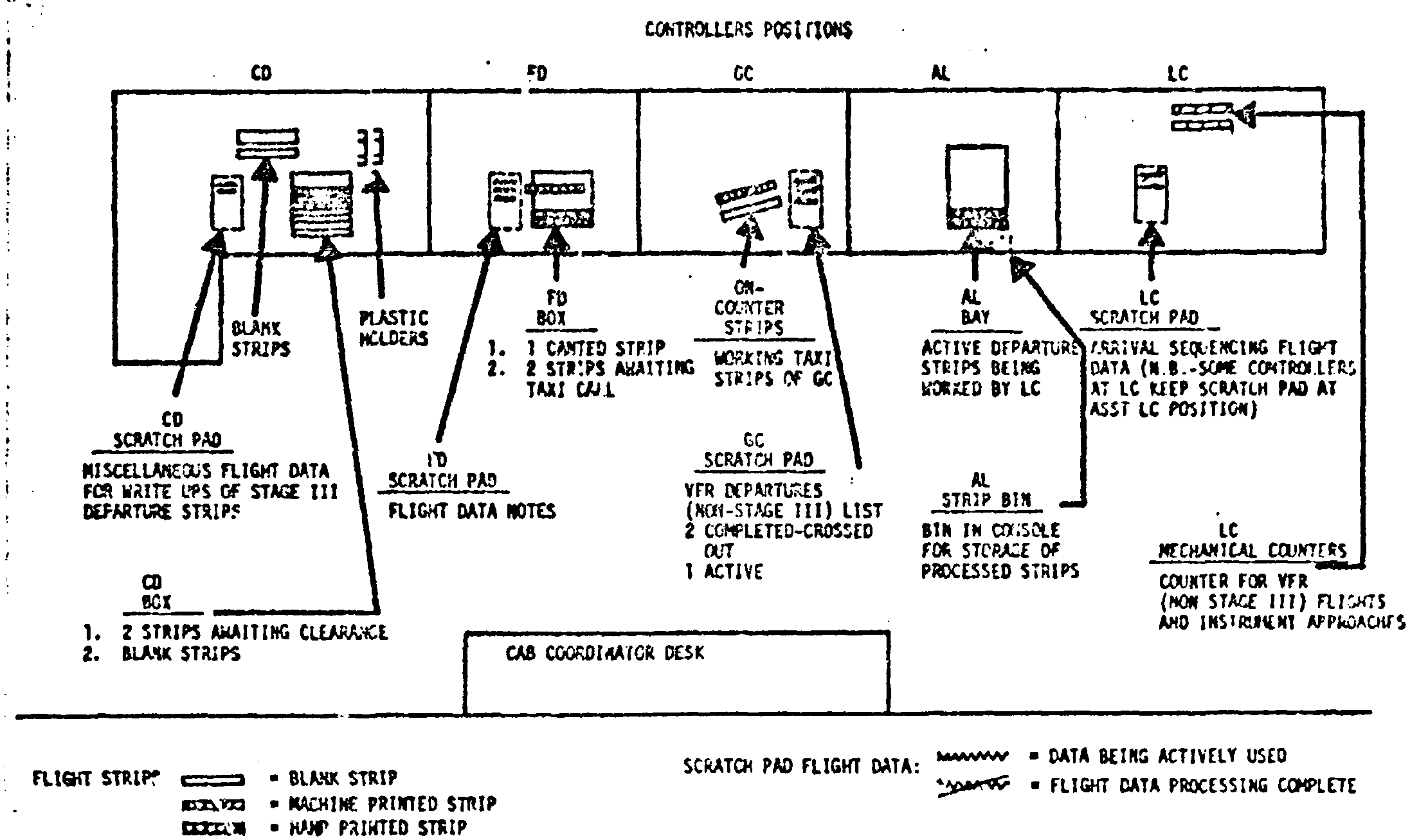


FIGURE 5-37. TYPICAL FLIGHT DATA LAYOUT AND LOADING FOR BUFFALO TOWER CAB (FIGURE LAYOUT NOT TO SCALE)

In contrast, GC and LC deal with flight data as the aircraft are actually processed. Flight strips and scratch pad data are referenced by GC and LC while controlling aircraft on the taxiways, runways, and in tower airspace. GC and LC move departure flight strips from the counter at GC, to the strip bay at AL, to the strip storage bin at the same position. The flight data load from arrival flights is difficult to assess due to the absence of flight strips and the reliance on the BRITE and scratch pad data.

Observations conducted during the daily peak hour (4:00 p.m. to 5:00 p.m.) showed that the Tower Cab may handle as many as 30 to 35 flights per hour. These are split almost evenly between arrivals and departures. The difficulty of processing such a load is increased by the predominant one-runway configuration of the airport.

5.4.2 TRACON

Information on flight data processing in the TRACON is presented in the following:

Table 5-6: Observed Flight Data Load by TRACON Position.

Figure 5-38: Typical Flight Data Layout and Loading for TRACON.

Similar to the previous description of the Cab, the latter figure illustrates flight data loads observed at each position.

The layout and load of flight data at each position is influenced by "flight data clerk" functions of the AD controller. AD's functions include:

1) Tending the FDEP.

2) Maintaining a backlog flight strip bay for IFR and Stage III departure flights in the thermial area.

3) Complying with flight coordination requirements.

4) Notating strips as required by local directive.

TABLE 5-6. OBSERVED FLIGHT DATA LOAD BY TRACON POSITION

NUMBER OF COMPLETED* FLIGHT STRIPS AT BUFFALO TRACON POSITIONS

Date	Day	Time Local	ARRIVAL DATA Box			DEPARTURE WEST Bay		ARRIVAL WEST Box	ARRIVAL WEST Bay (Combined Bay)		ARRIVAL EAST Box
				BUF Deps	NON BUF Deps	Pending	Active		Pending	Active	
Jul 22	Tues.	1700	1	4	4	2	2	-	4	2	-
		2100	-	14	3	3	1	-	3	4	-
Jul 23	Wed.	1430	-	5	1	5	4	-	9	4	1
		1630	-	6	1	2	4	1	5	5	-
		1730	-	3	4	6	6	2	2	3	-
Jul 24	Thurs.	0800	-	-	3	3	1	-	4	-	-
		1000	-	8	1	2	4	-	5	4	1
		1730	4	6	1	1	2	-	3	3	-
Jul 25	Fri.	0750	2	8	2	0	1	-	2	4	-
		0830	-	4	1	3	4	-	4	3	-
		0900	-	5	-	3	-	1	3	3	-
		0950	1	9	1	-	3	-	1	2	1
		1015		10	-	5	3	-	2	2	1

*Includes machine printed and hand printed strips observed; does not include blank strips at positions.

