U.S. Department
of Transportation

**Federal Aviation
Administration**

Report to Congress

A Feasibility Study of Regional Air-Cargo Airports:

Including a Case Study of a Regional Air-Cargo Center for the Washington, D.C., Area

Report of the Federal Aviation Administration Pursuant to Senate Report 101-121 Accompanying the Department of Transportation and Related Agencies Appropriations Act, 1990

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Executive Summary

The potential of regional air-cargo airports to relieve congestion at major airports in the immediate area has been examined by the Federal Aviation Administration (FAA) at the request of the Senate Appropriations Committee. Senate Report 101-121 accompanying the Department of Transportation FY 1990 Appropriations Act called for the study to include the feasibility of establishing an air-cargo airport in the immediate Washington, D.C., area. This report presents the FAA's findings. While a large portion of air-cargo operations is handled at busy air-carrier airports, this activity usually does not add significantly to congestion because cargo flights are few in number and occur during off-peak hours. Many major airports actively encourage cargo because it generates additional jobs and airport revenues. It is estimated that more than half of all air cargo is carried in the baggage holds of scheduled airliners, and, under most circumstances, it would be extremely difficult and inefficient to isolate cargo from passenger operations.

The question remains whether an air-cargo airport could succeed if it were developed for other reasons besides relieving congestion, such as to encourage land development or stimulate economic growth. There is no promising model at this time. Substantial efforts to develop Stewart International Airport in Newburg, New York, and Huntsville International Airport in Huntsville, Alabama, have not yet attracted a large part of the air-cargo market. The only clearly successful recent examples are the sorting facilities of small-package, express-delivery services, such as Federal Express in Memphis, Tennessee, United Parcel Service in Louisville, Kentucky, and Airborne Express in Wilmington, Ohio. These facilities are concentrated in a geographic area around the Ohio River Valley where flights can be brought together efficiently to transfer cargo. There may be other opportunities to develop successful cargo airports but they are not apparent at this time. Fort Worth Alliance Airport has been cited as a successful cargo airport, but the airport has not contracted with any all-cargo operator yet. Instead, the airport is operating as a general purpose reliever. Its activity has primarily been general aviation and airline training operations, and its tenants include manufacturers and companies involved in aircraft maintenance. This sort of multi-purpose reliever airport could be feasible in many urban areas.

It is expected that cargo will remain concentrated at very busy airports near major population centers where there is ample capacity available to shippers in the baggage holds of airliners. Air-cargo sorting operations will continue to be located at a few airports that the small-package, express carriers consider to be well located for that purpose. Efforts to develop regional air-cargo airports at other locations will involve considerable expense and financial risk. The least expensive approach may be to initiate civil air-cargo flights at military airfields under surplus-property or joint-use agreements. Military airfields have many of the attributes needed by cargo airports, including long, strong runways, ample apron area, and good highway access.

The air-cargo industry is dynamic and rapidly growing, and it is recommended that this subject be reconsidered periodically.

I — Introduction.

Purpose

This report has been prepared in response to language in Senate Report 101-121 on the Department of Transportation and Related Agencies Appropriations Act for FY 1990. The Federal Aviation Administration (FAA) was requested to study the feasibility of establishing regional air-cargo airports to relieve congestion at major airports in the immediate area. The study was to include the impact of an air freight and cargo operations facility to alleviate congestion and thereby increase capacity at the major airports in the Washington, D.C., area. This area includes Washington Dulles International Airport, Washington National Airport, and Baltimore/Washington International Airport.

Background

Air traffic delay is a serious problem, and it is expected to worsen because of the widening gap between the capacity of major airports and the traffic these airports are required to handle. According to FAA forecasts, the number of airports where airline delays exceed 20,000 hours annually will grow from 21 in 1988 to 41 by 1998 unless major capacity improvements are made to the national airport system. In addition, 15 airports will incur between 50,000 and 100,000 hours of airline aircraft delays annually by 1998 as opposed to just 5 today.

The top 100 airports in the U.S. account for 90 percent of the airline passengers enplaned, and the number of enplanements is projected to grow by 56 percent over the next 10 years. Aircraft operations (takeoffs and landings) at these same 100 airports are expected to grow by 36 percent during that same period to accommodate the increase in passenger demand.

Both the quality and cost of air service are strongly tied to aviation system capacity. In the dozen years since airline deregulation, real air fares have declined, and the airlines' emphasis on the hub-and-spoke system has improved the service to many cities. System capacity must continue to grow to allow for airline competition if this trend is to continue.

Large capacity gains result from the construction of new runways and new airports. For example, the new Denver airport will increase capacity and reduce congestion in Denver as well as reduce delays system-wide. However, at a cost of over $2.5 billion for a new airport

like Denver, it will be a challenge to finance and build others. New runways at existing airports also face opposition because of their environmental impact as well as their cost. In addition to new construction, other alternatives to increase capacity need to be investigated.

The FAA and the aviation industry have been working on a wide variety of alternatives to enhance capacity. These alternatives include: improvements in approach procedures and airspace planning and design, applications of new technology that have emerged from Research, Engineering, and Development (RE&D) programs, and solutions developed through free market influences, such as potentially new connecting hub airports, reliever airports, and expanded use of existing commercial service airports. The concept of developing regional air-cargo airports, separate from the major passenger hub airports, has been proposed as an alternative that could reduce congestion and delay at major airports.

The dynamic growth in the passenger side of the air transportation industry since deregulation and its impact on capacity have been well-documented and publicized. The air-cargo segment of the industry, on the other hand, has not been as well-studied, even though its growth has also been remarkable. There is some concern that rapidly expanding cargo operations at the major hub airports will add to the problems of congestion and delay these airports are experiencing as a result of expanding passenger operations. However, this study has found that all-cargo operations do not add to congestion and delays because these operations occur primarily in off-peak hours.

Study Methodology

Various means were used to conduct the study, as summarized below:

- A thorough literature search (magazines, journals, technical papers and reports) was performed. Sources in the airlines, air-cargo carriers, and airports were located and interviewed.
- Air-cargo and passenger data, including historical and forecasted growth, current volumes, and operations were gathered.
- The contribution of air-cargo operations to major air carrier airport congestion and delays was analyzed.

- Past and current efforts to develop regional air-cargo centers were analyzed.
- The national air-cargo system was analyzed to develop pros and cons in establishing regional air-cargo centers. These pros and cons were applied to the establishment of a regional air-cargo center for the Washington, D.C., area.
- Cost estimates for developing a new regional air-cargo center and for converting and improving an existing airport facility were obtained.

Problem Areas

Early in the study it became apparent that a great deal of the data necessary to perform a rigorous statistical analysis simply did not exist in any readily accessible form. Gathering data was far more difficult than had been anticipated. However, it was possible to derive operational characteristics from the data available.

II — Background and Future Requirements.

Evolution of the Air-Cargo Industry

Pre Deregulation

Until 1977, the Civil Aeronautics Board (CAB) maintained strict regulation of nearly all facets of the U.S. commercial air-cargo industry. During the early years, all-cargo carriers dominated the business. However, starting in the 1950's, several of the larger passenger/combination carriers entered the all-cargo business by acquiring fleets of freighter and/or QC (quick change) aircraft. These combination carriers continued to operate significant fleets of jet freighters until air-cargo deregulation. They were formidable competitors to the U.S. all-cargo airline operators, especially on the domestic routes, because they had greater financial strength, they offered day and night service combining the schedules and capacity of their passenger aircraft and freighter operations, and they could cross subsidize between their passenger and cargo operations.

Another element in the air-cargo industry was the air freight forwarders, such as Airborne, Emery, and UPS. They marketed, assembled, and consolidated air cargo, provided pick-up and delivery service, and assumed responsibility for the shipment from point of origin to point of destination. To provide this service, the forwarders used the direct air carriers (both combination and all-cargo) for the line-haul portion of the movement. By 1970 there were approximately 250 certificated U.S. air freight forwarders, with the top 10 companies representing well over 50 percent of the total forwarder traffic. In 1970, the CAB allowed five long-haul railroad or motor carrier companies to enter the market, further increasing competition.

The original small package "air express" service was offered by scheduled airlines in conjunction with the Railway Express Agency (REA). The airlines collectively negotiated an agreement with REA to act as their ground agent. However, during the 1970's, air express activity declined in shipper patronage, largely due to operational and financial difficulties at REA. In 1975 REA ceased operations and filed a petition for bankruptcy.

The air freight forwarding industry continued to grow in the early to mid–1970's, and air freight generally

exceeded the growth rates of the U.S. economy. But, many structural problems emerged to create a massive shift in market power. A primary factor was the seven consecutive years of losses on all-cargo operations suffered by the U.S. domestic airlines. During this time, three airlines discontinued freighter service completely and two others downsized considerably. Domestic all-cargo service was reduced by approximately 50 percent. To a great extent, these losses were caused by the jump in fuel prices experienced in 1973-74 and by artificially low domestic freight rates set by the CAB. This was compounded by the entry of passenger wide-body aircraft into the cargo market. These aircraft, with their huge belly holds, created a large excess of air-cargo capacity.

The down-sizing of all-cargo service caused the freight forwarders, who required and could no longer get high volumes of overnight lift, to seek new solutions. Most decided to provide their own dedicated lift, rather than depend on passenger carriers that provided coverage for barely 65 percent of the U.S. domestic air-cargo/express marketplace, and whose shipment, tracing, and tracking systems were at best rudimentary and inadequate.

Post Deregulation

During the past 15 years, there has been a dramatic change in the composition of the carrier group providing all-cargo aircraft services. This is largely due to the deregulation of the air-cargo industry in 1977. Because of the exceptionally high and sustained growth rates in traffic and revenues since deregulation, the U.S. freighter fleet today is much larger than it ever was.

The emergence of the integrated air express business has been particularly significant. Started by DHL, and continued with remarkable success by Federal Express, air express has been one of the fastest growing segments of the air-cargo industry. By and large, the new carriers do not depend on forwarders, consolidators, or other third parties to provide their traffic, as was the case for the passenger/combination carriers and the scheduled all-cargo carriers before deregulation. Much of the expansion of the U.S. freighter fleet is due to this integrated, air-express segment of the industry. A parallel development since deregulation has been the growth of cargo charter airlines. Many of the freight forwarders contract all their flight operations to several of these carriers.

