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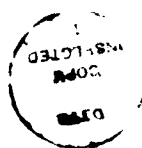
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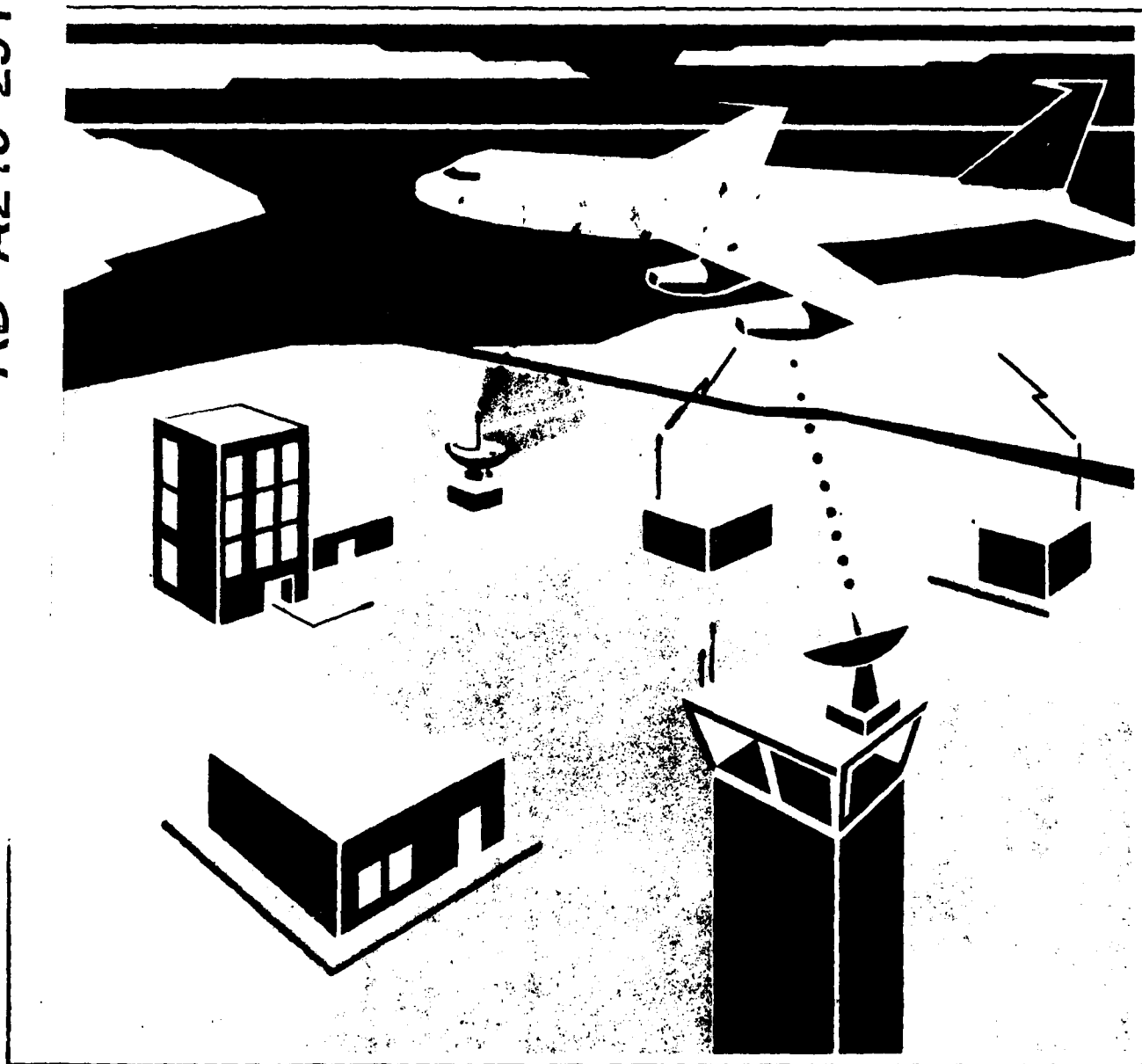


U.S. Department
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National Airspace System

Airport Movement Area
Control Operational Concept
NAS-SR-13211

AD-A216 251



September 1989

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Advanced System Design Service
Washington, D.C. 20591

**National Airspace System
Airport Movement Area
Control Operational Concept
NAS-SR-13211**

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Final Report

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U.S. Department
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16. Abstract This concept of operations is one of a set that in total will describe the operation on the National Airspace System (NAS) when the projected upgrades are completed. As described in the National Airspace System System Requirements Specification (NASSRS), Airport Movement Area Control involves the control and separation of aircraft and vehicles on the movement areas of qualifying aerodromes in all weather conditions, and includes the separation of aircraft from obstructions. This document describes specialists' functions necessary for the control of the airport movement area, most importantly, determining the identity and location of vehicles and aircraft on the movement area. This operational concept also describes interactions and information passed between the user, specialists, and NAS subsystems involved with airport movement area control in order to provide a common perspective for those engaged in this control.					
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1.0 INTRODUCTION

1.1 Background

The control and separation of aircraft and vehicles on the airport movement area is based mainly on radio and visual contact between the aircraft and controller, supplemented (at many major facilities) by the controller's use of Airport Surface Detection Equipment (ASDE)-3. Several control positions as well as a supervisory position, where available, are involved in providing this control in the Air Traffic Control Tower (ATCT). The positions are supported by various automated aids which are provided via the Tower Control Computer Complex (TCCC) Position Console or tower workstation. Weather information, air traffic control clearances, and movement instructions including departure sequencing are provided to the pilot during airport movement area control operations.

1.2 Objective

The purpose of this document is to present an operational concept for Airport Movement Area Control that outlines the basic capabilities of and necessary interactions within the National Airspace System (NAS) to provide functional control of the movement area. This area includes all runways, taxiways, and other areas of an airport that are used for taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and parking areas. At airports with a tower, specific approval must be obtained from Air Traffic Control (ATC) before an aircraft or ground vehicle may enter the movement area.

A NAS Operational Concept is intended as an interpretive tool to support the transition from NAS System Requirements Specification (NASSRS) to NAS design. This operational concept is intended to faithfully reflect and clarify the requirements in the NASSRS, NAS-SR-1000, in order to provide an operational perspective for system development, implementation, testing, and evaluation. In addition, it provides to management and technical personnel of the Federal Aviation Administration (FAA) and other involved organizations a general description of airport traffic area control operations. Airport traffic area control operations depend on both surveillance coverage of and communications with aircraft and other vehicles on the movement area during all airport weather and lighting conditions. The focus of this Operational Concept will be to illustrate the specialist/user interactions within the NAS, i.e. the interface between the tower controllers and the pilot, necessary to provide airport surface control.

1.3 Scope

This document covers Airport Movement Area Control requirements as specified in Section 3.2.11 of the NASSRS. The six main paragraph topics in Section 3.2.11 are as follows:

- 3.2.11.A Identifying and locating aircraft and vehicles on airport movement areas within specified weather conditions.
- 3.2.11.B Displaying position data for aircraft and ground vehicles on airport movement areas under all lighting conditions.
- 3.2.11.C Displaying aircraft position and related data in relation to appropriate geographic information.
- 3.2.11.D Providing specialists with an unobstructed view of the airport movement area.
- 3.2.11.E Providing airport movement area control on a continuous basis at qualifying airports.
- 3.2.11.F Providing communications with aircraft and vehicles in the movement area as well as alternative forms of communication in the event of failure of normal voice and data communications.

Each paragraph in the Airport Movement Area Control NASSRS section specifies these requirements for "qualifying aerodromes," defining the scope of this operational concept. Focus is, therefore, on towered airports with Advanced Automation System (AAS) automation in the form of TCCCs and those with ASDE-3.

This operational concept will address controller/user functionality as opposed to procedures to illustrate airport movement area control at these "qualifying aerodromes." There are over 10,000 airports in the U.S. serving all types of aviation. They differ in many respects--capacity, equipment (surveillance, communications, tower), geography, configuration, gate areas, ramp towers, fleet mix, helicopter traffic, and weather. Operational procedures are site-adapted to accommodate this variability, but common functions are provided by controller positions supported by common NAS subsystems and information flows.

1.4 Methodology

The methodology used in providing perspective and insight into this operational concept provides information in a number of different ways. The material focuses on four different kinds of diagrams and/or accompanying descriptive information described below:

1. OPERATIONAL BLOCK DIAGRAM/DESCRIPTION. The operational block diagram illustrates the connectivity between major elements of the NAS, i.e., processors, specialists/controllers, and the user, for

those elements that support the service. The operational block diagram in this Operational Concept is extracted from the overall NAS Operational Block Diagram.