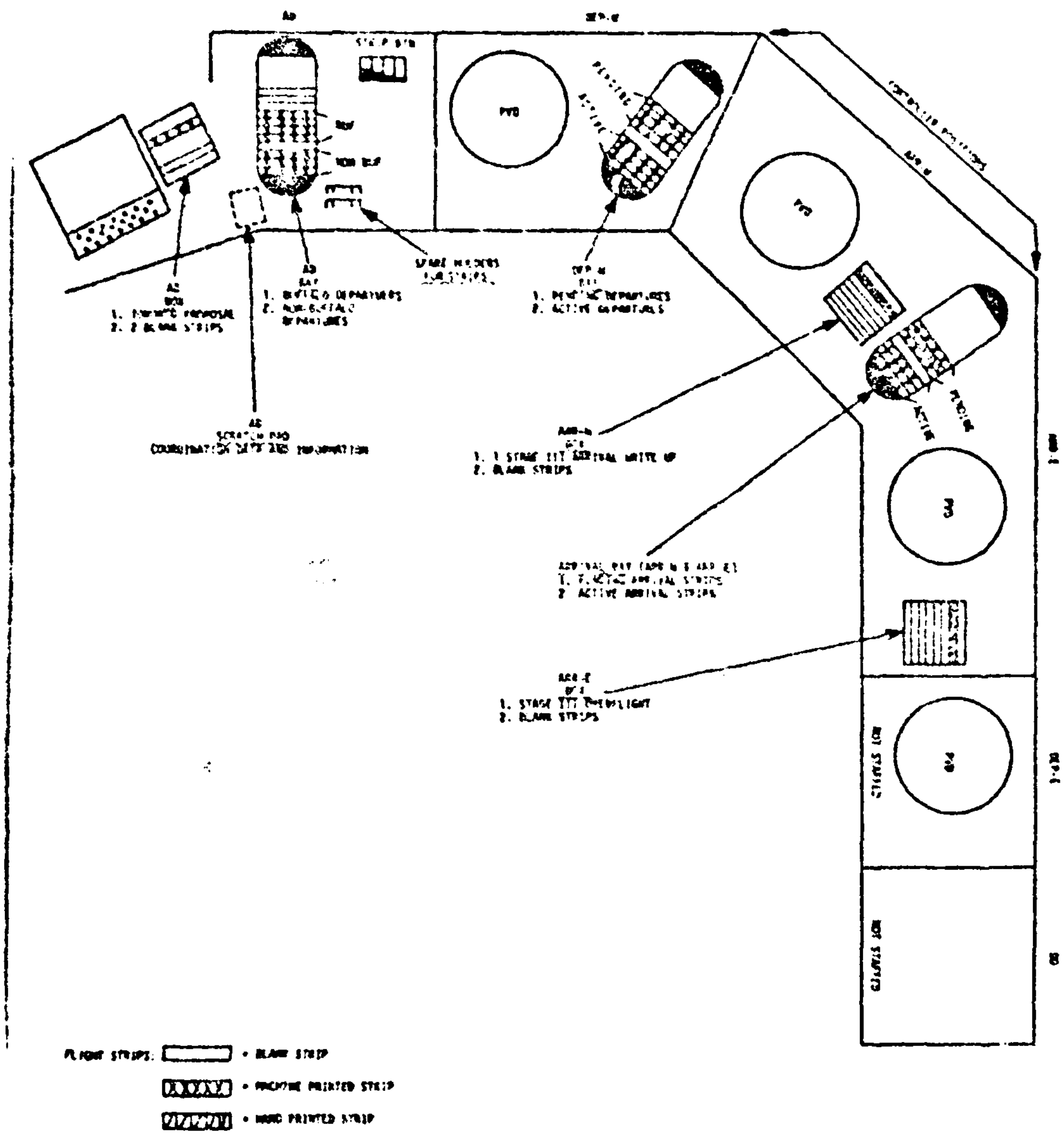


FIGURE 5-38. TYPICAL FLIGHT DATA LAYOUT AND LOADING FOR BUFFALO TRACON
(FIGURE LAYOUT NOT TO SCALE)

5) Delivering flight strips (in plastic holders) to the operational radar positions.

6) Retrieving processed flight strips and storing them in the strip bin at AD.

7) Assisting the radar controllers as requested.

8) Delivering processed flight strips to the Watch Supervisor's desk each hour for counting.

AD transfers a departure strip to the pending section of the DEP-W strip bay only after receiving the notification call from FD in the Tower Cab that the aircraft is taxiing. This procedure keeps DEP-W flight strip load to a minimum and permits the DEP-W controller to concentrate on active strips.

The handling of arrival flight strips by position (ARR-W and ARR-E) does not include such preliminary servicing. After a flight strip is printed by the FDEP, reviewed by AD and inserted in a plastic holder, it is immediately placed in the main arrival flight strip bay by AD. If the Coordinator position is staffed, the strip may be handed from AD to the Coordinator, who stands directly behind the bay between the two arrival controllers. The Coordinator may rearrange the ordering of the strips in the pending section of the bay, if necessary. Once an arrival flight strip is processed, the Arrival Controller removes the strip from the active section of the bay and places it on the counter in front of the bay. The AD controller retrieves that strip from the counter, (or from the Coordinator when that position is staffed) for delivery to the Watch Supervisor for counting and storage.

Flight strip load in the wooden boxes at ARR-E and ARR-W is typically low (1 strip) since only Stage III overflight strips are retained in the box while under TRACON control. Stage III arrival strips are handwritten while in the wooden box and transferred to the flight strip bay.

In the daily peak hour (4:00 p.m. to 5:00 p.m.), the TRACON processes approximately 50 flight strips which typically include 20 departures, 25 arrivals and 5 overflights.

5.5 FLIGHT DATA RECORD KEEPING

Flight data is recorded on the following forms at Buffalo (see Appendix for copies of each):

- Local Form: "TRACON Hourly Traffic."
- FAA Form 7230-26: An official form used by Approach Control Facilities (Terminal) to log Instrument Operations (front side) and Stage III TCA Operations (reverse side).
- FAA Form 7230-1: Airport Traffic Record.

Each hour during the two regular shifts and periodically during the midwatch, the AD controller in the TRACON removes the processed strips from the flight strip storage bin at the AD position and delivers them to the Watch Supervisor's desk. The Watch Supervisor manually counts the strips by categories consistent with those identified in the "TRACON Hourly Traffic" form. This form serves as a local sheet for logging hourly flight data in the same categories required for daily reporting on FAA Form 7230-26. One copy of the TRACON Hourly Traffic form is completed for IFR strips and one copy is completed for Stage III strips. At the end of each day (about midnight), the Watch Supervisor totals the flight data on each of the TRACON Hourly Traffic forms. The daily totals are then manually transferred on to a copy of FAA Form 7230-26 maintained at the Watch Supervisor's desk in the TRACON.

The Watch Supervisor also completes a daily entry on FAA Form 7230-1: Airport Traffic Record. This form contains totals of all takeoffs and landings at the Greater Buffalo International Airport for each day of the month. The data for this form is derived from two sources:

1) The primary airport figures for IFR and Stage III flights on Form 7230-26.

2) The daily mechanical counter figures totalling VFR flights in the Tower Cab.

The Watch Supervisor calls the Cab at the end of each day to ascertain the VFR flight counts. Summing these two data sources provides an airport operations count for entry on Form 7230-1.

At the end of each month, the 7230-26 and 7230-1 are completed in the TRACON and sent to the administrative office in the tower for typing and distribution. Copies of each form are sent to the FAA in Washington, DC, the FAA Regional Office, and the Airport Manager.

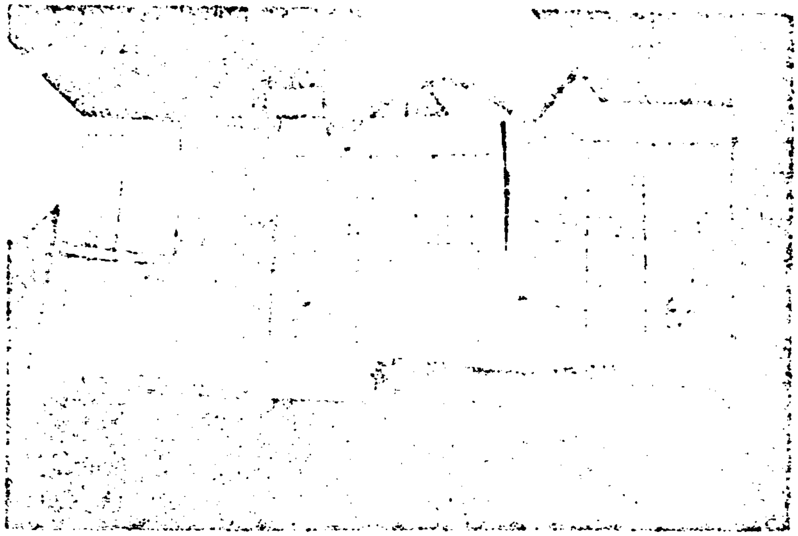
The tower administrative office also receives each day's set of flight strips, the day's TRACON Hourly Traffic forms, the daily TRACON log (Form 7230-4) and the individual position logs. This material is usually bound with an elastic by the supervisor and sent to the office as one package representing the days activities (see Figure 5-39).