In summary, the major U.S. passenger/combination carriers, with the exception of Northwest, have suspended all-cargo operations. With the buyout of Flying Tigers by Federal Express, the last pre-deregulation all-cargo carrier has succumbed. In 1977, the all-cargo/express carriers represented approximately 15 percent of the total cargo jet lift capacity. By the end of 1987, the all-cargo/express industry's fleet of 355 jets accounted for approximately 75 percent of the total cargo jet lift capacity. This trend has continued, with the all-cargo/express carriers growing at a rate of approximately 15 percent per year.

Current Status

Today the air-cargo/express industry provides overnight express service to and from virtually every zip code in the country. Customer service features, such as state-of-the-art tracing and tracking capability, on-call pick-up service, Saturday service, residential coverage, money-back guarantees, and automated billing and reporting systems, among numerous other advances, are innovations since 1973.

The industry is highly competitive. Pricing is a powerful marketing tool in terms of building volume and gaining market share. The growth and development of this industry structure has been significantly beneficial to all shippers and consumers throughout the United States. Air freight costs to the shipper have actually declined since 1980.

Services of the air-cargo/express industry have been a major factor in bringing small communities and rural America into the mainstream of economic growth. New manufacturing and high technology plants, along with medical and research centers, are being attracted to low capital/production cost areas of the country, at least in part, because they are provided regular express transportation access to every other corner of America, and most parts of the world.

Passenger airlines are no longer a major presence in the small package express market, but they continue to dominate the airport-to-airport movement of large shipments. Interviews with industry specialists, air carriers, airports, and others indicate that approximately 60 percent of all air cargo is still carried as belly cargo on scheduled airliners.

Despite this high percentage of ton-miles flown, the passenger/combination carriers account for only

13 percent of the air-cargo/express revenue in domestic markets due to wide disparities in yield, according to a study by Leeper, Cambridge, & Campbell, Inc., called *The All-Cargo Air Carrier Industry: Its Economic Impact and Future Needs.* Traditional passenger/combination carriers have increased their system freight and express traffic by only 12.7 percent since 1977. Domestic revenue ton-miles have actually declined by 10.5 percent, while international freight and express ton-miles increased 53.4 percent.

Table 1 shows the average annual growth from 1980 to 1988 for U.S. airline freight traffic. The major growth has been in the express carriers, and the growth in international operations has been much greater than that for domestic operations.

This international market has attracted a host of foreign competitors to the U.S. carriers. According to the September 1990 issue of *Cargo Facts*, of the top 10 freight carriers in 1989, seven were foreign flag carriers. These foreign flag carriers are still aggressively seeking business in the U.S., as reflected by the opening of major new cargo terminals at several U.S. airports and the acquisition of new 747-400F freighters.

TABLE 1 U.S. AIRLINE FREIGHT TRAFFIC

	Revenue Ton Miles in Millions			
	1980	1984	1988	Average Annual Growth
Domestic				
Scheduled	3,273	3,558	3,660	1.4%
Charter	291	615	251	-1.8%
Express Carriers	312	1,338	3,543	35.5%
Subtotal	3,876	5,511	7,453	8.5%
International				
Scheduled	2,466	2,989	4,788	8.6%
Charter	508	524	1,191	11.2%
Subtotal	2,974	3,512	5,979	9.1%
Total U.S. Airlines				
Scheduled	5,739	6,546	8,447	5.0%
Charter	799	1,139	1,442	7.7%
Express Carriers	312	1,338	3,543	35.5%
Grand Total	**6,850**	**9,023**	**13,432**	**8.8%**

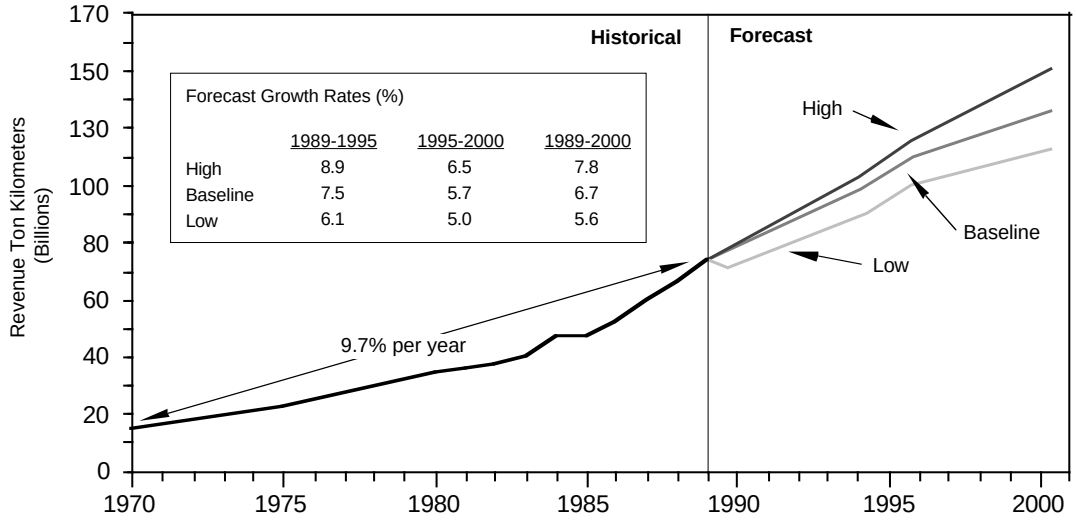
Source: Boeing, *World Air Cargo Forecast*

Future Requirements

The Boeing *World Air Cargo Forecast* predicts a 6.7 percent annual growth rate in world air cargo (Figure 1). Asian markets continue to lead the pack with annual growth rates of 8 to 8.5 percent. Intra-European markets should grow at about 5.5 percent per year. In the U.S., the $22 billion a year domestic market, which makes up about 20 percent of all air cargo carried in the world, is expected to double by 1995.

Aircraft capacity can be expected to keep pace with demand. Currently, Boeing and McDonnell Douglas have orders for almost 2,200 aircraft between them. With the expected increase in the passenger market and lack of pure freighters available, cargo capacity should remain static in the short term. However, since the air-cargo industry is presently in an "over-capacity" status, this is not expected to limit air-cargo growth in any way. Of the international and domestic airlines responding to inquiries on their average unused cargo capacity, the percentages of unused belly-and combi-cargo capacity ranged from a low of 15 percent to a high of 97 percent, but the average was about 40 to 50 percent. The percentages of unused all-cargo capacity ranged from 3.5 to 32 percent, with an average of about 20 percent. According to the *Cargo Facts* issues of May 1990 and June 1990, the load factor for selected all-cargo aircraft in domestic service for the fourth quarter of 1989 averaged about 50 percent of available capacity. By the time current capacity is reached, new aircraft will be on-line and ready to absorb any additional growth.

FIGURE 1 WORLD AIR FREIGHT FORECAST



Source: Boeing, *World Air Cargo Forecast*

III — Regional Air-Cargo Centers

Description of the Concept

The concept of developing regional air-cargo centers has evolved over a number of years, primarily as a result of successful examples of integrated, small-package, express carriers deliberately choosing less congested airports, away from major metropolitan areas, as their primary and regional hubs. When studying the problems of congestion and delay at major air carrier airports, cargo operations appear to be separate from passenger operations, that is, an entity that could be moved to a less congested airport relatively easily. The rationale for this separation is that all-cargo aircraft require take-off, landing, and runway time that could be used by passenger aircraft. A corollary of this is that cargo operations use valuable ramp space, and their warehouses and cargo-handling facilities occupy potential passenger terminal space.

If it is to be part of the solution to congestion and delay, a regional air-cargo center must be far enough from the major metropolitan airports to avoid any interference with, and delay of, aircraft on approach to, or departure from, these airports. At the same time, it must be close to the metropolitan area and have good access to highway systems in order to support the overnight and one-or-two-day delivery requirements of air freight. This would enable the center to serve its customers through a hub-and-spoke network of feeder airlines and road feeder services designed to reach outlying points. For a regional air-cargo center to be successful, the lack of infrastructure congestion and ease of access must improve cargo handling sufficiently to attract cargo customers and operators from the metropolitan airports.

Stewart International Airport, New York, and Fort Worth Alliance Airport, Texas, are often cited as examples of regional air-cargo centers. However, Fort Worth Alliance, which opened in early 1990, has not established air-cargo carrier operations as yet. Several air-cargo carriers do have operations at Stewart, and some of them have expansion plans. Currently, however, there are only a few all-cargo operations each day at Stewart. Huntsville International Airport, north of Birmingham, Alabama, with its International Intermodal Center, is another example of what could become a regional air-

cargo facility. But, it too has only a few all-cargo flights each day. (Each of these examples is described in more detail in Section III.) None of these airports has been able to relieve congestion and delay by attracting air-cargo operations from nearby air carrier airports.

Developing a Regional Air-Cargo Center

Advantages

Capacity Enhancement

Because there are so few all-cargo flights, regional air-cargo centers are also able to accommodate a large number of operations by General Aviation (GA). The latter, in fact, may be of more benefit to capacity enhancement. GA pilots are often eager to avoid congestion and delay at busy air-carrier airports. Relocating GA aircraft from congested airports can free up slots for use by the air carriers.

Economic Development

Airports, including regional air-cargo centers and industrial airports, may act as magnets for business development. The example of Fort Worth Alliance Airport is described in Section III. Facilities of this type may attract industries that are related to the aviation industry, that use Just-In-Time (JIT) inventory control systems, or that deal in perishable goods imported from or exported to overseas markets, among others.

Preparation for the Future

The consensus among aviation experts is that air cargo will continue to grow in the future. Those Nations which prepare for this situation will be in a better position to deal with the increase, dominate the transportation market, attract industry, and obtain overall economic benefits.

Joint-Use

Military air bases lend themselves to air-cargo use under surplus-property or joint-use agreements. The runways are usually able to accommodate even the largest cargo jets. Most of the necessary infrastructure (highways, buildings, sewage, electricity, water, etc.) is already in place. In those areas where joint use is contemplated, a limited number of cargo operations may be less disruptive to military operations than passenger traffic.

One serious obstacle is aircraft noise, because air-cargo carriers often operate at night and may use older and noisier aircraft than passenger airlines.