- a. Each specialist/controller (if any) is indicated by a number. This number remains the same in every operational concept.
 - b. Dotted lines segregate facilities.
 - c. Solid lines show digital data flow. Voice data flow is not shown.
 - d. The blocks within each facility are the major processors.
2. OPERATIONAL FLOW DIAGRAM/DESCRIPTION. The operational flow diagram and associated description for each specialist/controller provides more detail about the inputs, processes, outputs, and interfaces for each operator. Operational flow diagrams are used to functionally describe the products and services of individual specialists/controllers. The diagrams show major actions only. Principal features of an operational flow diagram include the following:
- a. Dotted lines segregate facilities.
 - b. White boxes indicate specialist/controller/user functions. Shaded boxes indicate hardware.
 - c. The functions listed by lower case alphanumeric characters in the white and shaded boxes are explained in the text.
3. OPERATIONAL SEQUENCE DIAGRAM/DESCRIPTION. The operational sequence diagram and associated description show a typical sequence of steps taken by operators/users in providing the service. Principal features of an operational sequence diagram include the following:
- a. Users and specialists/controllers involved with providing the service are listed along the vertical axis. When required for clarity, other FAA facilities may also be listed on the vertical axis.
 - b. The horizontal axis represents time. Sequential events or functions performed by an operator/user are indicated within separate boxes. Events which may occur simultaneously or near-simultaneously are shown vertically. The numbers on the right side of the blocks refer to numbers in the text.

- c. Decision points or points where alternate paths may be followed are indicated by a diamond shape.
 - d. Circles are connectors and indicate exit to, or entry from, another diagram. Circles with an alphabetic character connect either to another sheet of the same diagram or to another diagram; the relevant figure number is listed underneath if connection is to a different diagram.
4. OPERATIONAL SCENARIO/DESCRIPTION. The operational scenario and associated description depict a specific predefined situation and illustrate a particular subset of the generalized operational sequence or an unusual situation not covered by the operational sequence diagrams. Principal features of operational scenario diagrams include the following:
- a. Users and specialists/controllers involved with providing the service are listed along the vertical axis.
 - b. The horizontal axis represents time. Sequential events or functions performed by an operator/user are indicated within separate boxes. The numbers on the right side of the blocks refer to numbers in the text.
 - c. Shaded portions of boxes represent machine actions.

1.5 Document Organization

The remainder of this document is devoted to the main body, contained in Section 2, which is organized into six subsections. The text in these subsections revolves around the diagrams described in the previous subsection. Section 2.1 provides an Operational Block Diagram which pictorially illustrates the connectivities required to provide airport movement area control functions. Section 2.2 elaborates by identifying the inputs, outputs, processes, and interfaces necessary to provide the information flow for this control. Section 2.3 presents the functions of the tower controllers providing the control of the airport movement area. Section 2.4 offers in table form the correlation between NASSRS requirements pertaining to airport movement area control and the subsections of this document where these requirements are addressed. Section 2.5 graphically illustrates the range of typical movement area control Operational Sequences. And finally in Section 2.6, a set of three Operational Scenarios describe a hypothetical situation involving operational control of the airport movement area; the first scenario focuses on airport movement area control of a departing aircraft, the second scenario on an arriving aircraft, and the third scenario on movement area control of ground vehicles.

2.0 OPERATIONS

2.1 Support

An overview of the support facilities and systems for airport movement area control is presented in Figure 2-1. An Operational Block Diagram, Figure 2-2, shows the major information connectivities among the user, specialist positions, and system components for airport movement area control. NAS facilities, systems, and positions are discussed in Section 2.1.1; other organizations involved in airport movement area control as well as user systems are discussed in Sections 2.1.2 and 2.1.3, respectively.

2.1.1 NAS Facilities/Systems/Positions

Airport movement area control operations are supported mainly by the TCCC processing system. This system has the capability to process and display surveillance, flight, and environmental data. Some towers have an alternate TCCC configuration that will process and display only flight and environmental data. During Normal Mode of operation, the TCCC will exchange information with its parent Area Control Computer Complex (ACCC). When communications between the TCCC and the associated ACCC become unavailable, the TCCC will transition to Stand-Alone Mode. In this mode the TCCC will continue all processing and display functions possible, such as limited surveillance processing and flight data display. Airport environmental data processing and display will be the same in either mode.¹

While providing the information briefly outlined above, the TCCC will also afford tower controllers operational control of airport equipment, mainly airport surface and approach lights. A TCCC Position Console referred to here as a tower workstation serves as the interface between the tower processing system and the tower controllers. Automatic Terminal Information System (ATIS) broadcasts, providing recorded information about airport status and conditions, will be available to pilots through a listen-only Tower Communications System (TCS) connection.²

ASDE-3 will display aircraft and ground vehicle airport surface position data to the controllers at qualifying airports independent of the TCCC. A TCS will provide voice communications at ATCTs, enabling controllers to communicate with aircraft, each other, airport service vehicles, and other ATC facilities.

1 *Advanced Automation System System Level Specification, FAA-ER-130-005H-AP, p. 430.*