Other flight data forms completed in the TRACON by the Watch Supervisor include:

- o Local Form: Surveillance Approach Log.
- o FAA Form 7230-16: Approach Data Worksheet (Copies of each of these forms are included in the Appendix).

The local Surveillance Approach Log is maintained by the Watch Supervisor as a record of each controller's performance of surveillance approaches. Controllers are required to perform a minimum of one surveillance approach per month to maintain official proficiency in this particular air traffic control service.

The number of instrument approaches at Buffalo is logged on FAA Form 7230-16 which is submitted to the FAA monthly.



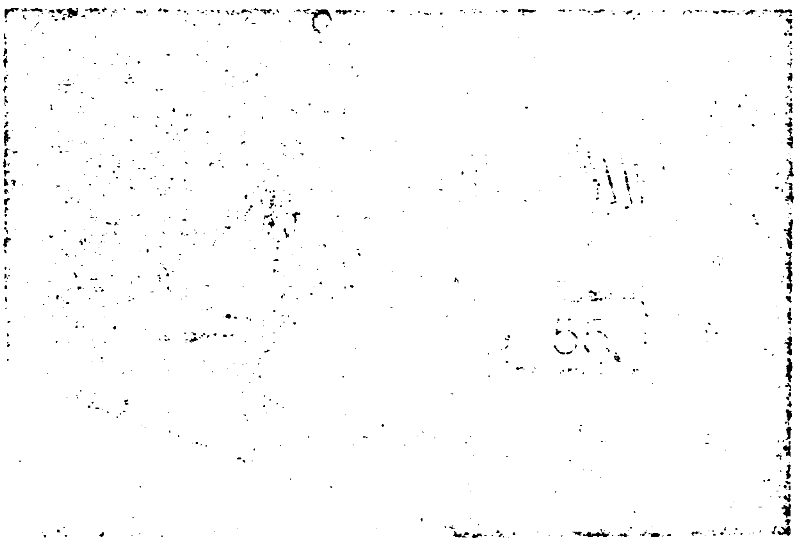


FIGURE 5-39. END OF DAY FLIGHT DATA PACKAGE AT WATCH SUPERVISOR'S DESK

6. WEATHER

The weather communication network at the Buffalo tower includes several organizations: the WSFO, FSS, and NWS at the airports, the ARTCC in Cleveland, Niagara Falls International Airport, and pilots aloft. The equipment linking the Cab and TRACON with these organizations are represented in Figure 6-1 and include the FDEPs, electrowriters, FAA radios, and the telephone system. Weather information received at and sent from the tower are described in the following sections.

6.1 WEATHER INFORMATION RECEIVED AT BUFFALO TOWER

The sources, types, and use of weather information received at the Buffalo Tower are described in this section. The information is summarized in Table 6-1.

6.1.1 WSFO

The WSFO sends weather information to the Cab and TRACON over the electrowriter from its weather observation site, located approximately 1500 feet east of the runway intersection. This weather information includes the Terminal Forecast (FT) that is issued 3 times a day, the hourly Surface Aviation Weather Report (SA), the Special Surface Aviation Weather Report (SP) (issued as required) and the Winds Aloft Report that is issued twice daily. When messages are unreadable, due to a machine malfunction or poor handwriting, a controller or supervisor telephones the WSFO and asks that the message be transmitted again (to see if the electrowriter is malfunctioning) or receives the necessary information verbally.

(a) Terminal Forecasts

The Terminal Forecasts cover, for 24-hour periods, the area within 5 miles of the airport. They are issued at approximately 0940Z, 1440Z and 2140Z and, in accordance with "Aviation Weather Services" (AC00-45) are valid from 1000Z-1000Z, 1500Z-1500Z and 2200Z-2200Z, respectively.