Disadvantages

Cost

Although new regional air-cargo centers do not cost as much as passenger airports, the expense is considerable (see Section III, Cost Estimates) and income may be much lower. Conversion of existing airports is somewhat less expensive, but the costs are still substantial.

Space

There are very few remaining sites for new airports close enough to major metropolitan areas to serve as regional cargo centers. During the last thirty years, urban development has taken up most of the available land. Areas which are available tend to be remote and do not possess the necessary infrastructure. The most likely alternative would involve conversion of an existing airport, but few are ideally located for this purpose.

Infrastructure

Regional air-cargo centers must be served by a well-developed highway system. They must be supported by sewage, water, electricity, and telephone systems. Taking the Fort Worth Alliance Airport as an example, the infrastructure enhancements necessary to support the facility are projected to cost at least twice what the airport facility itself cost.

Operational Efficiency

All-cargo operations are not easily separated from passenger operations. Fully 60 percent of air cargo is still moved as belly cargo. Since belly cargo is carried on passenger aircraft, it must remain at the air carrier airports. Separation of all-cargo and belly cargo will force agents and freight forwarders who deal in both types of operations to maintain facilities at two or more locations. In addition, they will lose at least a certain degree of flexibility in deciding whether to send a particular cargo shipment as belly cargo or on an all-cargo aircraft.

Airport Efficiency

Most all-cargo/express flight operations are conducted late at night or early in the morning (about 10:00 p.m. to 7:00 a.m.). According to a study by Leeper, Cambridge, & Campbell, Inc., fully 66 percent of the all-cargo

carriers' jet operations are at night. For most airports, these are the very hours that aircraft operations are at their lowest point, with very few passenger aircraft taking off or landing. At major air-carrier airports, which must remain open 24 hours a day, nighttime all-cargo operations make efficient use of the airport facilities and generate revenue for the airport without adding significantly to airport congestion and air-traffic delay.

Shipment Delays

Integrated carriers move their overflow in belly cargo. They require the availability of passenger aircraft to maintain their schedules. Removing these carriers to an all-cargo facility would require them to ship their overflow to air-carrier airports by truck, thus unacceptably delaying shipments.

Integrated and Traditional Air-Cargo Carriers

In reviewing the advantages and disadvantages of developing a regional air-cargo center, it is important to differentiate between the integrated air-cargo carriers, such as Federal Express, United Parcel Service, and Airborne Express, and the more traditional air-cargo operators, such as Evergreen International, Southern Air Transport, Zantop, and the scheduled passenger airlines. Because of the integrated nature of their operations, with their "self-feeding" network of door-to-door pickup and delivery services, the integrated air-cargo carriers are not as dependent upon any one location. It is much easier for them to relocate to another airport if it makes operational and economic sense.

The more traditional air-cargo operators, on the other hand, are much more inter-dependent. The shippers, forwarders, brokers, consolidators, and individual airlines all depend on each other to put cargo shipments together at competitive rates and provide the necessary lift to deliver these shipments to their destinations. No one element of these traditional operations could be moved to another airport facility without the other elements. For the scheduled passenger airlines, this dependence on location extends even further because virtually all their cargo, both international and domestic, moves as belly or combi cargo and must travel from one passenger hub airport to another until it reaches its destination.

Data on the volume of cargo carried as all-cargo versus belly-cargo is not readily available. For those airports where data was available, the percentages of all-

cargo versus belly cargo varied widely from airport to airport. Airports which serve as hubs/sorting centers for integrated air-express operations, such as Memphis and Ontario, have a high percentage of their cargo volume carried on all-cargo flights, 61 percent for Memphis and 93 percent for Ontario. In general, airports with a predominantly domestic market served by the integrated express cargo carriers have about 60 percent of their cargo volume carried by all-cargo aircraft. However, for those airports which serve as origin/destination centers, especially for overseas flights, the percentage of all-cargo to belly/combi cargo is reversed, 60 percent belly/combi and 40 percent all-cargo. These latter figures are in line with the world air-cargo capacity figures in Boeing's *World Air Cargo Forecast*, 60 percent passenger (belly/combi) and 40 percent freighter.

Facilities Required

In order to support a regional air-cargo center, an airport should provide certain basic facilities.

Runways

Given the importance of international operations in the air-cargo market, the runway should be 10,000 to 12,000 feet long and 150 feet wide and have the necessary strength to support the take-off of a fully-loaded freighter on a long-haul, non-stop intercontinental flight. The operational takeoff length of the runway at Alliance Airport is 9,600 feet. Stewart International Airport in New York extended their runway to 12,000 feet to support international operations. Huntsville International Airport is extending one of their runways from 8,000 feet to 10,000 feet to accommodate international wide-body cargo aircraft. Runways and taxiways also need to be designed with the necessary pavement strength to support very heavy aircraft. Boeing's newest cargo plane, the 747-400F freighter, has a maximum takeoff weight of 870,000 pounds.

Landing Aids

One of air cargo's most significant attributes is on-time delivery. A regional air-cargo airport should have the facilities to provide continuing and reliable operations during weather conditions that restrict visibility during takeoff and landing. These may include an air traffic control tower (ATCT), an airport surveillance radar (ASR), and an appropriate instrument landing system (ILS) and associated landing light systems.

Freight Storage and Movement

To receive, store, and distribute cargo, an airport must have the apron space and cargo buildings necessary to accommodate the cargo operators, customs service, brokers, and freight forwarders. These buildings may be built by the airport authority and leased to the cargo operators, built by the operators themselves, or they may be built and leased out by a third-party franchisee.

Transportation Infrastructure

In order to function as a true regional air-cargo center, the airport must have convenient access to interstate highways, preferably both north-south and east-west. Railheads are also desirable.

Support Infrastructure

All those facilities necessary to support an intensive cargo operation need to be in place. These include, but are not limited to, modern high-capacity telephone trunking and switching systems, environmentally approved waste-disposal systems, and adequate electric power and water for current and future needs.

Labor

Such a facility needs access to a readily available, reasonably priced, at least semi-skilled labor market. This labor market should be located relatively close and should contain sufficient numbers to staff operations at least in the near-term.

Cost Estimates

New Facilities

It is difficult to develop cost figures for a new airport without knowing something about the specific airport site. Construction costs depend a great deal upon local construction and labor costs, land value, terrain, obstructions, and other factors which can vary widely from site to site.

Given the problems in developing cost estimates without knowing the specific site, it is useful to look at recent examples of construction costs for runways, access roads, and terminal facilities at airports around the country.

The Fort Worth Alliance Airport was completed in 1990. According to the Perot Group, the runway, with an operational takeoff length of 9600 feet, two parallel taxiways, large terminal area apron, and the service and access roads, cost $39 million to construct, not including

land costs. The runway pavement strength is designed to support an airplane gross weight of 870,000 pounds, the maximum takeoff weight of Boeing's newest cargo plane, the 747-400F freighter. An Instrument Landing System (ILS), associated landing lights, and FAA tower will add about $6 or $7 million. A highway interchange with the nearby interstate highway cost about $6 million with the associated bridge, ramps, and frontage roads. (According to the Alabama Highway Department, a more complex interstate highway interchange being built to improve access to Huntsville International Airport in Alabama will cost $17 million.) Access roads (six lane) beyond the immediate boundary of the airport and connecting the airport with the interstate interchange and other public highways cost about $8 million per mile. Vital infrastructure support systems cost as follows: waste water treatment plant - $12.5 million; power supply system - $10 million; telecommunications system - $3.4 million; water supply system - $4.5 million.

The construction cost for the necessary cargo terminal facilities, including ramp space for the aircraft, buildings for the handling and temporary storage of cargo, and loading docks for the trucks that pick up and drop off cargo, must also be considered. The Huntsville International Intermodal Center reports that a 50,000 square foot cargo facility completed in April 1990 at Huntsville International Airport cost approximately $1.6 million. A much larger 300,000 square foot cargo complex at Washington Dulles International Airport, currently scheduled for completion in the fall of 1991, will cost nearly $21 million, according to the Washington Airports Task Force.

It is unlikely that any airport will be built to serve only as a regional air-cargo center, so facilities will probably be necessary to serve general aviation and other traffic. In addition to the cargo terminal facilities, an airport would require at least the minimum operations and passenger ramp and terminal facilities for general aviation, business and corporate aircraft, and small commuter or air-carrier passenger operations. As an estimate of the cost for a small passenger terminal, construction of a new 640 foot long, 90 foot wide concourse at Huntsville International Airport will cost about $12 million, according to the Huntsville Madison County Airport Authority. This concourse will accommodate

10 jet aircraft parking positions and four commuter aircraft parking positions.

A November 18, 1990, newspaper article in the Raleigh, North Carolina, *The News and Observer* describes the proposed development of an "air-cargo and manufacturing complex" in North Carolina, much like the regional air-cargo center discussed above, with an adjacent industrial park. The cost to develop the entire complex, with "2 two-mile-long runways… surrounded by manufacturing plants and air-cargo firms," is given as $250 to $400 million. This probably represents a fair assessment of the cost to develop any such industrial airport facility considering the acquisition of property; installation of road, sewer, water, electrical and other support infrastructure; and construction of an airfield that would support long-haul international flight operations.

Converting and Improving an Existing Airport

Costs for converting and improving an existing airport vary so widely that citing such costs is hardly instructive. Some of the estimated costs only for runway and taxiway extensions in various airports, which could be considered as regional air-cargo centers in the Washington area, are given in Section V. To these costs must be added all the expenses for infrastructure upgrades, road access, and so forth. While it is unlikely that upgrades of existing facilities would be as costly as the construction of new facilities, the costs can be expected to be substantial.