2 *Tower Communication System Functional Requirements, pp. 1-7, 1-8.*

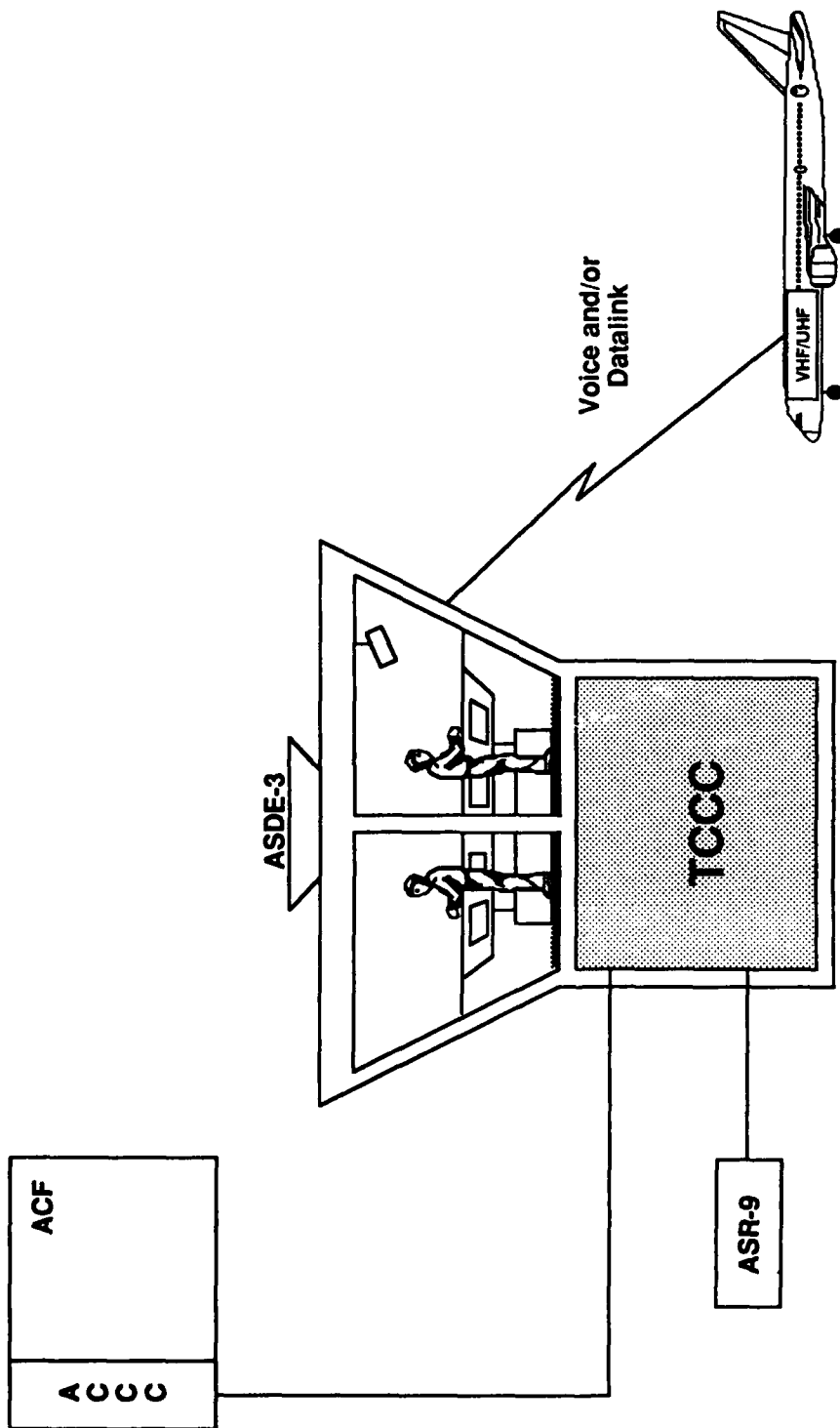


FIGURE 2-1
OVERVIEW OF NAS/USER SYSTEMS FOR
AIRPORT MOVEMENT AREA CONTROL

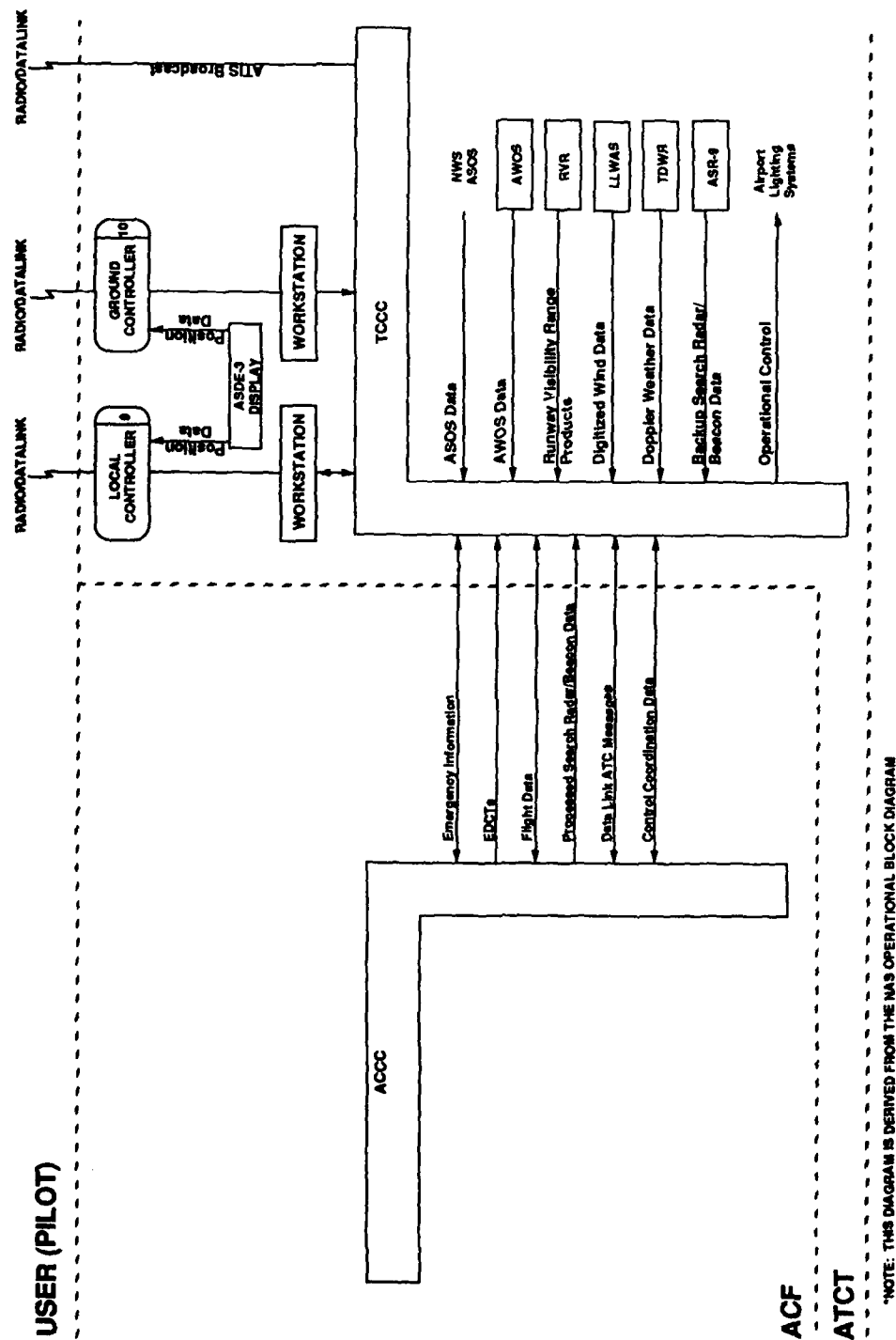


FIGURE 2-2
AIRPORT MOVEMENT AREA CONTROL
OPERATIONAL BLOCK DIAGRAM

All airport towers will have a TCS.³ In the event of a failure in the TCS, controllers will resort to the use of a light gun to communicate with aircraft and vehicles on the ground.

The function provided by each specialist position and a brief description of each follows. Included with each description is a reference to existing procedural manuals.

Position 10: Ground Controller

Function: Provides movement instructions to aircraft and ground vehicles

Description: The ground controller establishes and maintains the location and identity of all aircraft and vehicles on the airport movement area, generally inboard of the active runways, enabling the establishment and maintenance of effective ground traffic flows through communication with pilots and operators.

Procedures: Air Traffic Control (FAA order 7110.65E), Chapters 2-4;
Operational Position Standards, Chapter 23.

Position 9: Local Controller

Function: Issues clearance to takeoff and land

Description: The local controller receives control of an aircraft from the ground controller when it reaches the threshold of the departure runway on takeoff. The local controller clears aircraft to takeoff and to land on active runways. A local controller may expedite an aircraft's exit from the runway. Generally the local controller also controls all ground traffic outboard of the active runways.

Procedures: Air Traffic Control (FAA order 7110.65E), Chapters 2-4;
Operational Position Standards, Chapter 24.

2.1.2 Other Organizations

Virtually all aspects of actual airport movement area control are handled by FAA subsystems and FAA specialists. Commercially owned ramp areas, however, may allow an aircraft clearance from a gate via commercially owned communications systems such as Aeronautical Radio Incorporated (ARINC), however, control on the actual airport movement area is fully FAA supported.

2.1.3 User Systems

The user's interface to the controllers is UHF/VHF voice radio, with the prospect of datalink in the future. The TCS provides ATIS radio

3 Tower Communications System Functional Requirements, p. v.

broadcasts for pilots. ARINC may also provide the pilot information prior to entering the airport movement area.

2.2 Information

This section summarizes information generated by and received through performing airport movement area control services. Figures 2-3 and 2-4, Operational Flow Diagrams, picture the basic interactive communication flow between the two controller positions and the pilot, and the NAS subsystems on which this communication depends. The following paragraphs elaborate on specific information provided by the pilot, the controllers, and by NAS subsystems.

2.2.1 Information Pilots/Operators Will Provide

Pilots and operators of ground vehicles will provide their position and identification on the airport movement area to the controller when queried and will supply any weather or surface condition information appropriate.

2.2.2 Information Controllers Will Provide

Controllers will provide movement instructions to pilots and ground vehicle operators. The controller determines the location and identity of aircraft and vehicles on the airport surface. The controller effectively informs and separates all traffic.

Controllers provide information not only to the pilots and operators, but also to each other.

- Local and ground controllers verbally coordinate active runway crossings.
- Flight strips are routed to the next controller position as directed by the previous controller.
- Controllers provide each other relief briefings upon relinquishing a controller position to the next controller.

Any relevant information not contained in the most recent ATIS broadcast will be relayed to pilots and vehicle operators as needed. This could include recent runway or other hazardous conditions.

The TCS is required to provide not more than one hour of total system outage in 20 years.⁴ In the event of a radio communications failure,

⁴ Tower Communications System Functional Requirements, p. 4-1.