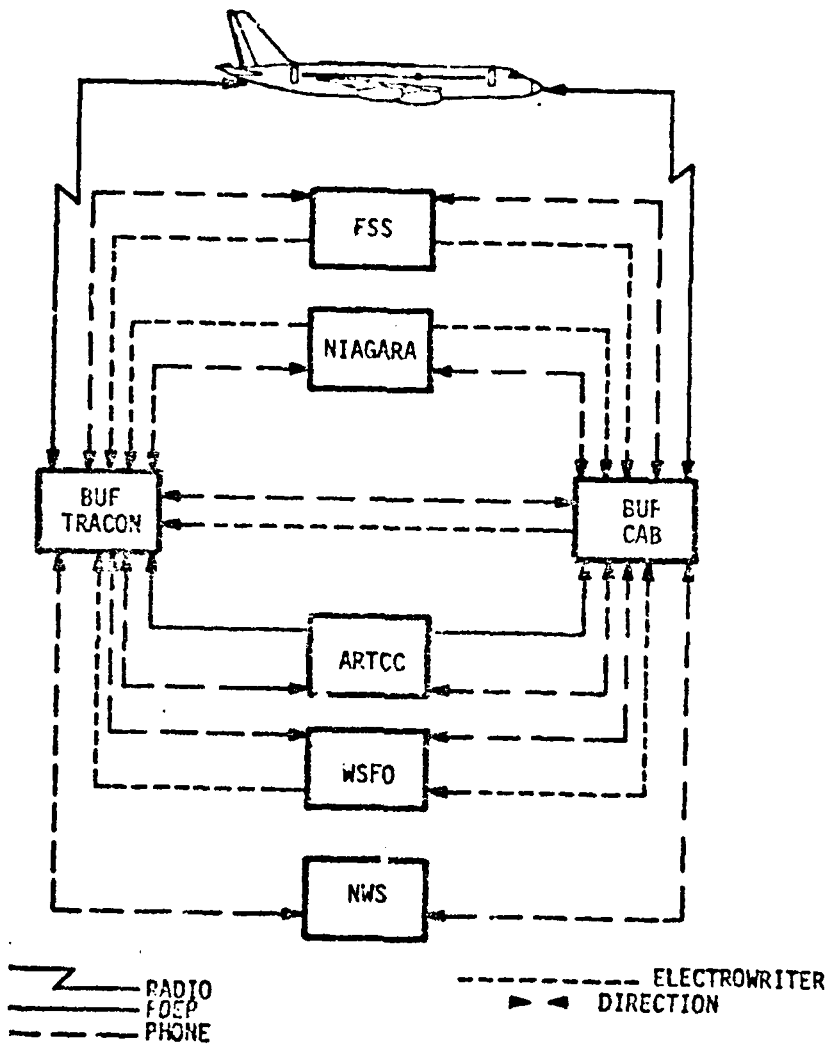


FIGURE 6-1. WEATHER COMMUNICATIONS AT BUFFALO TOWER

TABLE 6-1. CATEGORIES OF WEATHER INFORMATION RECEIVED AT BUFFALO

WEATHER MESSAGE	CONTENTS	SOURCE	EQUIPMENT	TIMELY?	ISSUED	USEFUL?	PRIMARY POSITIONS OF INTEREST	COMMENTS
TERMINAL FORECAST (FT)	24-HOUR FORECAST FOR AREA W/IN 5 MILES OF AIRPORT	WSFO	ELECTRO-WRITER	YES	3 TIMES/DAY	YES	WATCH SUPERVISOR	
SURFACE AVIATION WEATHER REPORT (SA)	OBSERVED WEATHER CONDITIONS AT AIRPORT	WSFO	ELECTRO-WRITER	YES	HOURLY	YES	FD, CC, LC, CIC, AD, AR,** WS	MOST USEFUL WEATHER REPORT
SPECIAL SURFACE AVIATION WEATHER REPORT (SP)	UPDATES OF SA	WSFO	ELECTRO-WRITER	YES	AS REQUIRED	YES	FD, CC, LC, CIC, AD, AR, WS	IMPLIES WEATHER CHANGES FROM SA
AIRMET (WA)	WEATHER HAZARDS TO G.A. AIRCRAFT	ARTCC	PDSP	YES	AS REQUIRED	MINIMALLY	FD, WS	RECORDED ON ATIS
SEVERE WEATHER WATCH BULLETIN (WW)	SEVERE THUNDER-STORMS, TORNADOES	NWS	TELEPHONE	YES	AS REQUIRED	YES	ALL	SAME INFO AS SIGMETS AND CONVECTIVE SIGMETS
WINDS ALOFT REPORT	SPEED & DIRECTION FROM 1000' TO 16,000' AGL	WSFO	ELECTRO-WRITER	YES	2 TIMES/DAY	MINIMALLY	AR	
SIGMET (WS)	ADVISES OF HAZARDOUS WEATHER IN AREA	ARTCC	PDSP	YES	AS REQUIRED	NO	FD, WS	RECORDED ON ATIS
CONVECTIVE SIGMET (WST)	ADVISES OF THUNDER-STORMS IN AREA	ARTCC	PDSP	YES	AS REQUIRED	NO	FD, WS	RECORDED ON ATIS
PIREP (UA)	WIND, ICING, *CAT, BIRDS	PILOTS OR FSS	FAA RADIO (PILOTS) OR ELECTRO-WRITER (FSS)	YES	UPON REQUEST	YES	LC, RADAR CONTROLLER WS	RELATED TO FSS
SURFACE AVIATION WEATHER REPORT (SA) FROM NIAGARA	OBSERVED WEATHER CONDITIONS AT NIAGARA AIRPORT	NIAGARA WEATHER PERSON-NEL	ELECTRO-WRITER	YES	HOURLY	YES	ARR-W, WS	
NIAGARA SPECIAL SURFACE AVIATION WEATHER REPORT (SP)	UPDATES OF NIAGARA SA	NIAGARA WEATHER PERSON-NEL	ELECTRO-WRITER	YES	AS REQUIRED	YES	ARR-W, WS	

*Clear Air Turbulence
**AR - Denotes ARR-W And ARR-E

The Terminal Forecasts are of the standard format, containing information on the ceiling, visibility, weather, wind, expected weather changes, and a categorical outlook (expected VFR, marginal VFR or IFR conditions) for the last six hours of the forecast period.

In the Cab, Flight Data (FD) tears the forecast off the electrowriter and posts it on the NOTAM board. The Controller in Charge (CIC) may read it to get an idea of what to expect during his shift. If a significant weather change is expected, the CIC may advise Local Control (LC). Then, they look for a wind shift and change runways if necessary, at a more appropriate time than if they had no warning. Occasionally, a pilot may ask Clearance Delivery (CD) for a forecast, in which case CD reads the FT to him. The FT is saved until the next one arrives, which is usually no longer than 12 hours. When the Cab electrowriter malfunctions, the FT is not received unless a Cab controller calls the WSFO.

In the TRACON, Arrival Data (AD) removes the FT from the electrowriter and places it on the Watch Supervisor's desk. He uses it to determine if extra controllers will be needed for the next shift (It is up to the WS on the prior shift to call in the controllers if overtime is necessary for the following shift.) due to poor weather conditions or a restricted traffic flow. The WS also uses it to get a general idea of what the weather at Niagara will be like, although the forecast does not officially extend that far. Occasionally, an airline may call the WS to obtain a weather forecast, in which case he reads the FT. It is saved until the next one arrives. Although they are officially valid for 24 hours, they are not used for more than 12.

(b) Surface Aviation Weather Report (Figure 6-2)

These weather reports indicate observed local weather conditions and are valid until a new or special report is issued. The observances for the SAs are usually made between 5 and 10 minutes before the hour and are transmitted approximately 1-3 minutes

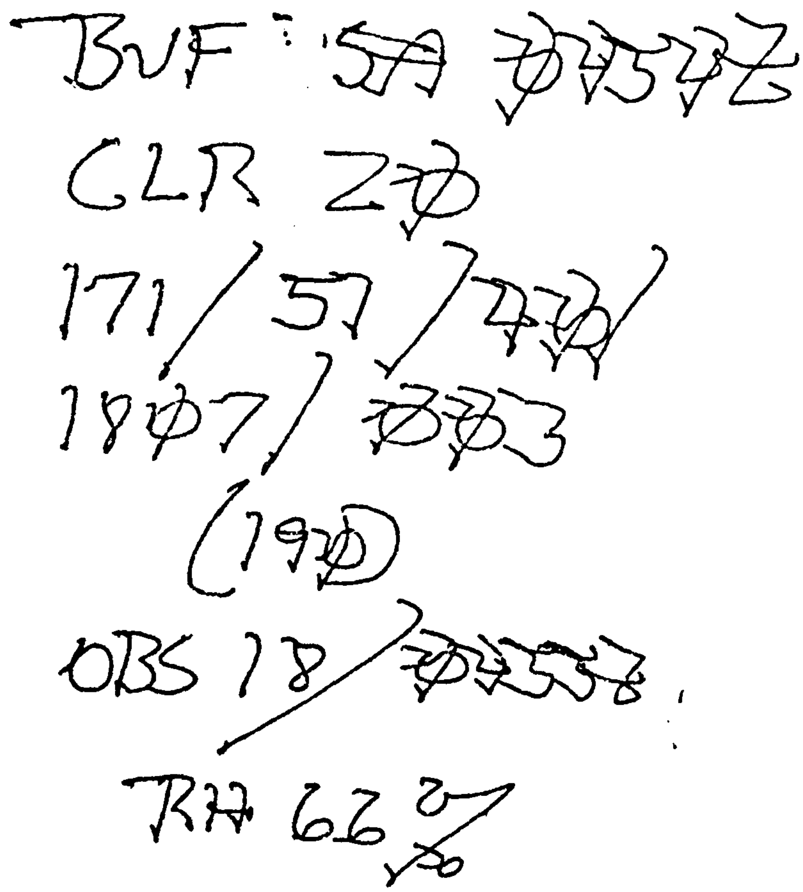


FIGURE 6-2. HOURLY WEATHER REPORT FROM THE WSFO

afterwards. A typical report is shown in Figure 6-2. It is translated as follows:

- o Station identifier for the reporting station.
  BUF The report is from Buffalo, New York.
- o Type and time of report.
  SA 0454Z Denotes a regular hourly report and observations were made at 0454Z.
- o Sky condition, ceiling, and visibility information.
  CLR 20 The sky is unobscured and visibility is 20 statute miles.
- o Sea Level pressure in millibars, temperature, dew point, wind and altimeter reading.
  171/51/40/1807/003 Sea level pressure is 1017.1 millibars/temperature is 51° F/dewpoint is 40°F/wind is from 180° at 7 knots/altimeter is 30.03 inches.
- o Remarks
  This section of the report may contain descriptive information concerning weather conditions. Usually, it consists of data that is not used by controllers. (190) Meaning unknown as it is not used in the tower.
- o Source, date and time issued.
  OBS 18/0455Z This report is from the WSFO observer on the 18th day of the month at 0455Z.
- o Relative Humidity
  This information is included at the end of the hourly report, it is not used by the controllers.
  RH 66% The Relative Humidity is 66%.