Case Studies

Fort Worth Alliance Airport (AFW)

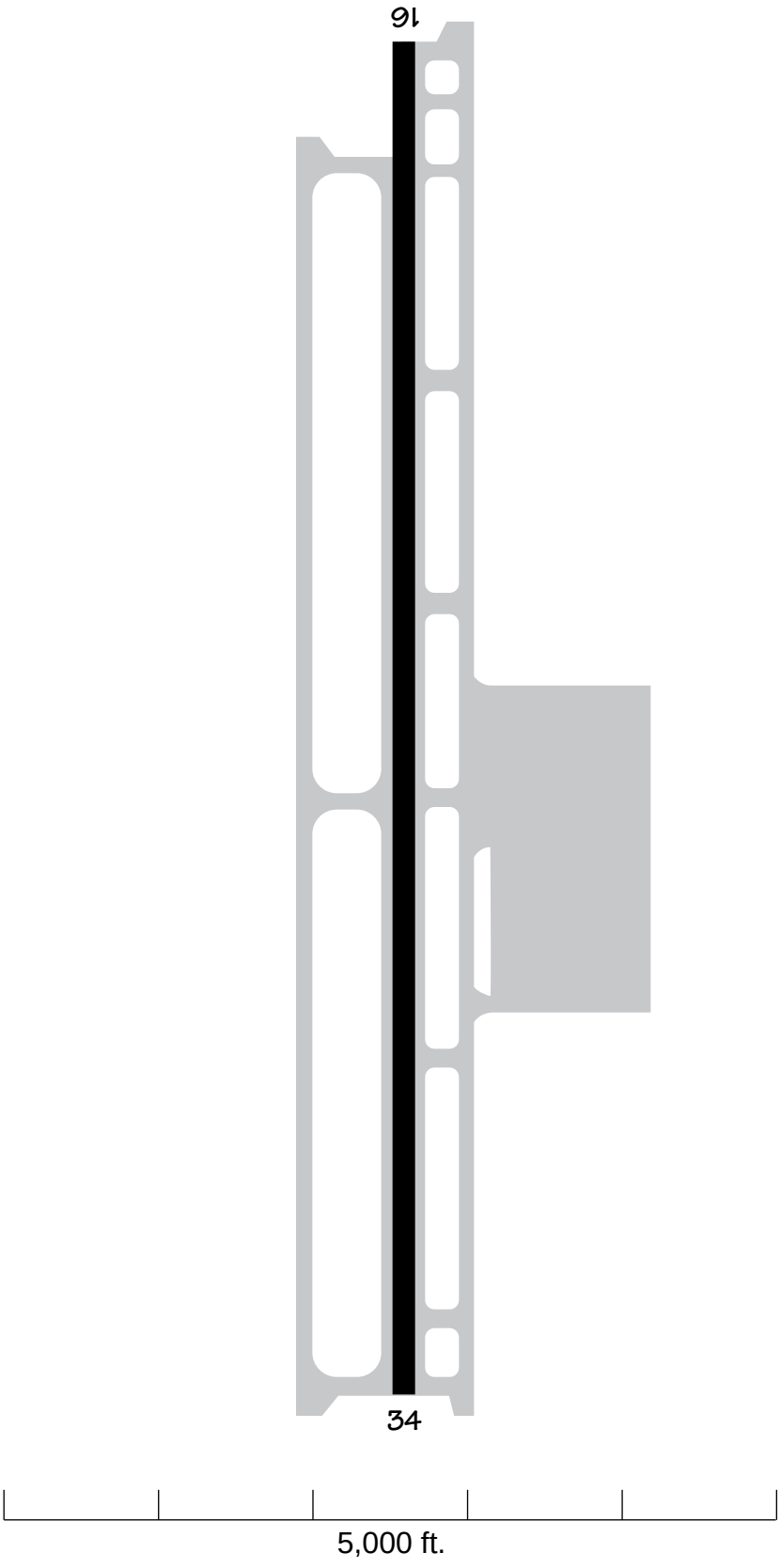
Fort Worth Alliance Airport (Figure 2) is the result of a successful public/private partnership. A private investment firm, the Perot Group, donated 418 acres as the site of a new airport adjacent to a planned industrial park. The airport is owned by the City of Fort Worth, which developed it with over $40 million in Federal aid for air traffic control and airport facilities. The project was also supported by Tarrant and Denton counties, the State of Texas, the Perot Group, and another private investment group. The entire project, including support facilities and vehicles, reportedly cost nearly $250 million.

Alliance is a multi-purpose reliever airport that was designed and built specifically for the manufacturer, distributor, and cargo carrier. It is believed to be the first purpose-built industrial facility that incorporates an airport with an industrial park and attracts major aviation maintenance and manufacturing companies. Alliance can accommodate all types of aircraft, including the C-5 Galaxy and Boeing 747-400, in all weather conditions. Alliance has an FAA control tower and two Instrument Landing Systems (ILS) with Approach Light Systems (ALS).

The Alliance facility opened just over 18 months after ground was broken. Some of the companies committed to locating at the airport are American Airlines with their $481 million aircraft maintenance facility (which is projected to employ 2,500 initially, and more than 4,500 upon completion), a Santa Fe Railway automobile unloading/distribution facility, Ishida Aerospace Manufacturing, and the Drug Enforcement Agency. Manufacturers that locate at Alliance will have direct access to taxiways, as well as close proximity to rail and highways.

Alliance Airport opened in early 1990 and is already operating at the level that was forecasted for the 10-year point (150,000 to 200,000 operations). Current operations are mostly general aviation training and some practice landings from Southwest Airlines. Alliance is, in this way, relieving and complementing DFW Airport. However, no all-cargo operators have planned operations there as of December 1990.

FIGURE 2 FORT WORTH ALLIANCE AIRPORT (AFW)



Stewart International Airport (SWF)

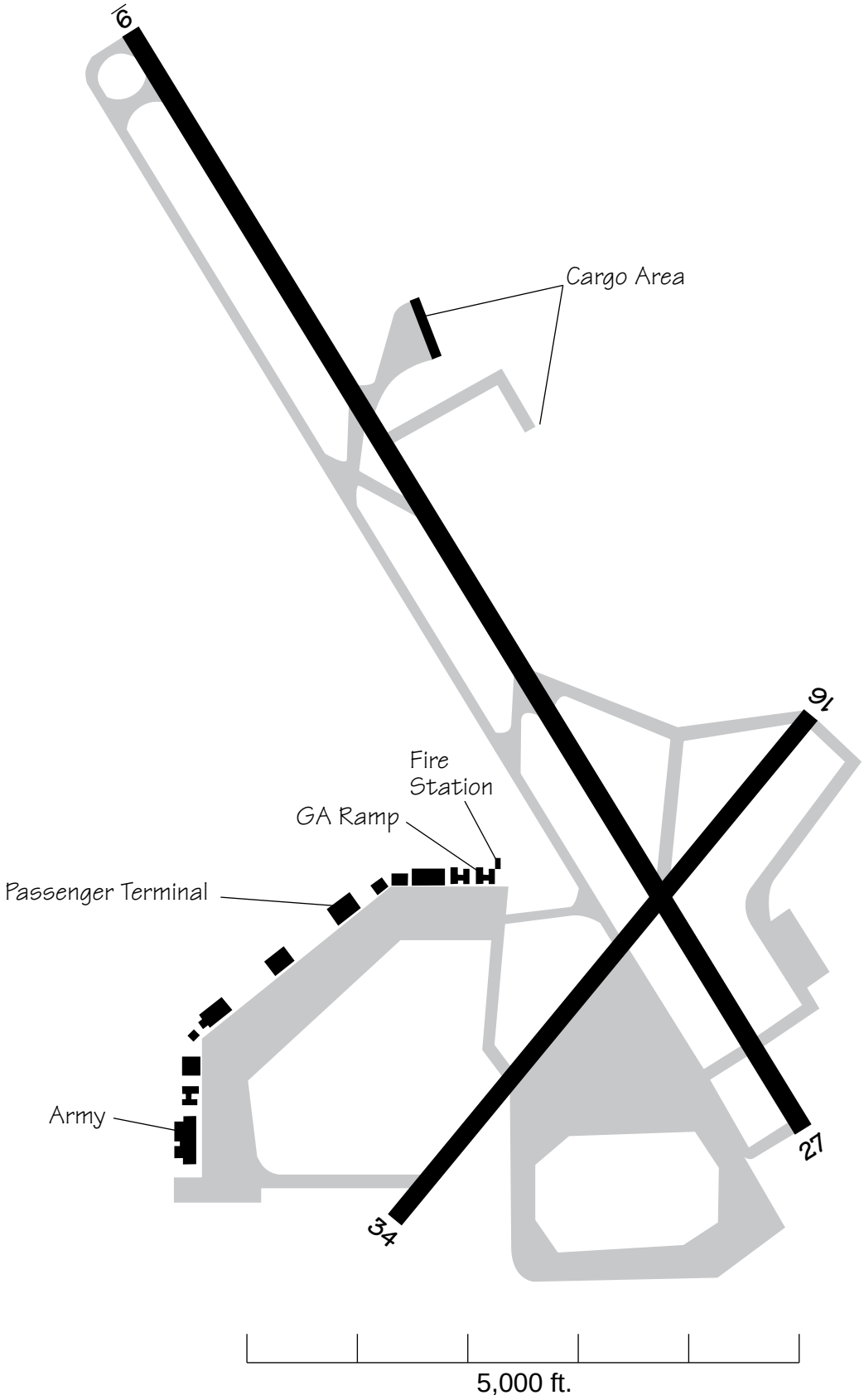
Located in Newburgh/New Windsor, New York, Stewart International Airport (Figure 3) is a reliever and cargo airport that was converted from a surplus Air Force Base. Despite a major land acquisition and improvement program sponsored by New York State, the airport has been slow to attract traffic. Although turned over to the State in 1970, the airport was not well-developed or marketed. In 1983, it was taken over by the State Department of Transportation (NYDOT), which began to market the airport to serve commercial, cargo, and corporate, as well as general aviation users. In addition, the NYDOT developed an industrial park on airport property to attract large businesses.

Prior to 1983, the State of New York invested $83 million in land acquisition and runway/taxiway improvements, and the Federal Government invested $2.2 million for the runways and taxiways. Since 1983, the State of New York has invested an additional $35 million, primarily in developing the industrial park and other airport lands. The Federal Government has invested $155 million for the Air National Guard Base, $30 million for the U.S. Postal Service Regional Mail Facility, and $15 million for other improvements on the airport. As of September 1990, private investment on the airport totalled nearly $100 million. Airport tenants were paying rents and payments in-lieu-of taxes of about $1 million per year.

Stewart today is the site of several distribution centers, production plants, and other commercial activities. Some of the tenants are Anheuser-Busch, American Express, the Air National Guard, and Cessna. Airborne, Consolidated Freightways/Emery Worldwide, Federal Express, the U.S. Postal Service, and the U.S. Department of Agriculture Animal Import Center (largest in the world) are also located at Stewart. Stewart is a regional trucking hub for Consolidated Freightways/Emery operations. The airport is a major employer in the area, accounting for about 4,300 jobs.