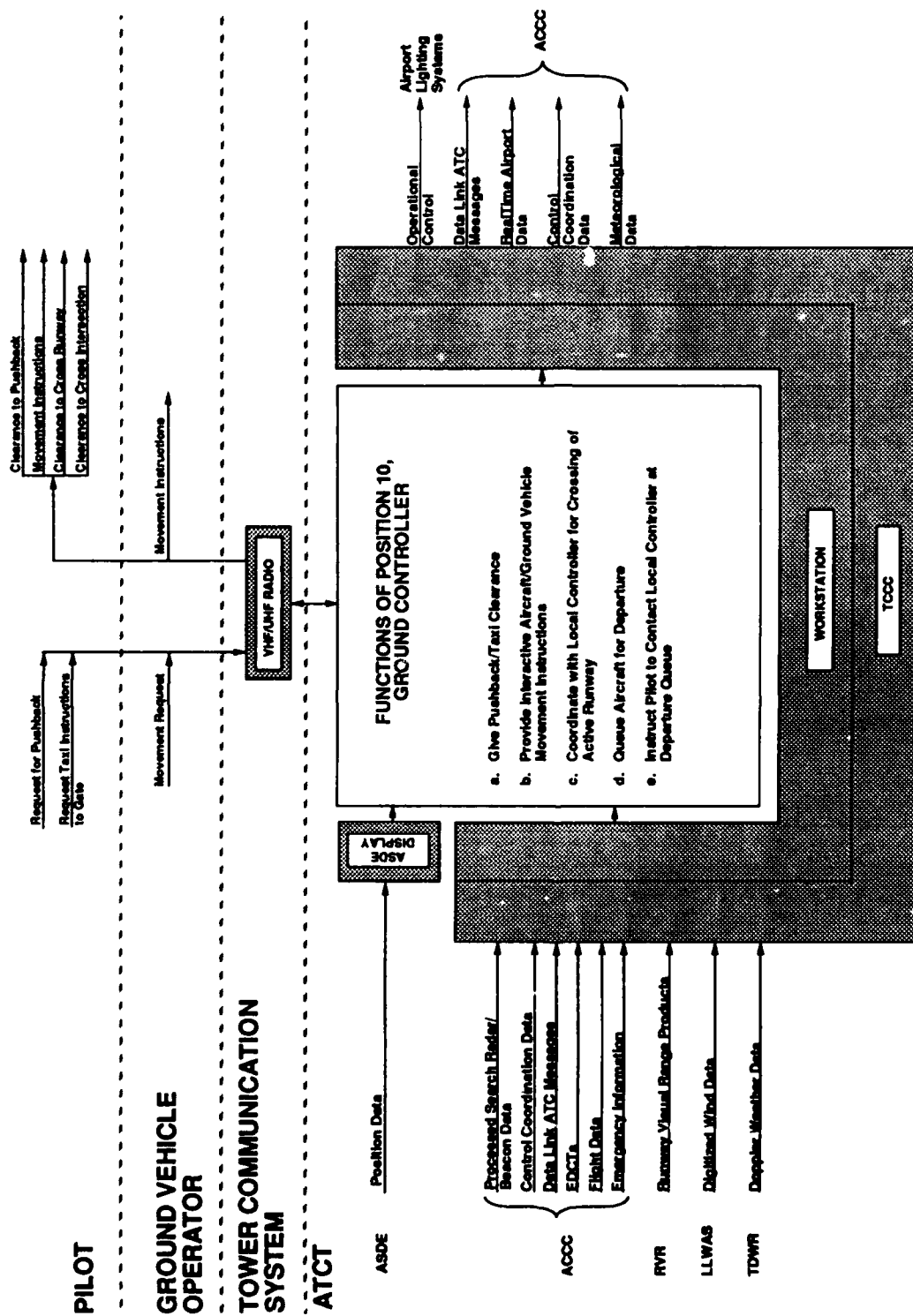


FIGURE 2-3
OPERATIONAL FLOW DIAGRAM FOR POSITION 10:
GROUND CONTROLLER FOR AIRPORT MOVEMENT AREA CONTROL

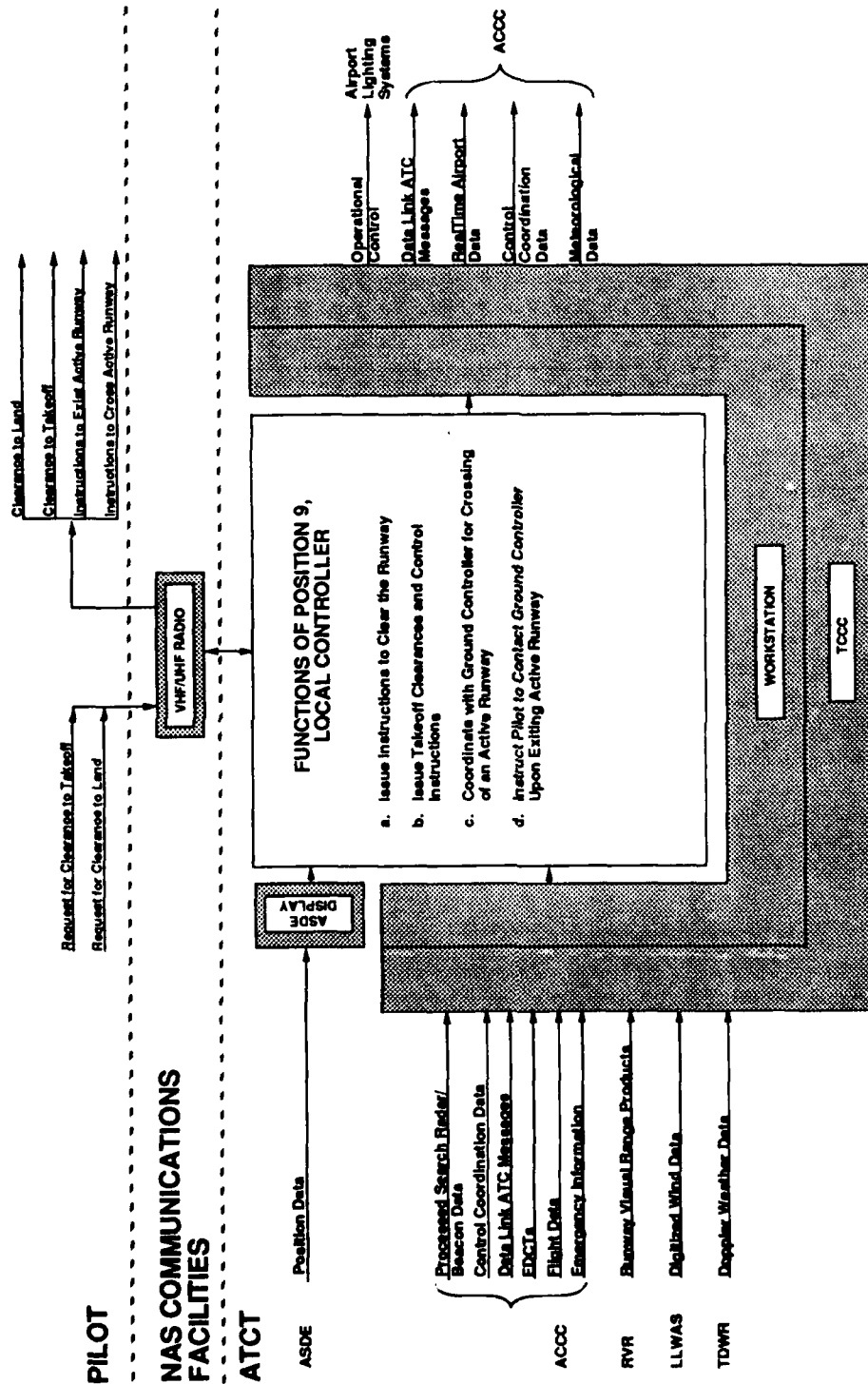


FIGURE 2-4
OPERATIONAL FLOW DIAGRAM FOR POSITION 9:
LOCAL CONTROLLER FOR AIRPORT MOVEMENT AREA CONTROL

controllers will utilize any existing alternative equipment installed in the tower cab, such as portable transceivers, battery operated UHF and/or VHF transmitters, etc. to mitigate the outage. In the event of radio failure in the plane, controllers will issue limited instructions using a light gun which can precisely aim a narrow beam of red, green, or white light.⁵

2.2.3 Information Provided by NAS Subsystems

At qualifying airports, the ASDE-3 will provide surveillance information on aircraft and vehicles, both moving and fixed, located on or near the surface of airport movement and holding areas during all weather and visibility conditions.⁶ This data will be displayed to the ground and local control positions independent of the TCCC.

The TCCC will automatically generate the ATIS message. This message will be updated with the arrival of a new surface observation (SA); with a change in the source data such as a runway configuration change, instrument approach change, etc.; and by a controller input.

2.3 Functions

The two tower operational control positions, Ground Control and Local Control, perform the functions summarized in Figures 2-3 and 2-4. As described in the scope of this document, these positions are site-adapted to accommodate the variety of capacities, configurations, and other specific idiosyncrasies among airports. The following controller functions described are, therefore, applicable to generic position specialist operations; in reality they may be carried out by multiple controllers or by a different variation of one of the two positions to balance the workload.

Close coordination is required between various controller positions. When a ground controller has an aircraft or ground vehicle holding short to cross an active runway, coordination with the local controller is necessary to give the aircraft or vehicle clearance to promptly cross.

Along with the local controller, a supervisory position or cab coordinator may coordinate arrival and/or departure information via interfacility communications systems. Delay information from the ACCC and other facilities will be received and passed to the appropriate controller(s) by the cab coordinator. This position does not exercise immediate control of the airport movement area, but provides another set of

5 *Private Pilot Manual*, p. 3-22.

6 *Airport Surface Detection Equipment ASDE-3*, p.1.

eyes observing the situation on the airport movement area and in the tower cab to facilitate operations on and around the airport surface. The supervisor may provide, interpret, or help coordinate information such as flow control restrictions. The cab coordinator or supervisor may also participate in runway configuration decisions.

The clearance delivery position in the tower cab has also been excluded from this itemized list of functional operational control of the movement area since this position does not directly exercise control of the airport movement area. Clearance delivery does, however, provide critical ATC information such as delay, weather, route, airport, and emergency information often regarding the aircraft's future movement on the airport surface.

Specific tasks/responsibilities are not included in the list of controller functions following in Figures 2-3 and 2-4 and the corresponding text. Position detail such as specialists monitoring their respective frequencies, visually monitoring the movement area, utilizing the ASDE and/or radar display, and monitoring their workstations will be considered a routine procedure as opposed to an operational function and will, therefore, not be depicted on the diagrams.

The following two sections elaborate on the diagrams. Sections 2.3.1 and 2.3.2 correspond to Figures 2-3 and 2-4.

2.3.1 Function of Position 10, Ground Controller

The ground controller mainly issues movement instructions to aircraft and ground vehicles. This position is responsible for establishing the location and identity of every aircraft and vehicle on the movement area. The following are more specific functions that this position performs.

a. Give Pushback/Taxi Clearance

If there is no need for delay, the ground controller will give the pilot clearance to pushback. When necessary, in tight taxiway to gate areas, the ground controller may also need to give clearance to start engines. If, because of a delay situation the ground controller cannot grant the clearance to pushback and taxi, the controller will notify the pilot, and a gatehold will continue to be in effect.

b. Provide Interactive Aircraft/Ground Vehicle Movement Instructions

Once the aircraft has pushed back from the gate and has started its engines, the ground controller will establish and maintain aircraft identity and location on the movement area. In the case that the airport

has a ramp tower, however, the ground controller will not be concerned with the guidance of the aircraft until the aircraft reaches the end of the airline-owned ramp area. The ground controller, mainly through visual contact, will be aware of all movement on the airport movement area. The ASDE-3 display in the tower will supplement this direct visual contact especially during foul weather and adverse lighting situations, providing position data on all aircraft and ground vehicles.