In the Cab, FD tears the report off the electrowriter. He uses the ceiling, visibility, temperature, wind, and altimeter setting information for the ATIS (Figure 6-3). FD writes the ATIS code letter on the message and verbally disseminates its contents to the other controllers. It is posted at Assistant Local Control (AL) (Figure 6-4) where it can be referenced by

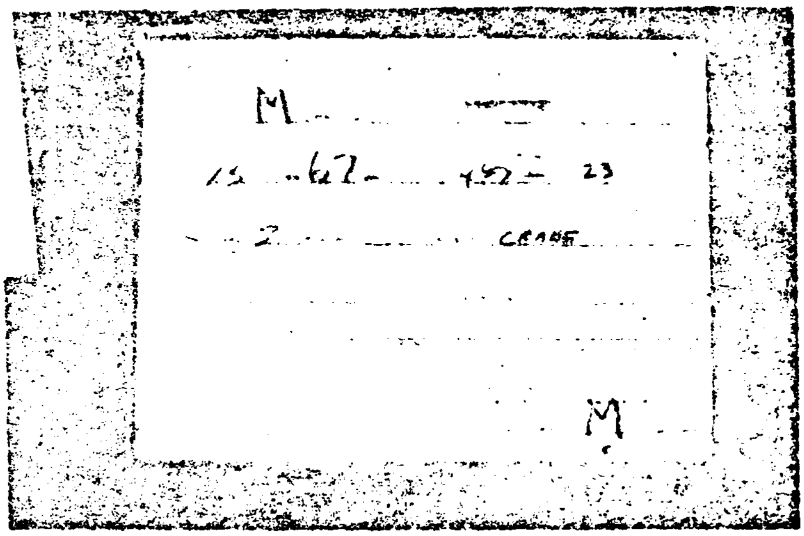


FIGURE 6-3. WRITTEN RECORD OF ATIS MESSAGE AT CAB COORDINATOR POSITION

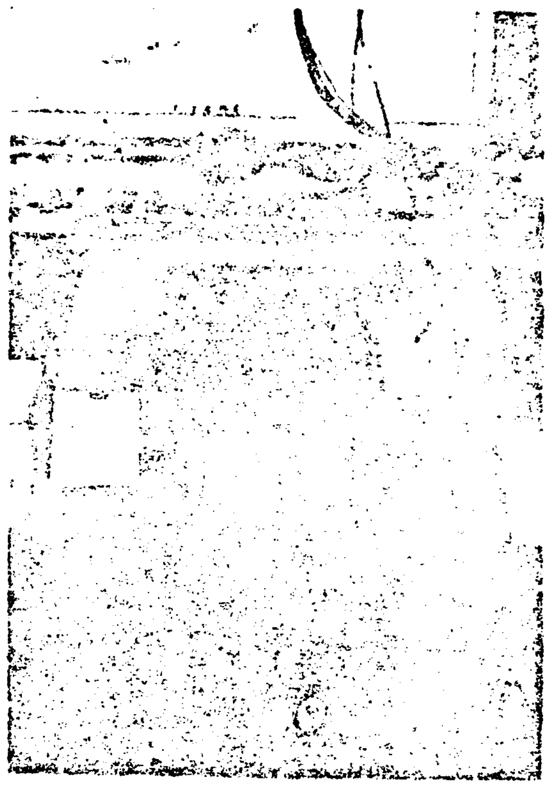


FIGURE 6-4. HOURLY WEATHER REPORT AT ASSISTANT LOCAL CONTROL

Ground Control (GC) and LC. The controllers use it to have a general knowledge of the current weather. LC also uses the visibility information on it to determine when to use the IFR Approach Counter.

In the TRACON, AD removes the message from the electrowriter and disseminates it to the WS and TRACON controllers. It is primarily of interest to the Arrival Radar controllers as they want to know if the visibility is above the minimums required for visual approaches, therefore it is posted between them (Figure 6-5). During the midshift, however, when DEP-W is the only operating radar position, they are left at the DEP-W console (Figure 6-6).

In both the Cab and TRACON, these remain posted until replaced by the next SP or SA report. If the electrowriter is out of service the WSFO calls the report over the telephone, or FD calls them to get the report over the telephone as it is necessary for the ATIS. Approximately twice a day, the SA reports are followed by additional data (Figure 6-7) not used by the tower. This is usually torn off and thrown away immediately.

c) Special Surface Aviation Weather Report

Special weather reports are similar to the hourly reports but are of more interest to controllers because they indicate significant weather changes and require a new ATIS recording. They are issued whenever the weather changes considerably (such as 0.02-inch change in altimeter or the sky cover changing from clear to partly cloudy). They are disseminated and used in the same way as the SA messages.

d) Winds Aloft Report (Figure 6-8)

Winds aloft reports are issued twice a day, usually once at 0000Z and again at 1200Z. They give wind direction and velocity at altitudes from 1000Z AGL to 16,000 feet AGL. As in the example, the first column of numbers are the altitudes in the 1000's of feet AGL, the column of numbers after the dash is the direction and the numbers following the slash are the velocity in knots.