Stewart has a 12,000 foot runway with an instrument landing system and 9,960 acres of State-owned land available for airport development. It is the second largest airport in terms of area in the United States. A new 200,000 square-foot cargo terminal is under construction on 170 acres at the north end of the runway. Another 250,000 square-foot facility is to be built on the south end.

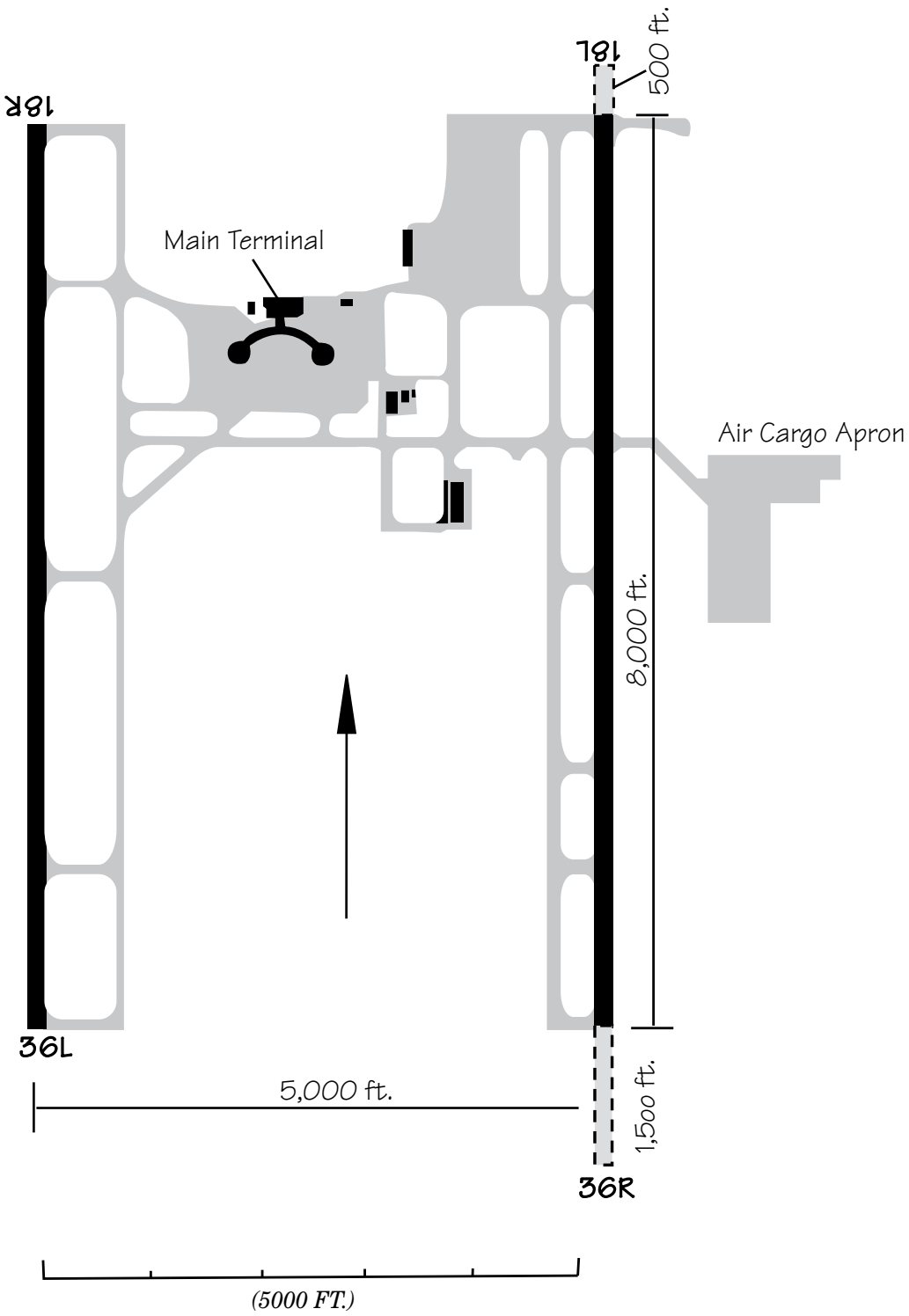
FIGURE 3 STEWART INTERNATIONAL AIRPORT (SWF)



Unlike Fort Worth/Alliance, Stewart is intended to attract passenger as well as cargo service. More than two million people live within a 45 minute drive from Stewart making it an ideal site for a satellite commercial service airport for the New York City area. The passenger terminal can handle 500 passengers an hour, and the airport has a U.S. customs center for international flights. Passenger service is seen as a vital supplement to air cargo. According to an article by Terrence Laughlin, "Countdown to Takeoff," in the September 1988 issue of *Hudson Valley* magazine, "Nothing will have a greater effect on increasing Stewart's cargo load than scheduled passenger service. Today's wide-body aircraft can carry huge amounts of cargo in the belly…The drive for passenger service is, consequently, critical to the growth of Stewart's cargo activity." American Airlines began scheduled service to Stewart in April 1990, and two other carriers have followed, although a portion of the service is by smaller, regional aircraft.

It is arguable whether Stewart is a success as a regional air-cargo center. Despite the advantage of a large investment by New York State and proximity to the New York metropolitan area, the airport has had relatively low activity historically, ranking 512 among U.S. airports in 1988 with 4,171 passengers (on non-scheduled, charter flights) and accounting for less than 1 percent of the cargo carried from the region. Currently, there are only a few all-cargo operations each day. However, several of Stewart's air-cargo tenants, including Airborne and Consolidated Freightways/Emery Worldwide, have plans to expand their facilities and operations, and develop regional hubs there. In addition, since April, when scheduled passenger service began, through December of 1990, Stewart enplaned 191,971 passengers, which will place Stewart among the 170 or 180 busiest U.S. airports in 1990.

FIGURE 4 HUNTSVILLE INTERNATIONAL AIRPORT (HSV)



Huntsville International Airport (HSV)

Huntsville, a regional commuter airport (Figure 4), and its associated industrial park were completed in 1967. It has two 8,000 foot parallel runways with 5,000 foot separation, permitting simultaneous independent ILS operations. The east runway is to be extended to 10,000 feet. With 432,000 passenger enplanements in 1988, Huntsville ranked 110th among U.S. airports.

Huntsville International Airport has every intention of becoming an intermodal cargo center for the south. In the early 1980's, the Huntsville-Madison County Airport Authority decided to go ahead with plans to pursue the cargo market in order to increase the utilization of the airport and create jobs. As a direct result of this decision, the International Intermodal Center was completed in December 1986, after a phased construction program that cost about $13 million. Money for the project came from FAA grants-in-aid under the Airport Improvement Program (AIP) and from grants by the Economic Development Administration and the Appalachian Regional Commission, while about one–third of the funds were raised through airport revenue bonds. The International Intermodal Center provides services for receiving, transferring, storing, and distributing containerized air, rail, and truck cargo. While most cargo is rail/truck traffic, a new air-cargo building was completed in April 1990 to accommodate more air traffic. And, there are already plans to expand this facility. Airborne Express, Consolidated Freightways/Emery Worldwide, Burlington Northern, and Panalpina/Cargolux provide all-cargo services at the airport. Huntsville handles about 8 million pounds of cargo annually, with more that 85 percent of the cargo (by weight) carried by the all-cargo carriers. Also located at the airport is the Huntsville-Madison County Jetplex Industrial Park, which, in addition to many businesses and industries, houses U.S. Customs, a Free Trade Zone (FTZ), and an industrial bond financing operation.

The Huntsville-Madison County Airport Authority, which includes the Huntsville International Airport, the International Intermodal Center, and the Jetplex Industrial Park, is a self-sufficient entity. No tax dollars from the city, county, State, or Federal Governments are used to support its operations. Grants and entitlements have been used for capital improvement projects, and the additional funds required have been raised through airport revenue bonds. In an economic impact study completed for the year 1988, the airport and businesses

and industries located on airport property accounted for over 5,200 jobs, with an additional 6,500 airport-related jobs located off the airport site itself. Since the study was completed, the Airport Authority estimates that the number of jobs has increased by 10 to 20 percent.

IV — Analysis of Air-Cargo Operations

Cargo Operations and Their Contribution to Delay

In analyzing cargo operations and the extent of their contribution (or non-contribution) to delay, it is important to differentiate between two types of cargo operations, belly-or combi-cargo and all-cargo. Belly cargo carried on passenger aircraft and cargo carried on combination cargo/passenger (combi) aircraft are considered passenger operations because these operations will continue whether cargo is carried or not. Cargo operations actually contribute to delay only if they are flown by all-cargo aircraft during peak hours. The approach of this study has been to consider only these all-cargo operations in the delay analysis. This has created problems in data gathering, because many airports do not maintain records of the number of flights by all-cargo aircraft.

Table 2 shows the U.S. airports with the greatest volume of cargo traffic (in total freight tonnage) and also includes selected airports with significant cargo operations, such as the major and regional hubs for the integrated express carriers. The information in the table is based on data from calendar year 1988, because that is the latest year for which published data is available. The table also includes the percentage of all-cargo to total operations for the limited number of airports that reported all-cargo operations as a discrete category. At those relatively uncongested airports that are hubs for the integrated express cargo carriers, all-cargo operations represent only about 15 percent of the total aircraft operations. At other airports, all-cargo operations are normally less than 4 percent of the total. Even at John F. Kennedy International Airport, which is number one in total cargo tonnage, all-cargo operations are only 6 percent of total operations.

Table 3 shows the airports in the U.S. with the highest percentage of operations delayed 15 minutes or more. The three New York area airports are among the top five airports in terms of aircraft delay. Of the Washington, D.C., area airports, only Washington National appears on the table. (And, as discussed below, Washington National does not have any all-cargo operations.)