The ground controller will then plan, establish, and coordinate taxi traffic flow, anticipating and controlling aircraft and ground vehicle movement.

If a ground delay exists, the ground controller may instruct the pilot to taxi to a holding area or "penalty box" on the movement area, or the controller may instruct the pilot to taxi in a certain ground pattern.

These types of delay absorbing mechanisms are dependent on availability of gates and holding areas at an airport.

c. Coordinate with Local Controller for Crossing of Active Runway

If there is a potential conflict at a taxiway or runway intersection, the ground controller will direct an aircraft to hold short of a specified taxiway or runway until further notice or until a specific aircraft or vehicle passes. Interaction with the local controller is necessary for crossings of active runways. The ground controller will verbally notify the local controller that there is an aircraft or vehicle ready to cross the active runway. The local controller will subsequently notify the ground controller when there is a break in the arrival and departure flow on that runway. Arrivals and departures take priority over runway crossings.

d. Queue Aircraft for Departure

After interactively directing aircraft to the assigned runway via airport taxiways, instructing them to hold short and proceed as necessary, the ground controller will place the aircraft in the runway departure queue. Normally aircraft will be sequenced in the order in which they called the clearance delivery controller. The aircraft will wait in line, moving up the queue as instructed, as aircraft ahead are one by one cleared to takeoff by the local controller.

e. Instruct Pilot to Contact Local Controller at Departure Queue

The ground controller will instruct the pilot to contact the local controller when the aircraft is in the departure queue of the active departure runway.

2.3.2 Functions of Position 9, Local Controller

The local controller issues takeoff and landing clearances and helps in sequencing and coordinating arrivals and departures. The following is a list of more specific functions the local control position provides.

a. Issue Instructions to Clear the Runway

If necessary, the local controller may issue instructions to pilots to expedite the aircraft's exiting of the runway.

b. Issue Takeoff Clearances and Control Instructions

When an aircraft is first in the departure queue, the local controller will give the pilot clearance to takeoff, after which the pilot will taxi onto the runway and promptly depart.

c. Coordinate with Ground Controller for Crossing of Active Runway

The ground controller will verbally notify the local controller when there is an aircraft or vehicle ready to cross an active runway. The local controller will then notify the ground controller when there is a break in the arrival and departure flow on that runway. Arrivals and departures take priority over runway crossings.

d. Instruct Pilot to Contact Ground Controller upon Exiting Active Runway

Upon landing, the pilot will exit the active runway as promptly as possible. The local controller may clarify or expedite this process if necessary. The pilot will be instructed to contact the designated ground control frequency for any clarifications of movement instructions to the appropriate gate.

2.4 Correlation With Operational Requirements

Table 2-1 summarizes the correlation of the paragraphs of NAS-SR-1000 related to airport movement area control with pertinent paragraphs in this operational concept.

The fact that a correlation is shown between a requirements paragraph and a paragraph describing the controller function performed should not be construed as indicating that the requirement is completely fulfilled.

TABLE 2-1
AIRPORT MOVEMENT AREA CONTROL
OPERATIONAL REQUIREMENTS CORRELATION

NAS-SR-1000 Paragraph		Support	Information	Airport Movement Area Control Functions											
Paragraph		2.1.1 2.1.2 2.1.3	2.2.1 2.2.2 2.2.3	2.3.1 2.3.1.a 2.3.1.b 2.3.1.c 2.3.1.d 2.3.1.e 2.3.2 2.3.2.a 2.3.2.b 2.3.2.c 2.3.2.d	2.3	2.3.1 2.3.1.a 2.3.1.b 2.3.1.c 2.3.1.d 2.3.1.e 2.3.2 2.3.2.a 2.3.2.b 2.3.2.c 2.3.2.d									
3.2.11	General	X X X	X X X	X X											

2.5 Operational Sequences

Figures 2-5 through 2-7 illustrate control of the airport movement area through the following three control situations: departure of an aircraft, arrival of an aircraft, and movement of ground vehicles. A departure begins as the aircraft at the gate contacts clearance delivery for a pre-departure/route clearance and ends upon takeoff. Actual functional control on the airport movement area begins when the departing aircraft pushes back from the gate, however. Arrival control on the movement area begins with touchdown of the aircraft and continues through to the arrival gate or ramp. Functionally, the movement of ground vehicles on taxiways and runways is monitored as the movement of aircraft is monitored by the ground controller and coordinated with the local controller for active runway crossings. Since the operational goal of a ground vehicle does not include takeoff and landing, ground vehicle movement has been addressed in a separate operational sequence diagram.

These operational sequence diagrams generically describe the variety of interactions between the pilot, the ground vehicle operator, the ground controller, and the local controller to provide effective airport movement area control.

Chronologically illustrating the functional flow of airport movement area control between the pilot or operator and the key specialists or positions can be complicated; for clarity, certain lower level detail is not included. Continual responsibilities/tasks of the specialists such as monitoring their respective frequencies, visually monitoring the movement area, and monitoring their workstation (including equipment) are considered understood and, therefore, not depicted on the diagrams. Similarly, pilot tasks such as engine start are not represented. At any time unanticipated events can alter these sequences.

Ground Controller is abbreviated to GC, and Local Controller to LC where space is limited.