FIGURE 6-5. HOURLY WEATHER REPORTS BETWEEN THE ARRIVAL RADAR POSITIONS

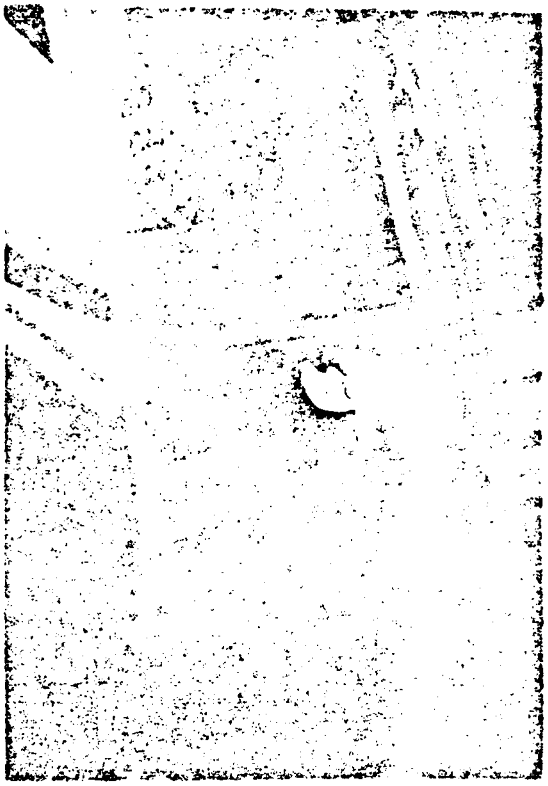


FIGURE 6-6. HOURLY WEATHER REPORTS AT DEPARTURE RADAR WEST

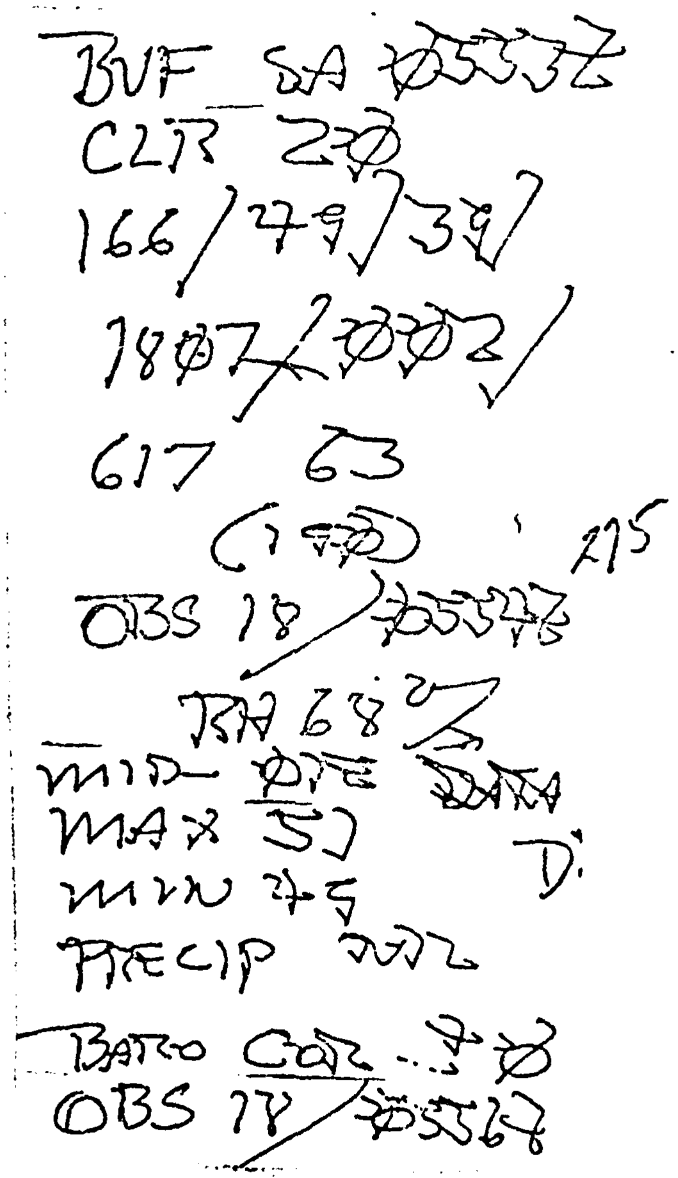


FIGURE 6-7. HOURLY WEATHER REPORT AND ADDITIONAL DATA

ØØZ WINDS ALOFT

1- 24Ø/12

2- ~~24Ø/12~~

235/14

3- 235/~~13~~

4- 25Ø/13

5- 25Ø/13

6- 255/15

7- 26Ø/15

8- 26Ø/17

9- 26Ø/20

12- 27Ø/24

14- 265/26

16- 265/32

OBS 18/ ~~[illegible]~~ FT

FIGURE 6-8. WINDS ALOFT REPORT FROM WSFO

In the Cab, FD removes the winds aloft report from the electrowriter and either throws it away or places it at the NOTAM Board. It is not used in the Cab.

In the TRACON, AD removes it from the electrowriter and posts it between the Arrival Radar positions. It is used to relay the information to pilots upon request and sometimes to compensate for wind when vectoring aircraft. It remains posted until the next one is received.

6.1.2 ARTCC

The Cleveland ARTCC sends the Cab and TRACON SIGMETS, Convective SIGMETS and AIRMETS over the FDEP as general information (GI) messages. Some weather information, when requested by controllers, may be telephoned by the ARTCC to the tower.

a) SIGMETs (WS), Convective SIGMETs (WST) (Figure 6-9)

SIGMETs generally advise of potentially hazardous weather, such as severe icing, turbulence, hail, or thunderstorms expected within the Cleveland ARTCC region. Convective SIGMETs are similar to SIGMETS and generally pertain to widespread thunderstorms.

The information contained in SIGMETs usually includes a message identifier, area covered, valid times, type of hazard, movement and other information.

The example shown in Figure 6-9 is translated as follows.

GI W1 Identifies message as General Information.

Convective SIGMET 24E This is a Convective SIGMET Bulletin, the 24th issued this day for the Eastern U.S.

211055Z It is issued at 1055 Zulu on the 21st of the month.

IN OH from 40SE FWA to 35W IND The storm advisory is for Indiana and Ohio. It is located from 40 nautical miles (NM) southeast of Fort Wayne, Indiana to 35 nautical miles west of Indianapolis, Indiana.

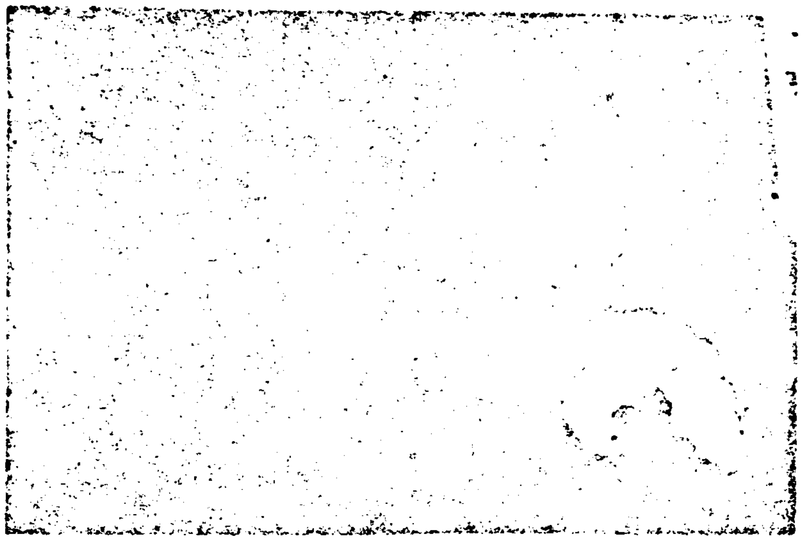


FIGURE 6-9. SIGMET AT CAB COORDINATOR POSITION

LN TSTMS 25 MI WIDE MOVG FROM 3215 The system is a line of thunderstorms 25 NM wide moving from 320° at 15 knots.

MAX TOPS to 450 The tops of the storms go to 45,000 feet.

FCST TO 1255Z The forecast is valid until 1255 Zulu.

DVLPG LN WL MOV SEWD 15 KT THRU 1255Z The developing line of thunderstorms will move southeastward at 15 knots, through 1255 Zulu.

WC 211109Z The message is from "WC" at Cleveland ARTCC and is sent on the 21st Day of the Month at 1109 Zulu.

In the Cab, FD removes the message from the FDEP, records it on the ATIS if the storm is within a 50 mile radius of the airport, and places it on the NOTAM board. When the valid time ends, it is thrown away.

In the TRACON, AD removes the message from the FDEP and places it at his position. If the SIGMET contains information that affects Buffalo and is not already known, it may be brought to the WS's attention. Generally, controllers feel they are not particularly useful.

b) AIRMETS (WA)

AIRMETS are similar to SIGMETS but advise of hazards to General Aviation aircraft. These conditions include moderate icing or turbulence, strong surface winds and widespread low ceilings (less than 1000 feet) or restricted visibility (less than 3 miles).

When an AIRMET is received, FD puts it on the ATIS, relays it to the FSS by telephone, and posts it at the NOTAM board. It may be mentioned to the other controllers if the information affects Buffalo.

In the TRACON, AD leaves it at his position and brings it to the attention of the WS. It is usually not disseminated to the other controllers.

6.1.3 National Weather Service (NWS)

The NWS sends Severe Weather Watch Bulletins (WW) to the Watch Supervisor via the telephone. These bulletins advise of tornado or thunderstorm watches or high winds. When received, the WS writes information down and calls the CIC. They verbally disseminate the message to their controllers. Written copies are posted at LC in the Cab and between the Arrival Radar positions in the TRACON. The information is relayed to pilots when they are approaching Buffalo or prior to their departure. They contain information similar to SIGMETs but are considered more timely and pertinent to the Buffalo area.

6.1.4 Pilots

Pilots issue weather information to controllers in the form of Pilot Weather Reports (PIREPs). These reports usually contain information concerning aircraft icing, Clear Air Turbulence (CAT), cloud tops, or other hazards. Some are issued spontaneously by pilots but many are requested by controllers. PIREPs are received by LC and any of the radar positio . In the TRACON, the information is written down by the controller receiving it, verbally disseminated to the other controllers and the supervisor and then passed on to the AD position, who calls the FSS. If the Cab is affected, the WS will call the CIC, who in turn notifies his controllers. When received by LC, the Cab controllers are notified by him and the CIC notifies the WS. The WS notifies his controllers and FD notifies the FSS. If the described condition is moderate or greater turbulence, or icing, the message is put on the ATIS.