Table 4 compares the statistics from Tables 2 and 3. It is interesting to note that, of the top ten airports with the highest percentage of delay, 6 are in the top ten in cargo

TABLE 2 ENPLANED AND DEPLANED FREIGHT AND MAIL, INCLUDING EXPRESS — YEAR ENDING 12/31/88

ID	Airport	Ranked by Cargo Tonnage	Total Freight Metric Tons	Total Freight Short Tons	Total Ops	All Cargo Ops	% Cargo Ops
JFK	NY-John F. Kennedy Intl	#1 in total cargo enplaned/deplaned worldwide	1,299,104	1,431,613	304,490	18,343	6.02%
LAX	Los Angeles Intl	#4 in total operations & cargo enplaned/deplaned worldwide	1,099,522	1,211,673	622,427		
ORD	Chicago-O'Hare Intl	#1 in operations & #5 in total cargo worldwide	906,928	999,435	803,453	15,356	1.91%
MIA	Miami Intl	#6 in total cargo enplaned/deplaned worldwide	740,280	815,789	364,476	54,670	15.00%
SDF	Sandiford Field, KY	UPS hub and #9 in total cargo enplaned/deplaned worldwide	701,502	773,055	159,958	25,476	15.93%
ATL	Atlanta-Hartsfield Intl	#2 in operations & #12 in total cargo worldwide	598,365	659,398	778,779		
SFO	San Francisco Intl	#8 in operations & #13 in total cargo worldwide	575,249	633,924	452,005		
DAY	Dayton Intl, OH	Emery hub, #16 in total cargo worldwide	500,031	551,034	214,391	32,488	15.15%
EWR	New York-Newark Intl	Fed Ex rgnl hub, #18 in total cargo worldwide	454,681	501,058	370,331	12,857	3.47%
BOS	Boston-Logan Intl, MA	#11 in operations & #21 in total cargo worldwide	320,156	352,812	414,968	9,001	2.17%
FWA	Ft Wayne Muni, IN	Burlington Air Exp hub, #22 in total cargo worldwide	318,982	351,518	121,398	14,128	11.64%
DEN	Denver-Stapleton Intl	#6 in operations & #25 in total cargo worldwide	290,387	320,006	503,095		
ONT	Ontario Intl, CA	UPS rgnl hub, #28 in total cargo worldwide	259,775	286,272	138,554		
IND	Indianapolis Intl	CF Air Freight, Arrow, FedEx rgnl hub, #31 in world cargo	236,242	260,339	220,234		
SEA	Seattle-Tacoma Intl	Air-Sea-Land intermodal center	227,200	250,374	315,944		
PHL	Philadelphia Intl	UPS rgnl hub, #12 in operations & #33 in cargo worldwide	219,535	241,928	414,902		
DFW	Dallas-Ft Worth Intl	#4 in total operations worldwide	201,601	222,164	675,060		
OAK	Metro. Oakland Intl, CA	Fed Ex/UPS rgnl hubs, #15 in operations & #38 in cargo	189,424	208,745	400,188	19,786	4.94%
IAD	Washington-Dulles Intl	Major Washington, DC, area airport	166,443	183,420	231,113	7,064	3.06%
BWI	Baltimore-Washington Intl	Major Washington, DC, area airport	145,747	160,613	307,879	8,100	2.63%
CVG	Greater Cincinnati Intl	DHL hub, #40 in operations & #48 in cargo worldwide	143,696	158,353	272,695	15,484	5.68%
ILN	Wilmington, OH	Airborne hub, privately owned	109,623	120,805	21,894	b) 21,675	99.00%
LGA	New York-LaGuardia	Major New York area airport	106,188	117,019	362,072	359	0.10%
MEM	Memphis Intl	Main Fed Ex hub, #24 in operations & #81 in total cargo worldwide	64,775	71,382	353,091	54,706	15.49%
DCA	Washington National	Major Washington, DC, area airport	64,390	70,958	322,403		
LCK	Rickenbacker ANGB, OH	Fed Ex large-cargo hub, formerly the Flying Tigers hub	29,824	32,866	a) 44,000	11,000	25.00%
SWF	Stewart Intl, NY	CF/Emery & Airborne regional hubs; planned as NYC reliever	18,041	19,881	81,797	3,223	3.94%
BGR	Bangor Intl, ME	Planned as east coast cargo reliever	527	581	128,436	272	0.21%

a) Enplaned tons only.
b) Estimate provided by Airborne Traffic Management; FAA/RSPA Airport Activity Statistics of Certificated Route Air Carriers.

tonnage. Looking only at this relationship, one might assume that delays could be reduced by relocating the cargo activity. However, as will be explained in the following paragraphs, this is not necessarily true.

TABLE 3 PERCENTAGE OF OPERATIONS DELAYED 15 MINUTES OR MORE

Airports	Percentage				
	1985	1986	1987	1988	1989
Newark International	9.2	13.8	6.5	6.7	10.3
Chicago O'Hare International	4.1	5.6	4.6	5.5	10.2
New York La Guardia	9.2	8.9	6.5	5.2	9.4
San Francisco International	3.4	5.3	6.2	6.3	7.0
New York Kennedy	6.1	7.0	6.5	5.3	6.0
Boston Logan International	6.1	7.3	4.8	3.7	3.0
St. Louis-Lambert International	4.6	4.4	1.6	2.7	2.8
Denver Stapleton International	4.6	3.2	3.7	3.7	2.6
Dallas-Fort Worth International	1.7	2.6	2.0	1.4	2.4
Atlanta Hartsfield International	6.2	6.5	6.2	3.5	2.3
Philadelphia International	0.9	2.0	3.7	2.6	2.0
Detroit Metropolitan	2.1	1.3	1.5	1.5	1.6
Los Angeles International	0.8	1.1	3.3	1.7	1.0
Washington National	2.0	3.2	2.3	1.5	1.0
Minneapolis International	2.2	3.9	0.7	1.4	0.7
Houston International	0.3	0.2	0.5	0.7	0.7
Pittsburgh International	1.7	0.6	0.7	0.7	0.6
Cleveland Hopkins International	0.1	0.3	0.1	0.5	0.2
Miami International	0.3	0.7	0.4	0.3	0.2
Kansas City International	0.3	1.0	0.5	0.2	0.2
Fort Lauderdale International	0.1	0.3	0.2	0.2	0.2
Las Vegas McCarran International	0.0	0.0	0.1	0.1	0.1

Source: ATOMS Data

TABLE 4 COMPARISON OF RANKINGS IN DELAY AND CARGO TONNAGE

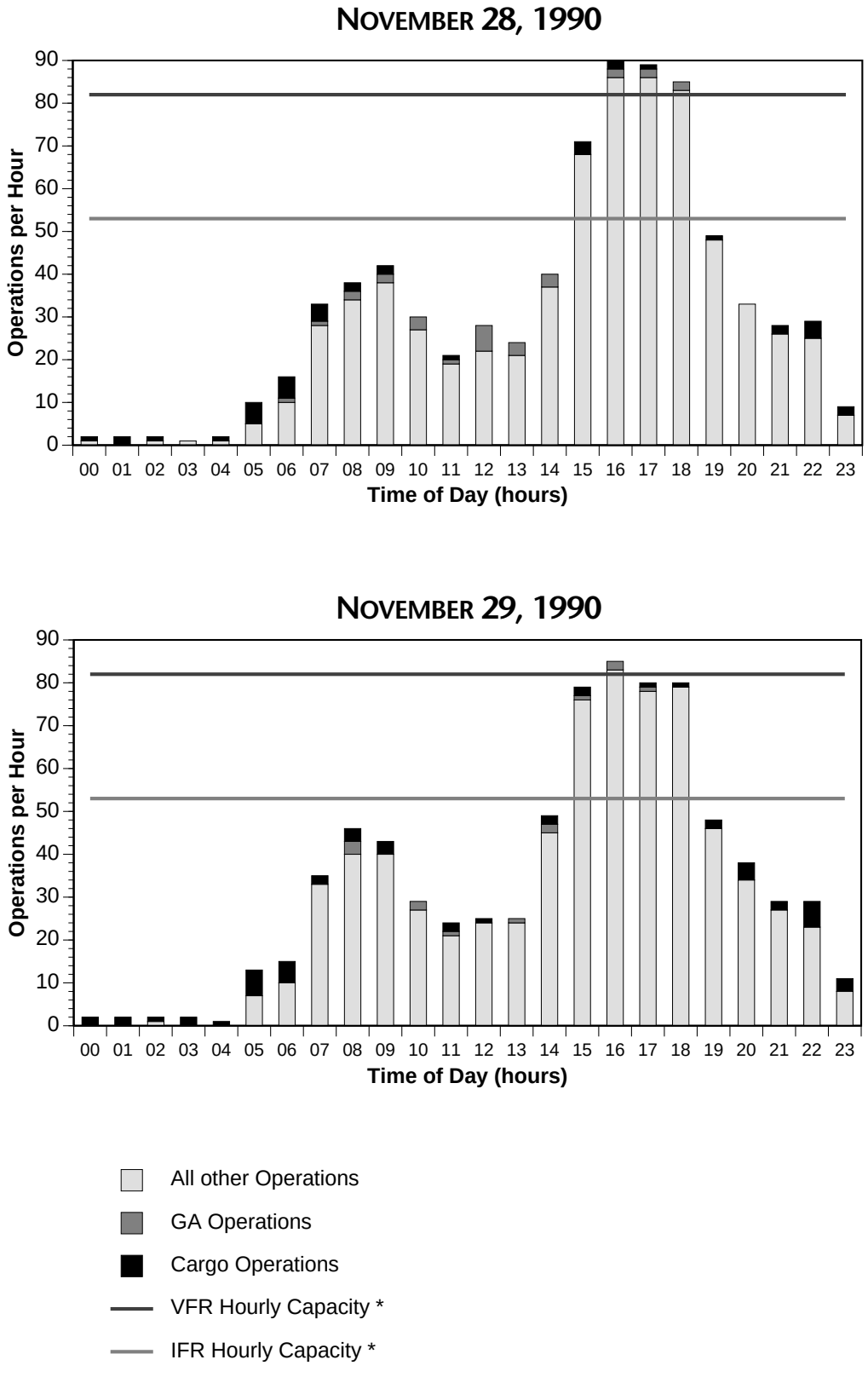
Delay Ranking	Airport	Cargo Tonnage
1	Newark International	9
2	San Francisco International	7
3	Chicago O'Hare	3
4	New York John F. Kennedy	1
5	New York La Guardia	30
6	Boston Logan	10
7	Denver Stapleton	13
8	Atlanta Hartsfield	6
9	St. Louis International	35
10	Philadelphia International	18

Analysis of All-Cargo Operations at New York-Area Airports

General

Tables 7 through 12 (see Appendix A) tabulate the number of cargo operations, general aviation operations, and all other aircraft operations, broken down by hour, for the three airports in the New York area for a typical two-day period. These hourly traffic figures were developed based on the *Official Airline Guide* and historical data provided by the FAA Central Flow Control Facility. In order to more easily visualize the actual impact by hour of all-cargo operations, Figures 5, 7, and 9 compare these operations to the airports' nominal hourly capacity, under both visual flight rules (VFR) and instrument flight rules (IFR) conditions. The nominal airport capacity figures were obtained from the National Plan for Integrated Airport Systems (NPIAS) database maintained by the FAA. They are intended only as a gauge for comparison against current hourly traffic figures. An airport's actual capacity varies during the day and depends on a number of factors, including the runway configuration that is being used and the mix of aircraft types taking off and landing.