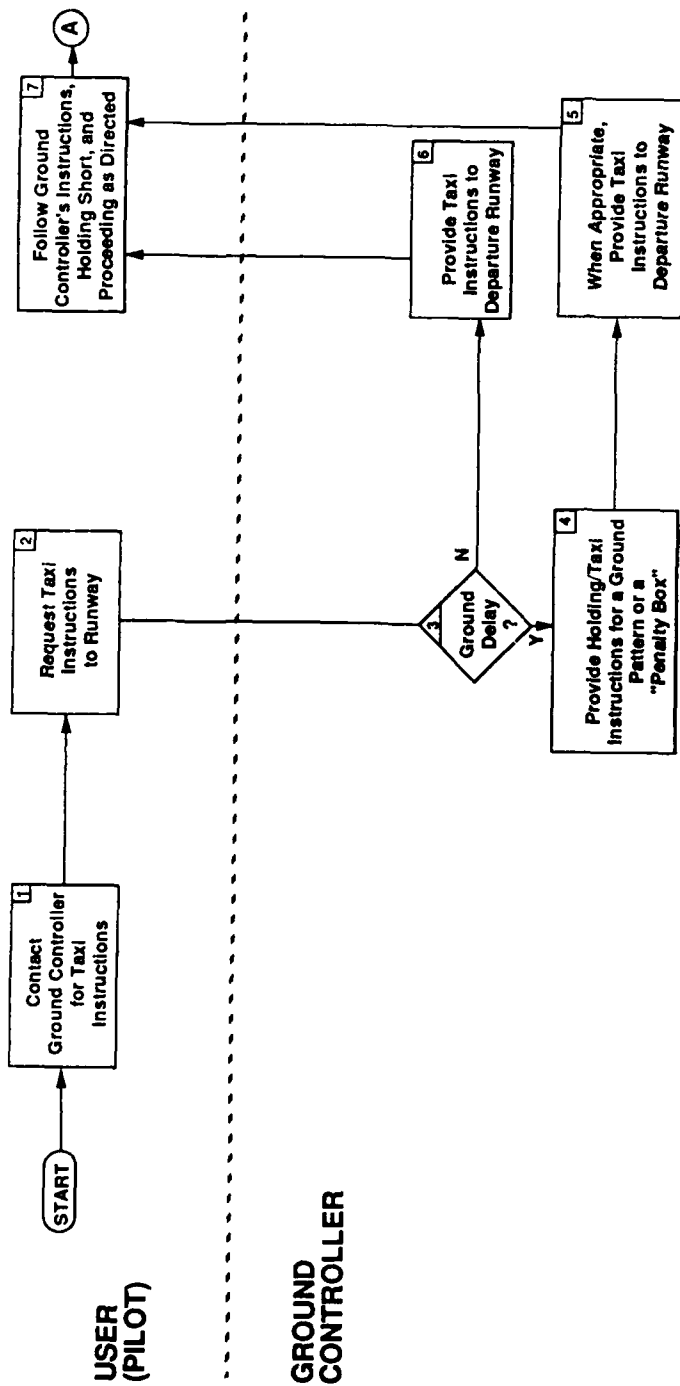


FIGURE 2-5
AIRPORT MOVEMENT AREA CONTROL
DEPARTURE OPERATIONAL SEQUENCE DIAGRAM

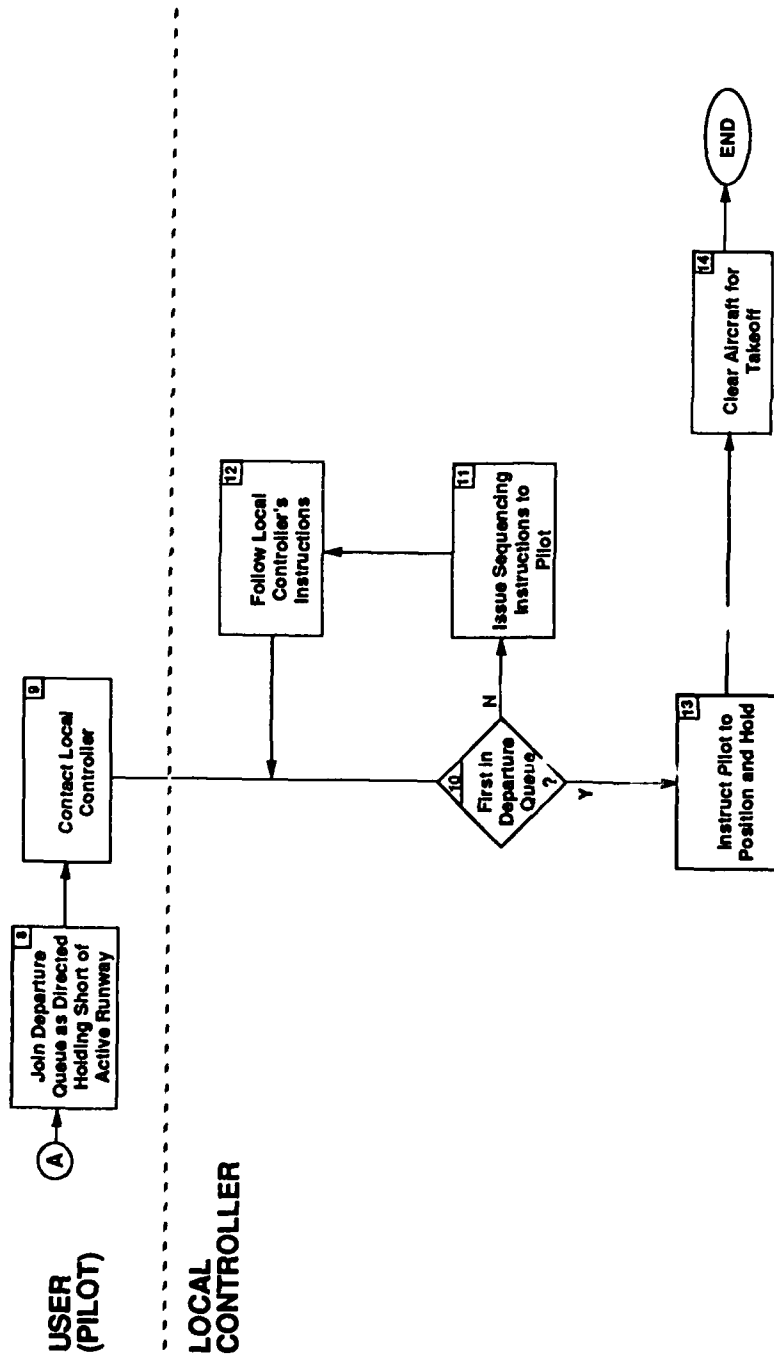


FIGURE 2-5
AIRPORT MOVEMENT AREA CONTROL
DEPARTURE OPERATIONAL SEQUENCE DIAGRAM
(Concluded)

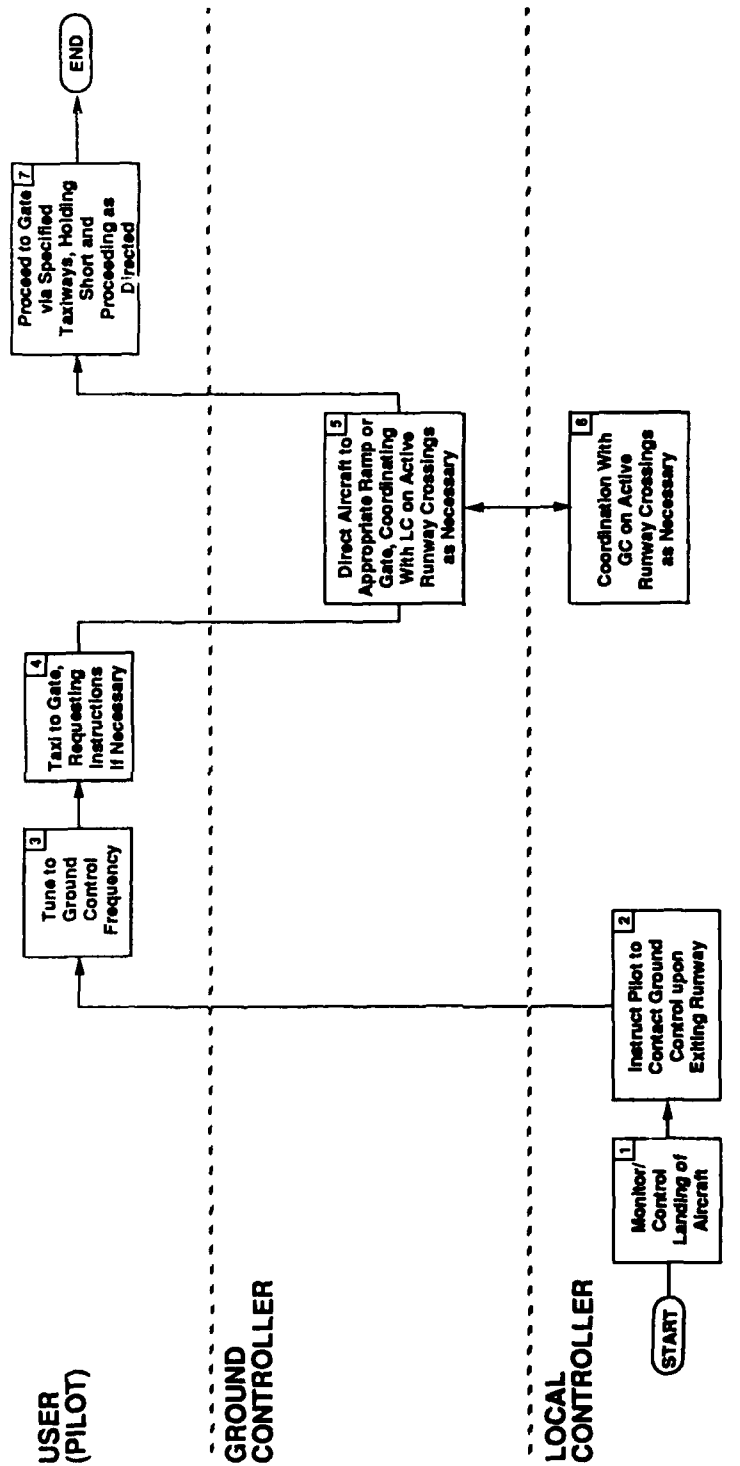


FIGURE 2-6
AIRPORT MOVEMENT AREA CONTROL
ARRIVAL OPERATIONAL SEQUENCE DIAGRAM

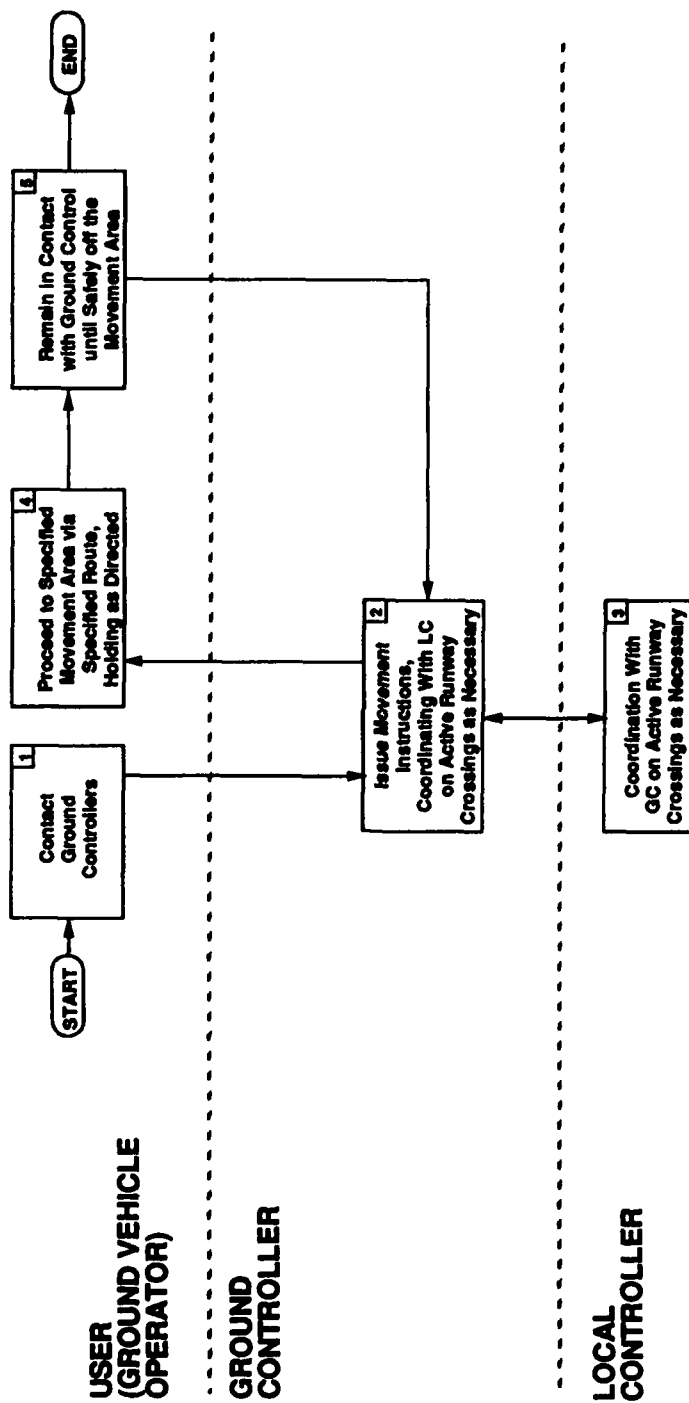


FIGURE 2-7
AIRPORT MOVEMENT AREA CONTROL
GROUND VEHICLE OPERATIONAL SEQUENCES DIAGRAM

2.6 Operational Scenarios

Figures 2-8 through 2-10 illustrate hypothetical operational scenarios of control of the airport movement area. These scenarios are representative of the range of control of the airport movement area provided by the various tower positions. Figures 2-8 through 2-10 are similar in format to the operational sequence diagrams, Figures 2-5 through 2-7, except that the operational scenario diagrams include more detail and have no decision branches. The first scenario focuses on control of a departing aircraft on the movement area, the second on an arriving aircraft's airport surface movement, and the third scenario shows control of two snow removal vehicles on the airport movement area.