6.1.5 FSS

The most common weather information received from the FSS are the PIREPs which are sent on the electrowriter. Most of these are not particularly useful because it is usually the Cab or TRACON that receives the PIREP from the pilot, then relays it to the FSS. Therefore, any controllers that need this information have already been verbally advised.

PIREPs that are not originally reported to the tower are disseminated when received from the FSS. In the Cab, FD removes the message from the electrowriter and notifies the CIC, who notifies his controllers, if they are affected. It is posted at the NOTAM board. In the TRACON, AD removes the message and gives it to the WS. He notifies the affected controllers and posts it with the weather messages between ARR-W and ARR-E.

Occasionally, other weather information is received over the electrowriter from the FSS. Generally, these are not used in the Cab or TRACON.

6.1.6 NFIA

Hourly (SA) and Special (SP) Surface Aviation Weather Reports are received from the Air Force weather observers at Niagara Falls International Airport (NFIA).

a) Surface Aviation Weather Report

Observations for the NFIA SA report are usually taken at 5 minutes before the hour and are sent 2 or 3 minutes later. The SA message is of a similar format to the Buffalo SA with a few differences.

The example (Figure 6-10) is translated as follows:

IAG SA 0455 This is a regular hourly message from NFIA and is issued at 0455 Zulu.

CLR 20 The sky is clear and visibility is 20 miles.

170/51/34 The sea level pressure is 1017.0 millibars/the temperature is 51°F/the dewpoint is 39°F.

E 230 06 The wind is estimated to be from 230° at 6 knots (the wind instruments were out of service).

IAG SA Ø455
CLR 2Ø
17Ø/51/39
E23Ø/Ø6
ACSTG 3ØØ5

FIGURE 6-10. HOURLY WEATHER REPORT FROM NFIA

ALSTG 3003 The current altimeter reading is 30.03 inches.

57 (initials) The report was issued at 0457 Zulu by (initials).

In the Cab, these reports are discarded.

In the TRACON, AD removes the report from the electrowriter and posts it between the Arrival Radar consoles. It is used by these controllers in the same way as the BUF SA is used. The WS also reads the message to be aware of the overall operation.

b) SP

The SP contains the same information as the SA and is used in the same manner.

6.2 WEATHER INFORMATION SENT FROM BUFFALO TOWER

The Buffalo Tower sends weather information to the same organizations they receive it from, although information sent is less formal and regular than that received. The equipment used in sending this information includes the electrowriter, FAA radios, and the telephone system.

6.2.1 WSFO

LC issues visibility information to the WSFO whenever visibility goes under 4 miles. He updates the reading whenever there is a change of 1/8 of a mile, until the visibility again exceeds 4 miles. To do this, LC uses the Visibility Reference Chart (Figure 4-1) and gives the reading to the CIC and FD, who issue it on the electrowriter. The TRACON also receives the message. AD informs the WS and posts the electrowriter message between ARR-W and ARR-E. It is removed when a more recent one is received, or the visibility improves to over 4 miles.

6.2.2 ARTCC

The ARTCC receives weather information through communications with the TRACON controllers and WS. This information may be received indirectly during regular communications, or may be a result of a direct request concerning visibility or other weather conditions.

6.2.3 NWS

The NWS, located near the TRACON in the terminal building, does not usually receive weather information from the tower. Occasionally, however, they telephone the WS to get specific weather information.

6.2.4 Pilots

Important weather information is issued to pilots by controllers using the FAA radios or via the ATIS recording. Weather information is given as a requirement, a courtesy, or upon request. Information given to pilots includes current visibility, cloud ceiling, altimeter, wind speed and direction, and other relevant observations. On request, pilots are also issued forecasts of expected conditions in the Buffalo area.

Any controllers communicating with pilots may issue weather information. CD relays the ATIS information to pilots of departing aircraft that do not have the ATIS code. GC sometimes issues wind to taxiing aircraft and to all taxiing departures that request a secondary runway. LC issues wind to arrivals and visibility (when using RVR) to both arrivals and departures. The Arrival Radar controllers give the ATIS information to arrivals that do not have the ATIS code, and the RVR readings when it is in use. All the radar controllers occasionally issue the altimeter reading, usually upon pilot request to verify an aircraft altimeter setting.

6.2.5 FSS

PIREPs are sent to the FSS by the Cab or TRACON as discussed in Section 6.1.4 Other weather information is sent to them upon request, usually by the WS over telephone.

6.2.6 NFIA

Weather information is relayed to the Niagara Tower upon request. These requests may concern visibility or expected conditions. They are usually made of the WS or AD, who give the desired information.

6.3 SUMMARY

The hourly (SA) and special (SP) Surface Aviation Weather Reports from the WSFO are considered by the controllers to be the most useful of all the weather information that they receive from other facilities. Most of the other weather information received by the tower is used by controllers and supervisors for general knowledge of current and expected weather conditions in the Buffalo area and is not specifically acted upon.

Unusual aspects of the weather information received at the Buffalo airport include the hourly and special Surface Aviation Weather Reports received from NFIA which are used by the WS, for his general knowledge, and ARR-W while monitoring aircraft approaching the airport.

Buffalo has more severe winters than the other airports studied to date in this series (Albuquerque, Atlanta, and Boston). The controllers indicated that the area gets approximately 3 storms a week of about 6 inches of snow each. This tends to slow things down slightly but rarely closes the airport.

Buffalo has a higher percentage of Instrument Approaches versus Total Operations compared with the other three airports (Table 6-2), an indication of generally poorer visibility conditions at Buffalo. However, the differences are only small, with the percentage of instrument approaches at Buffalo (11.0% for FY79) being only slightly higher than those of Atlanta (10.5%) and Boston (10.1%) in the same period. All three are well above Albuquerque, however, where only 0.8% of the total approaches were instrument approaches.

TABLE 6-2. INSTRUMENT APPROACHES AS A PERCENTAGE OF TOTAL OPERATIONS AT THE FOUR AIRPORTS STUDIED, FOR FY78 AND FY79

	FY78	FY79
ABQ	0.5%	0.8%
ATL	9.5%	10.5%
BOS	9.4%	10.1%
BUF	10.5%	11.0%

Derived from Tables 4 and 14 of "FAA Air Traffic Activity" Fiscal Year 78 and Fiscal Year 79.

APPENDIX A

APPROACH DATA WORKSHEET

1. IDENTIFIER

2. MONTH AND YEAR

3. FACILITY

☐ VFR TOWER (Instrument approaches controlled by CIFRR, RATCC, or RAPCON)

☐ APPROACH CONTROL, CIFRR, RAPCON, RATCC, OR VFR TOWER (Instrument approaches controlled by ARTCC)

☐ ARTCC

4. ARTCC AREA

5. AIRPORT

6. LOCATION

7. SUMMARY DATA ▶	A. AIR CARRIER	B. AIR TAXI	C. GEN. AVIATION	D. MILITARY	E. TOTAL

APPROACH TALLY (Subdivide the grid below proportionate to the approaches of each user category of aircraft and label the areas. Place a check or "X" in a box for each approach.)

FAA Form 7230-16 (6-71) Supersedes FAA Form 399

TRACON

HOURLY TRAFFIC

	PRIMARY					SECONDARY					OVERFLIGHT					TOTAL
Hour	ACR	AT	GA	MIL	TOT	ACR	AT	GA	MIL	TOT	ACR	AT	GA	MIL	TOT	GR. TOTAL
0500-1100																
1200																
1300																
1400																
1500																
1600																
1700																
1800																
1900																
2000																
2100																
2200																
2300																
2400																
0100																
0200																
0300																
0400																
TOTAL																

USERS: Approach Control Facilities (TERMINAL)

INSTRUMENT OPERATIONS

Mail ORIGINAL of this form to Washington Office, AMS-200

Use reverse for ST ... operations.