FIGURE 5 TOTAL HOURLY OPERATIONS AT JOHN F. KENNEDY INTERNATIONAL AIRPORT



* Theoretical capacity taken from the National Plan for Integrated Airport Systems (NPIAS) database maintained by the FAA.

John F. Kennedy International Airport (JFK)

John F. Kennedy International Airport (Figure 6) exceeded its nominal VFR capacity of 82 operations per hour during three hours on 11/28/90 and during one hour on 11/29/90 (Figure 5). Cargo operations do contribute to exceeding capacity in those hours, but, as the graph shows, this contribution is slight. Just over 2 percent of the total 90 operations at the busiest hour are due to all-cargo aircraft, about the same percentage as general aviation. This means that, at the busiest hour, there were only two all-cargo operations. Of the four times JFK's VFR capacity was exceeded, there was a total of only three all-cargo operations. About 90 percent of the cargo operations are scheduled for hours when the airport has ample capacity in good weather and bad.

FIGURE 6 JOHN F. KENNEDY INTERNATIONAL AIRPORT (JFK)

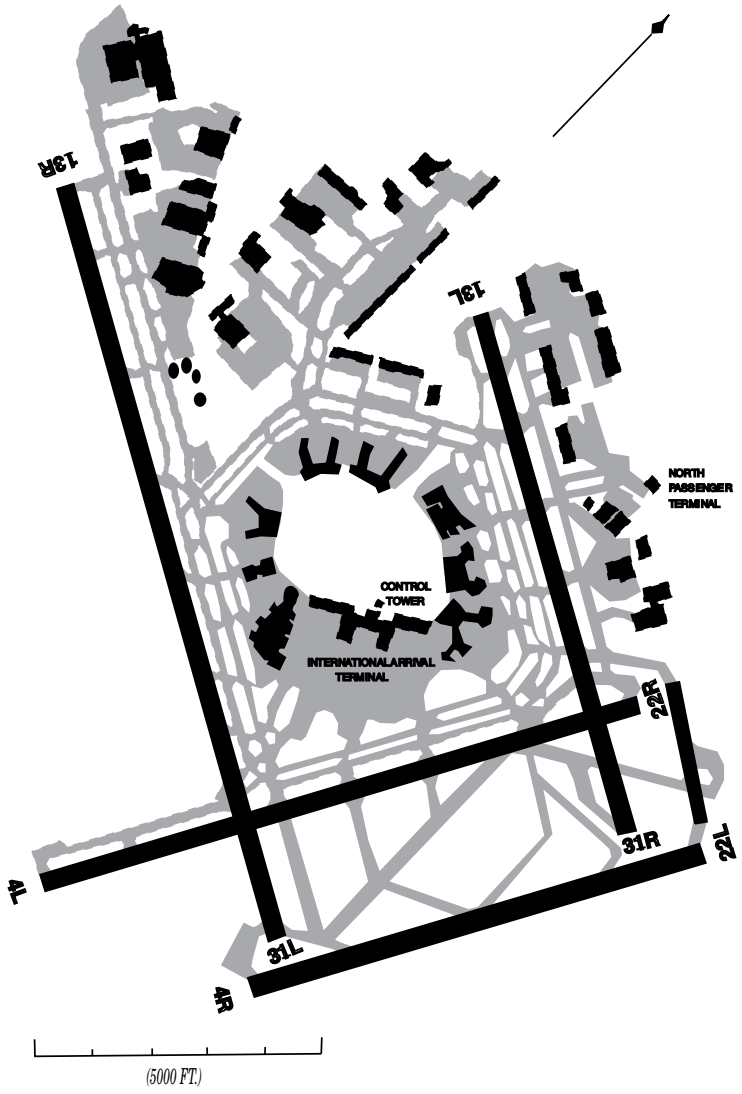
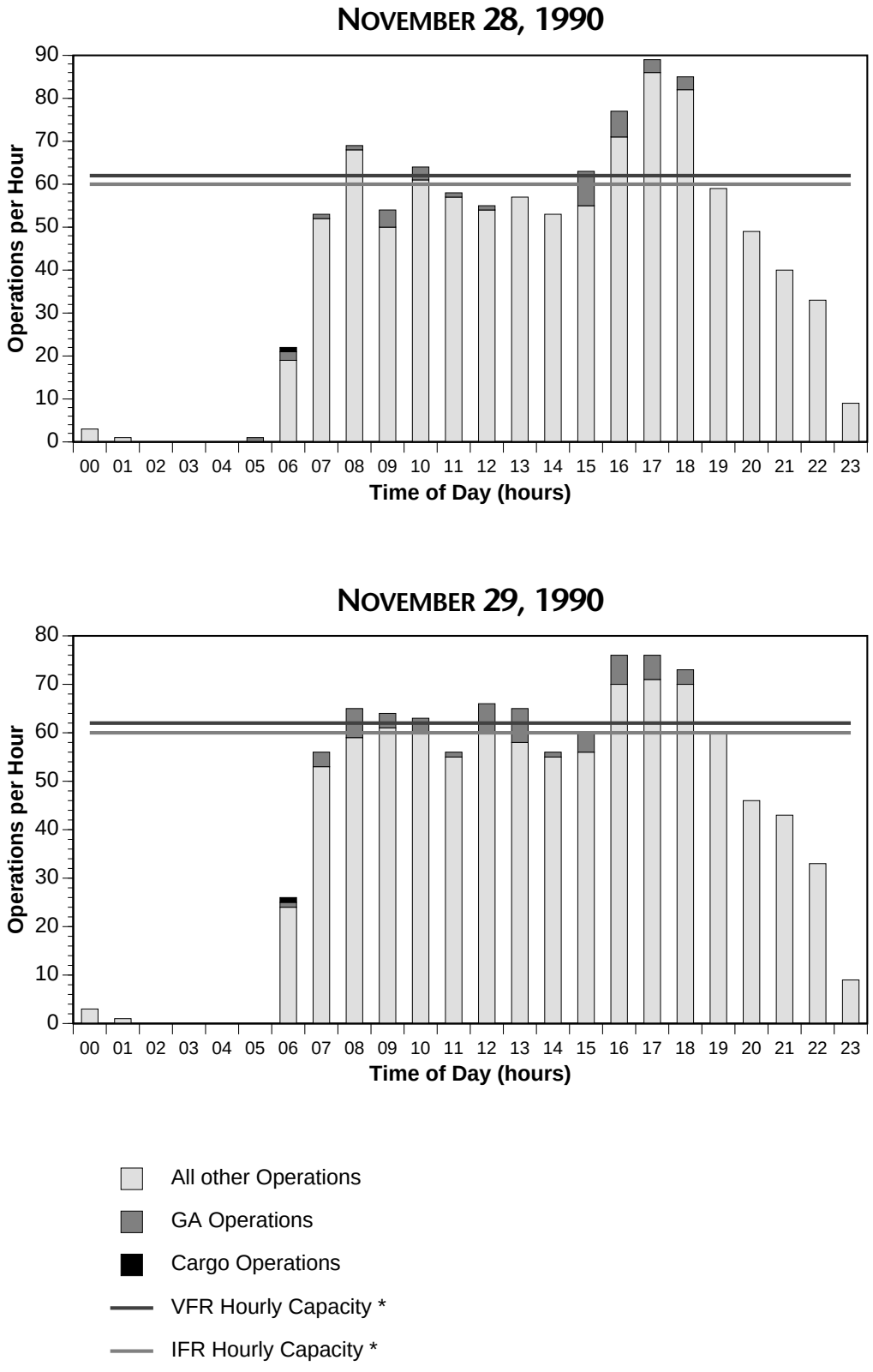


FIGURE 7 TOTAL HOURLY OPERATIONS AT LA GUARDIA INTERNATIONAL AIRPORT



* Theoretical capacity taken from the National Plan for Integrated Airport Systems (NPIAS) database maintained by the FAA.

LaGuardia Airport (LGA)

LaGuardia Airport (Figure 8) exceeded its VFR capacity of 62 operations per hour six times on 11/28/90 and eight times on 11/29/90 (Figure 7). Since LaGuardia has only one all-cargo flight per day, at 0600, cargo operations were not a factor in adding to congestion.