In this set of three operational scenarios, several airliners are at their respective gates preparing to depart. One jet transport is on final approach. Focus will be on this arrival's movement on the airport surface and the airport movement area control involved in moving one of the departing aircraft from the gate to takeoff. One normally active runway is temporarily closed for snow removal due to a storm the night before. Since the airport is normally configured in a two runway operation, one for arrivals and one for departures, the snow removal forces all aircraft to use a single active runway. Two aircraft are in a departure queue at the threshold of the active runway. It is still very overcast and fog has begun to set in over the airport movement area, obscuring the controllers' view out of the tower windows.

Control positions in this particular air traffic control tower include a clearance delivery controller (who also takes care of flight data functions during nonpeak operation times such as during this scenario), a ground controller, as well as a local controller and an assistant local controller. Only the ground and local controllers have direct control of the aircraft and vehicles on the movement area. Interactions between the pilot and clearance delivery controller are included in the departure aircraft scenario, however, in order to maintain the flow of the scenario.

2.6.1 Departure Aircraft Airport Movement Area Control Operational Scenario

On this afternoon a commercial airline pilot at his gate preparing to depart contacts clearance delivery (1). Since the airport does not have a ramp tower to release aircraft from the gates, the pilot contacts the clearance delivery controller from his gate on the designated clearance delivery frequency before his scheduled departure time. The clearance delivery controller responds by informing him of delayed airport operations due to the closing of one runway for snow removal (2).