FACILITY NAME

LOCATION

(1-2) MO. (3-4) YR. (6-9) LOCATION IDENT

(10) FACILITY TYPE ("X" one)
(11)
- ☐ A. CIFRR, RAPCON, RATCC, OR RAYCP
- ☐ B. RADAR APPROACH CONTROL TOWER
- ☐ C. LIMITED RADAR APPROACH CONTROL TOWER
- ☐ D. NON-RADAR
- ☐ H. CERAP

FACILITY TYPE CHANGED (12) ☐ YES

IF DAILY HOURS OF OPERATION HAVE CHANGED, ENTER NEW HOURS → HRS (13-14)

FACILITY USE

DAY	PRIMARY AIRPORT AC	PRIMARY AIRPORT AT	PRIMARY AIRPORT GA	PRIMARY AIRPORT MI	PRIMARY AIRPORT TOTAL	SECONDARY AIRPORTS AC	SECONDARY AIRPORTS AT	SECONDARY AIRPORTS GA	SECONDARY AIRPORTS MI	SECONDARY AIRPORTS TOTAL	OVERFLIGHTS AC	OVERFLIGHTS AT	OVERFLIGHTS GA	OVERFLIGHTS MI	OVERFLIGHTS TOTAL	DAILY TOTAL (IOE)	GRAND TOTAL
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
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25																	
26																	
27																	
28																	
29																	
30																	
31																	
NO. DAYS																	

FAA Form 7230-26 (8-78) SIDE 1 RIS: AT 7230-151

FOLD

THIS SIDE FOR STAGE III/TCA USE ONLY	ALL FACILITIES REPORTING STAGE III/TCA MUST COMPLETE →	(1-2) MO. (3-4) YR	(5-9) LOCATION IDENT.	ADP CONTROL 16-5 STAGE III/TCA NEW THIS MONTH (14) [ ] YES

INSTRUCTIONS

This form is designed to enable the users to arrive at the GRAND TOTAL by folding the form to position the two DAILY TOTALS conveniently side by side. 1. Fold on fold marks provided in the top and bottom margins. 2. Align the broken rules in the left margin with the heavy horizontal rules on the front to match keypunch numbers on the reverse with those on the front. 3. Add like-numbered items to arrive at GRAND TOTAL. 4. UNFOLD form before mailing to AMS-200

DAY	PRIMARY AIRPORT					SECONDARY AIRPORTS					OVERFLIGHTS					DAILY TOTAL (16-79) (14-1)
	AC	AT	GA	MI	TOTAL	AC	AT	GA	MI	TOTAL	AC	AT	GA	MI	TOTAL	
1																(16 19)
2																(20 23)
3																(24 27)
4																(28 31)
5																(32 35)
6																(36 39)
7																(40 43)
8																(44 47)
9																(48 51)
10																(52 55)
11																(56 59)
12																(60 63)
13																(64 67)
14																(68 71)
15																(72 75)
16																(76 79)
																(14-2)
17																(16 19)
18																(20 23)
19																(24 27)
20																(28 31)
21																(32 35)
22																(36 39)
23																(40 43)
24																(44 47)
25																(48 51)
26																(52 55)
27																(56 59)
28																(60 63)
29																(64 67)
30																(68 71)
31																(72 75)
TOTAL																
	(17 21)	(22-26)	(27-31)	(32-36)		(37-41)	(42-46)	(47-51)	(52-56)		(57-61)	(62-66)	(67-71)	(72-76)		
1/																

1/ FACILITY USE

SIDE 2

FOLD

FAA AC 70-4018

USERS: All ATCTs

AIRPORT TRAFFIC RECORD

Mail ORIGINAL of this form to Washington Office, AMS-30)

FACILITY NAME

LOCATION

(1-2) MO. (3-4) YR (5-9) LOCATION IDENT

(10-1) FACILITY TYPE ("X" one)

(11) APPROACH CONTROL TOWERS: ☐ A. RADAR ☐ C. LIMITED RADAR ☐ D. NON-RADAR (Also submit FAA Form 7230-26)

☐ E. VFR TOWER (Continue on reverse)

FACILITY TYPE CHANGED (12) ☐ YES

IF DAILY HOURS OF OPERATION HAVE CHANGED, ENTER NEW HOURS — HRS (77-78) 10ths (79)

AIRPORT OPERATIONS COUNT

DAY (15-16)	ITINERANT AC (17-21)	ITINERANT AT (22-26)	ITINERANT GA (27-31)	ITINERANT MI (32-36)	TOTAL ITINERANT	LOCAL CIVIL (37-41)	LOCAL MILITARY (42-46)	TOTAL LOCAL	TOTAL OPERATIONS	SPECIAL USE (47-51)
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
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22										
23										
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25										
26										
27										
28										
29										
30										
31										
TOTAL										

FAA Form 7230-1 (8-76) SUPERSEDES PREVIOUS EDITION AND FAA FORM 7230-11 — RIS: AT 7230-99

THIS SIDE **FOR USE BY VFR TOWERS ONLY** (ALL Approach Control Terminals MUST use FAA Form 7230-26)	ALL VFR Towers recording Instrument Operations on this side MUST COMPLETE →	(1-2) MO. (3-4) YR.	(5-8) LOCATION IDENT	ACP CONTROL 13-4

INSTRUMENT OPERATIONS

DAY	AC	AT	GA	MILITARY	TOTAL (10-2) (16-1)
1					(16-19)
2					(20-23)
3					(24-27)
4					(28-31)
5					(32-35)
6					(36-39)
7					(40-43)
8					(44-47)
9					(48-51)
10					(52-55)
11					(56-59)
12					(60-63)
13					(64-67)
14					(68-71)
15					(72-75)
16					(76-79)
					(14-2)
17					(16-19)
18					(20-23)
19					(24-27)
20					(28-31)
21					(32-35)
22					(36-39)
23					(40-43)
24					(44-47)
25					(48-51)
26					(52-55)
27					(56-59)
28					(60-63)
29					(64-67)
30					(68-71)
31					(72-75)
TOTAL					
	(17-21)	(22-26)	(27-31)	(32-36)	
1/					

REMARKS

1/ FACILITY USE

MONTH/YEAR ________ **SURVEILLANCE APPROACH LOG** PAGE/ ________

DAY	IDENTIFICATION	TYPE	WEATHER	RWY	TIME	CTLR	ASR	No-GYRO DF	REMARKS:

Local Form

U.S. DEPARTMENT OF TRANSPORTATION
RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION
TRANSPORTATION SYSTEMS CENTER
KENDALL SQUARE, CAMBRIDGE, MA. 02142

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF TRANSPORTATION
613

U.S. MAIL

TECHNICAL INFORMATION BRANCH SHEET 1 OF 1

REPRODUCTION ASSEMBLY SHEET

TITLE	SPT NO.	TEXT PGS. 26-2
BUFFALO TOWER	PPA NO.	FIGS.

LEFT	RIGHT	PAGE NUMBER	TABLE NUMBER	FIGURE NUMBER	HALFTONE	TURN PAGE	VERT. PAGE	FOLD-OUT	SPECIAL INSTRUCTIONS
	✓	COVER							
✓		INSIDE COVER							
	✓	TOC							
✓		ii	BLANK						
✓		[illegible]							
	✓	1-1							
		to							
✓		1-8							
	✓	2-1							
		to							
✓		2-22							
	✓	3-1							
		to							
✓		3-[illegible]	BLANK						
	✓	4-1							
		to							
✓		4-22							
	✓	5-1	BLANK						
		to							
✓		5-26							
	✓	6-1							
		to							
✓		[illegible]	BLANK						
	✓	[illegible]-1							
		to							
✓		A-2[illegible]							
		INSIDE BACK COVER							
		Back Cover							

ASSEMBLER DATE

[illegible signature]

LMED

-8