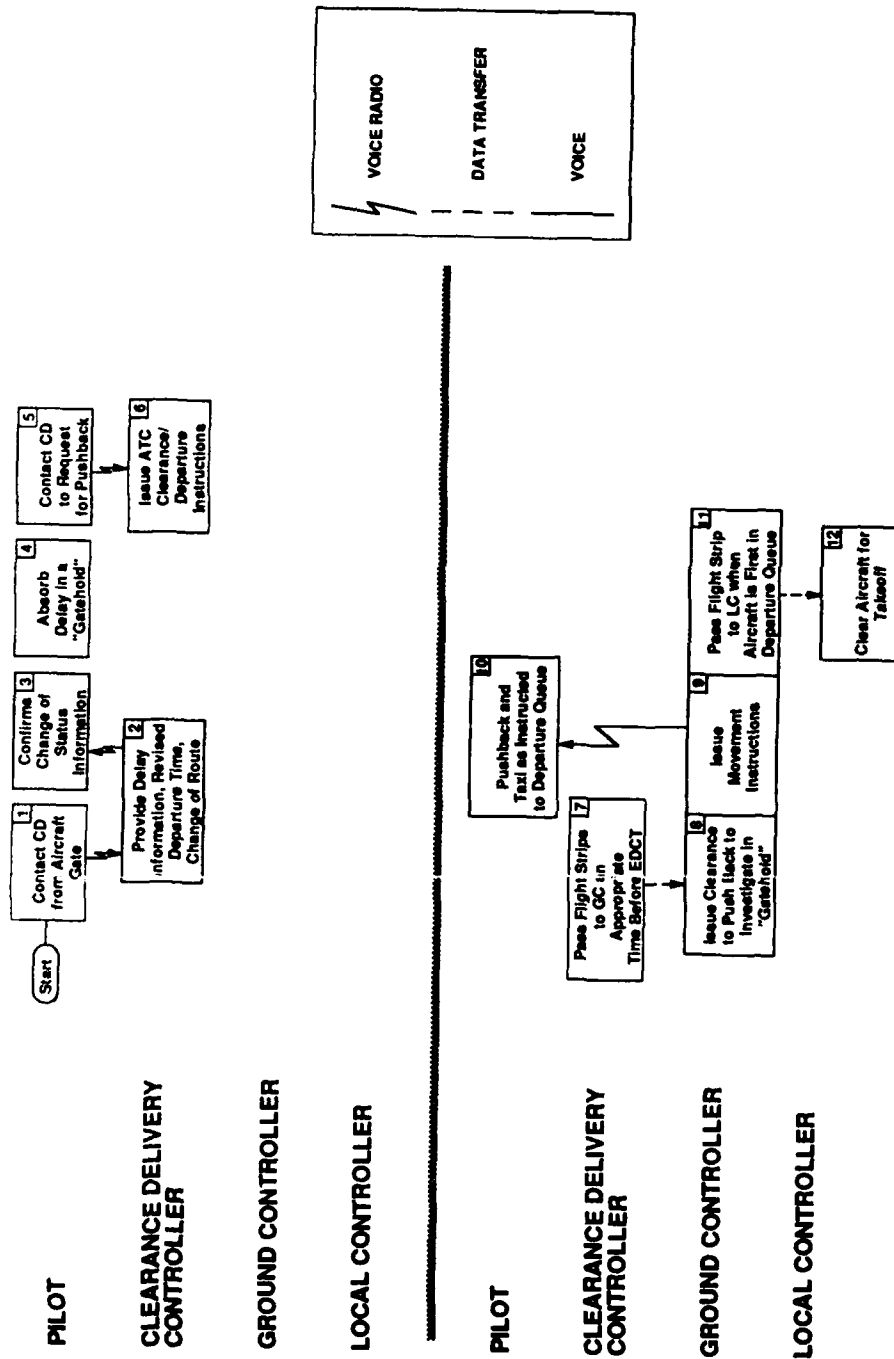


FIGURE 2-8
DEPARTURE AIRCRAFT AIRPORT MOVEMENT
AREA CONTROL OPERATIONAL SCENARIO

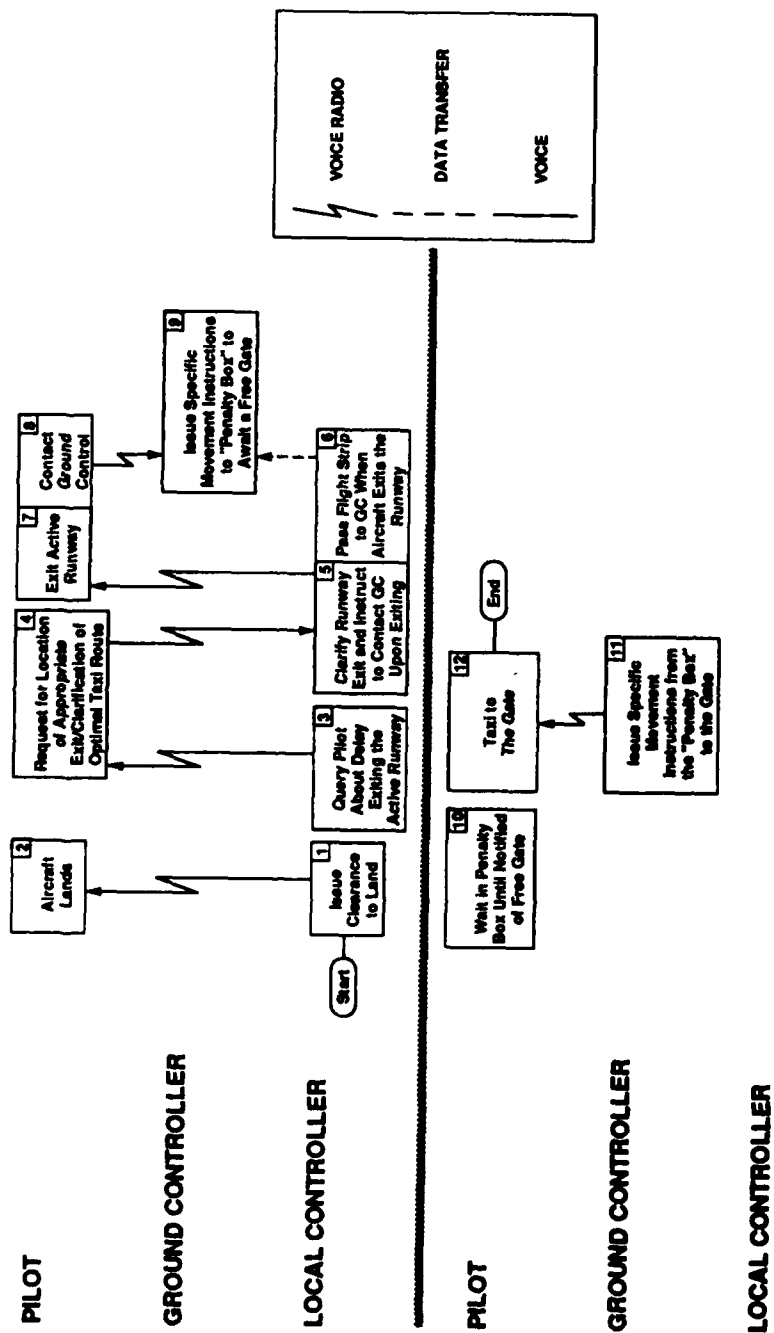


FIGURE 2-9
ARRIVAL AIRCRAFT MOVEMENT AREA
CONTROL OPERATIONS SCENARIO

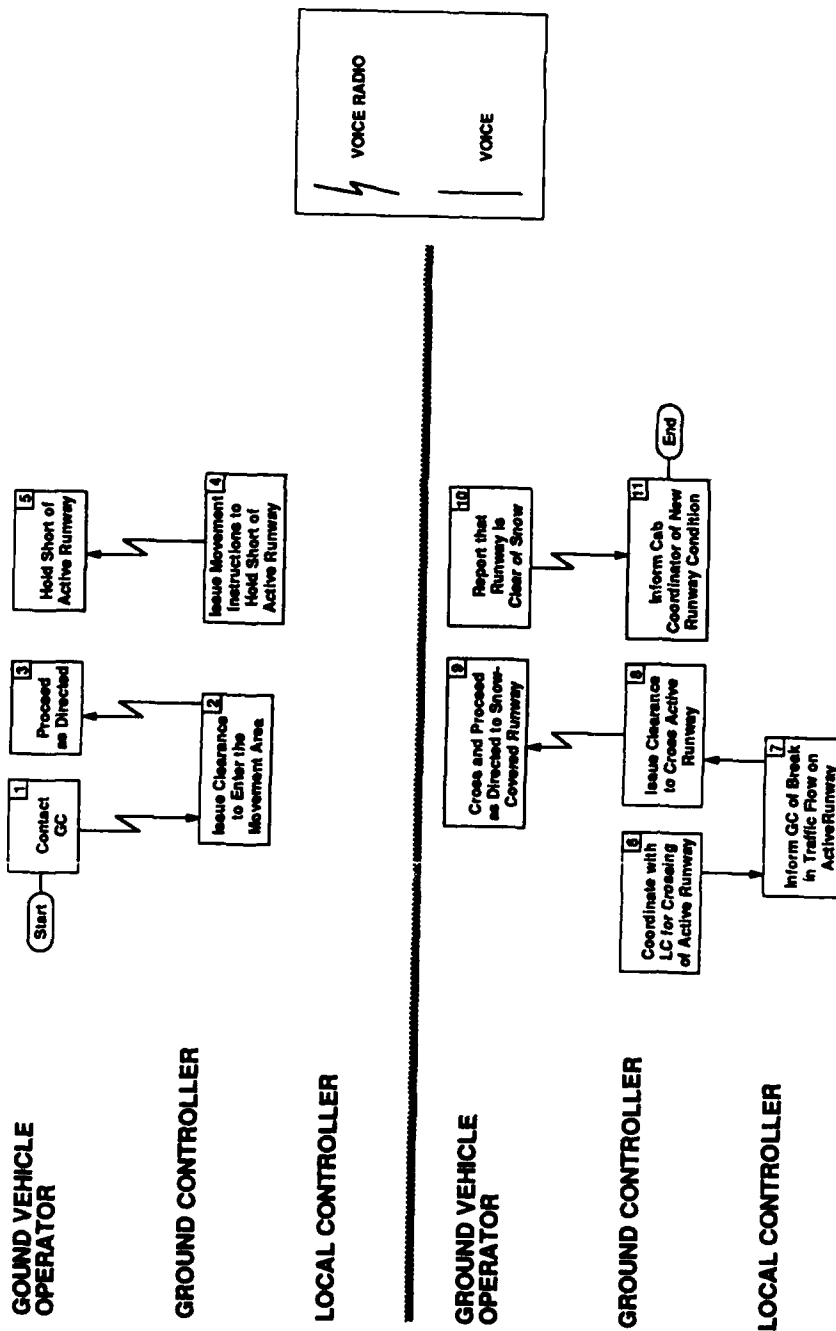


FIGURE 2-10
GROUND VEHICLE AIRPORT MOVEMENT
AREA CONTROL OPERATIONAL SCENARIO

The clearance delivery controller also changes the planned departure fix of the jet (2). The pilot confirms this change in the route of flight and the delayed departure clearance time (3).

The pilot of the departing aircraft chooses to absorb the delay at the gate, cutting down engine-on time and thus conserving fuel (4).

The departing pilot contacts clearance delivery at an appropriate time before his revised departure time and requests pushback (5). The clearance delivery controller issues the appropriate ATC clearance and departure instructions (6) and passes the appropriate flight strip to the ground controller's workstation (7). The ground controller surveys the current ground situation through the tower window and on the ASDE display (although the ground controller is constantly monitoring the movement area visually, due to the inclement weather this day he is depending heavily on the ASDE display for position data); the departure queue is now gone, and the gate is needed by an arrival aircraft waiting in the "penalty box" or cement holding area to the side of the taxiway on the movement area. He, therefore, grants the departing aircraft clearance to pushback (8). The ground controller then interactively issues specific movement instructions as necessary to the jet previously in the gatehold as he pushes back from the gate and taxis to the departure runway (9,10). The ground controller carefully monitors the progress of the aircraft on the movement area through the window and on the ASDE display since the pilots cannot see each other in the fog. The pilot and controller remain in close communication. The ground controller passes the appropriate flight strip to the local controller's workstation when the aircraft is in the departure queue (11).

2.6.2 Arrival Aircraft Airport Movement Area Control Operational Scenario

An arriving jet receives clearance to land from the local controller (1), touches down on the active runway, brakes, and hesitantly comes to a stop (2). An arriving aircraft may proceed to the appropriate gate unless told to otherwise hold,⁷ but the jet does not seem to be exiting the runway. The local controller asks the pilot if there is a problem (3); since there is presently only one runway for arrivals and departures, the local controller is anxious to allow the next aircraft in the departure queue to depart. The pilot responds that she is unfamiliar with the airport and its taxiways and is having difficulty clearly seeing the airport movement area due to the poor visibility. She requests specific instructions to the gate (4). The local controller tells the pilot where to exit the active runway and to contact ground control upon doing so (5). The local controller passes the aircraft's flight strip to the ground controller's workstation when the aircraft exits the runway (6).

⁷ Airman's Information Manual, p. C4-S3-9.

The aircraft exits the runway (7) and contacts ground control (8). The ground controller instructs the pilot of the arrival aircraft to taxi to the "penalty box" or cement holding area to the side of the taxiway on the movement area in order to wait for her gate currently occupied by a delayed departure aircraft (9). When her gate is vacated by the delayed departure, the ground controller issues specific movement instructions to the pilot of the aircraft waiting in the "penalty box" (10) to taxi to her gate (11). The pilot of the arrival jet taxis the aircraft to the appropriate gate (12).

2.6.3 Ground Vehicle Airport Movement Area Control Operational Scenario

Two snow removal vehicles contact the ground controller in order to enter the airport movement area (1). The ground controller gives the vehicles clearance to enter the movement area and issues further movement instructions as necessary, cautioning the operator to hold short of the active runway that must be crossed to reach the closed runway (2 through 5).

When the two vehicles reach the taxiway/runway intersection, the ground controller informs the local controller that there are vehicles waiting to cross the active runway (6). The local controller alerts the ground controller that there is a break in the relatively steady stream of arriving aircraft (7), at which point the ground controller instructs the snow removal vehicle operators to promptly cross the active runway (8). The ground controller continues to watch the progress of the vehicles and snow removal process (9).

A few hours later, one operator of the snow removal equipment contacts the ground controller to report that the runway is clear of snow (10). The ground controller passes this information along to the tower cab supervisor (11). The supervisor subsequently coordinates with the controllers and decides to resume a normal two runway operation. The ATIS message is promptly changed to reflect the new airport runway configuration.

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GLOSSARY

AAS	Advanced Automation System
ACCC	Area Control Computer Complex
ACF	Area Control Facility
ARINC	Aeronautical Radio Incorporated
ASDE	Airport Surface Detection Equipment
ASOS	Automated Surface Observation System
ASR	Airport Surveillance Radar
ATC	Air Traffic Control
ATCT	Air Traffic Control Tower
ATIS	Automated Terminal Information Service
AWOS	Automated Weather Observation System
EDCT	Estimated Departure Clearance Time
FAA	Federal Aviation Administration
LLWAS	Low Level Wind Shear Alert System
NASSRS	National Airspace System Requirements Specification
NAS	National Airspace System
NWS	National Weather Service
RVR	Runway Visual Range
SA	Surface Observation
TCCC	Tower Control Computer Complex (Installed in TCF)
TCS	Tower Communications System
TDWR	Terminal Doppler Weather Radar