FIGURE 8 LA GUARDIA INTERNATIONAL AIRPORT (LGA)

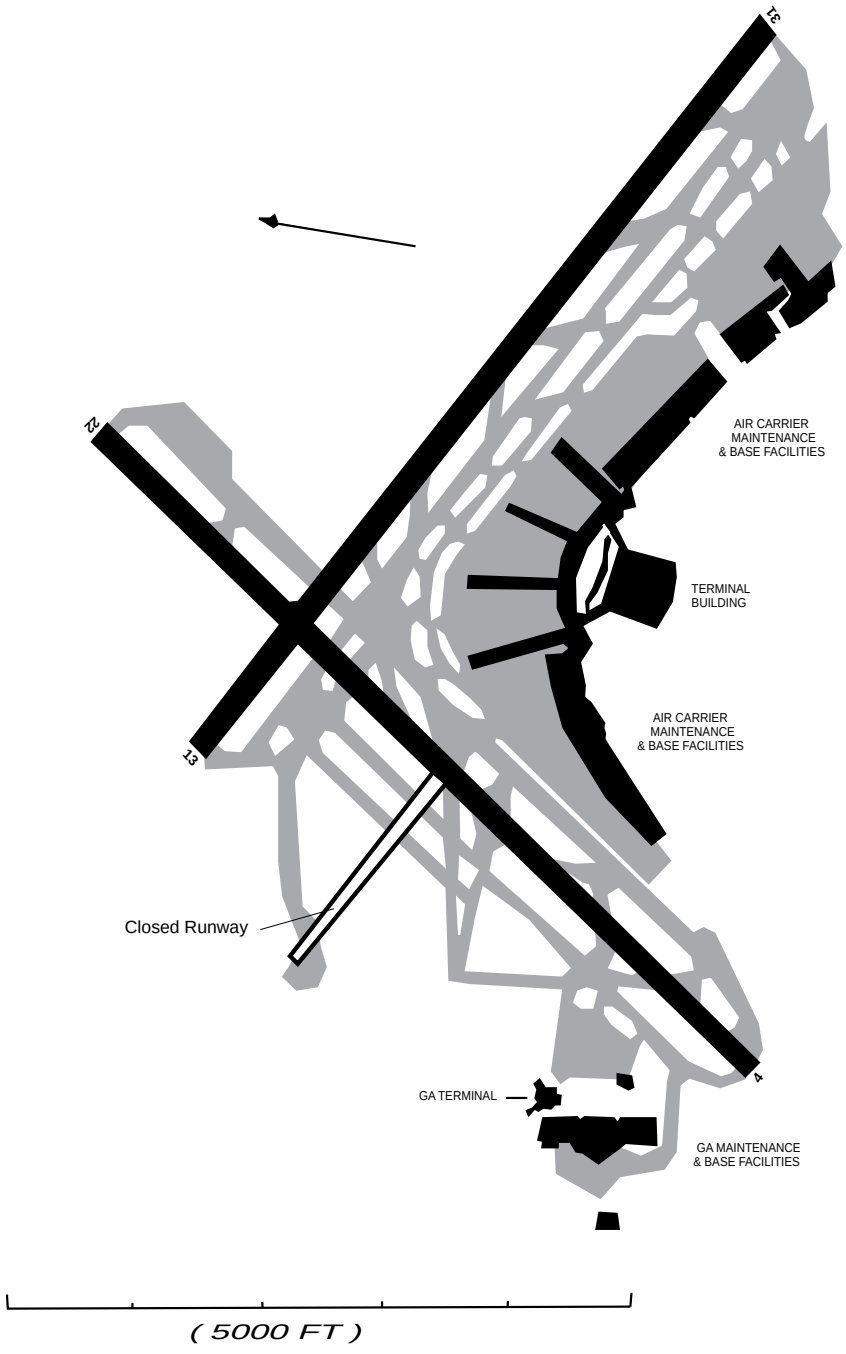
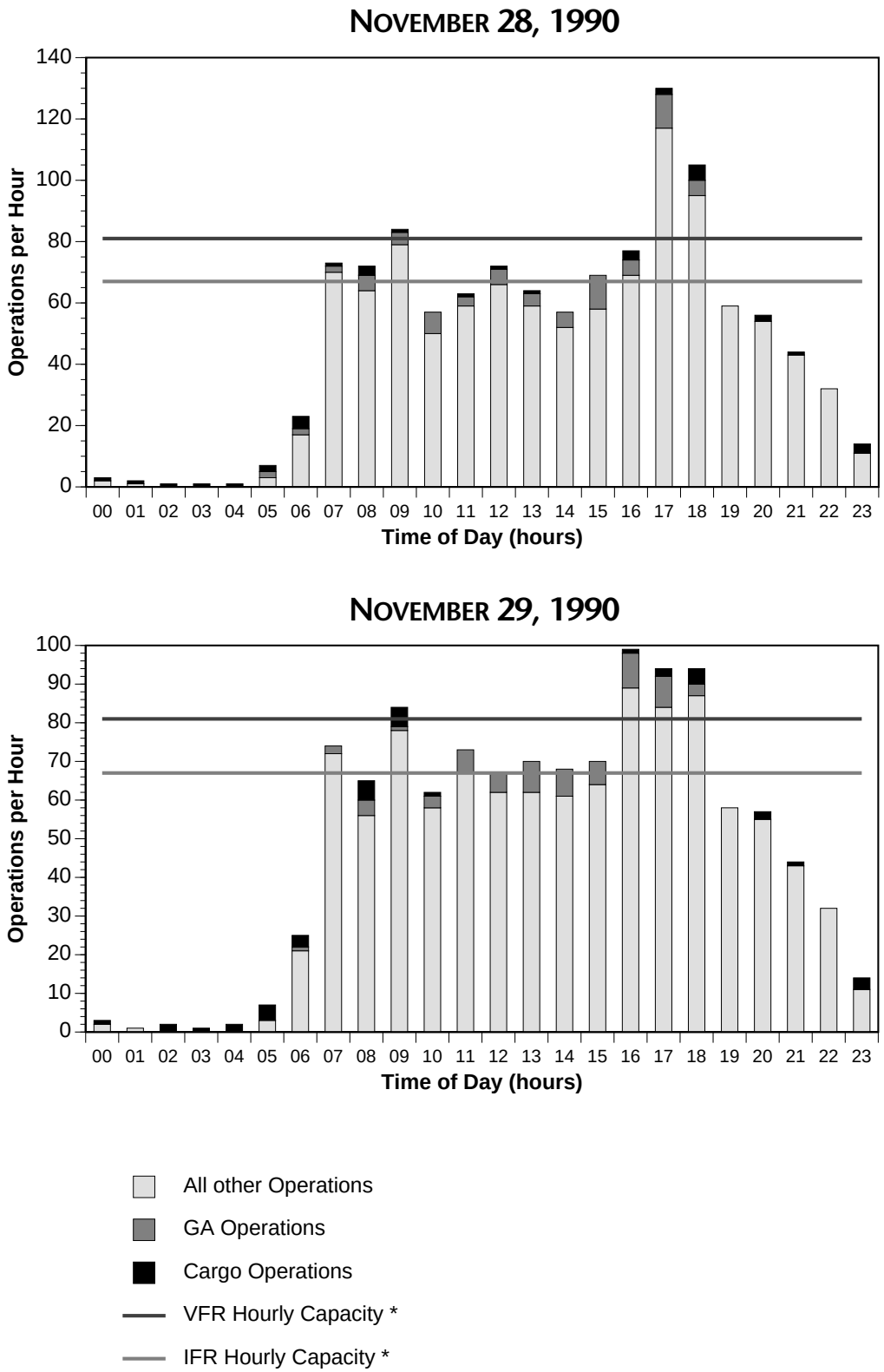


FIGURE 9 TOTAL HOURLY OPERATIONS AT NEWARK INTERNATIONAL AIRPORT

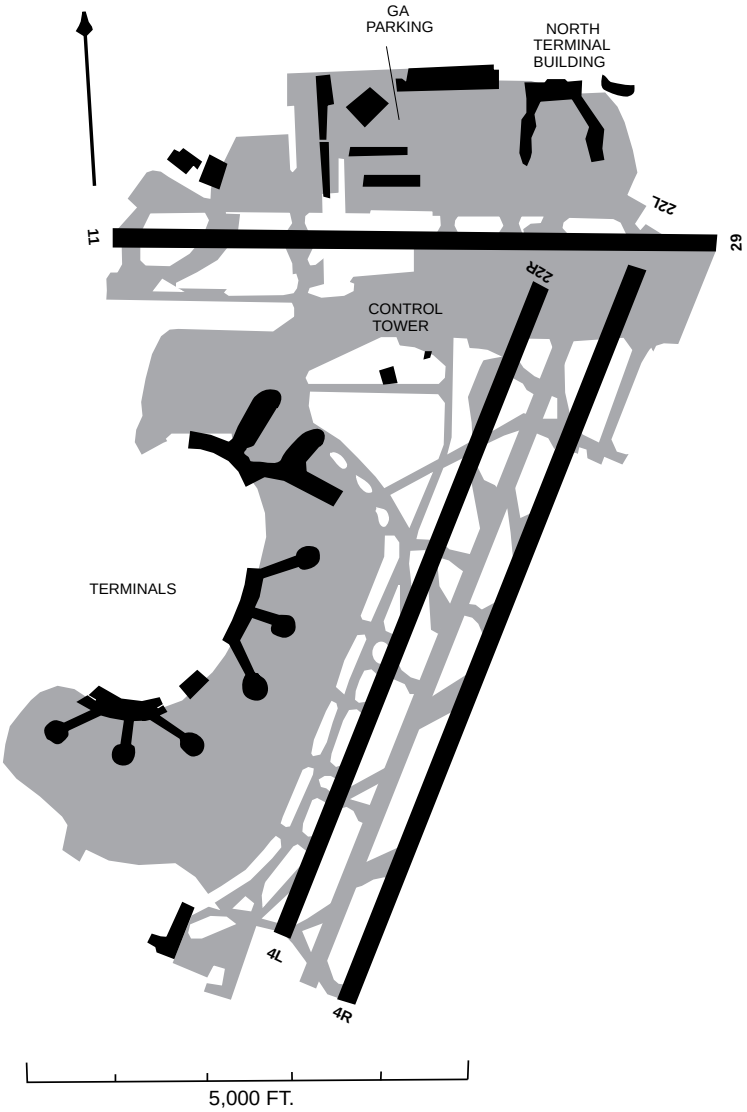


* Theoretical capacity taken from the National Plan for Integrated Airport Systems (NPIAS) database maintained by the FAA.

Newark International (EWR)

Newark International (Figure 10) exceeded its VFR capacity of 81 operations per hour three times on 11/28/90 and four times on 11/20/90 (Figure 9). All-cargo operations contribute to exceeding capacity, but this contribution averages about three percent, less than general aviation. At the busiest hour (1700, 11/28/90), there were only two all-cargo operations. At their worst (0900, 11/29/90), all-cargo operations represented 6 percent of the total operations, or 5 of 84 operations. About 60 percent of the cargo operations at Newark are scheduled for hours when there is ample capacity in good weather and bad.

FIGURE 10 NEWARK INTERNATIONAL AIRPORT (EWR)



In summary, air-cargo operations are only a small part of the delay and congestion problem at JFK and Newark airports. Any benefits in terms of delay-cost savings that would result from diverting all-cargo operations to another airport would probably be far outweighed by the cost of duplicating the tremendous cargo infrastructure that has developed there. A large part of the cargo is carried in the baggage holds of airliners and will remain at the busiest passenger airports. Several of the cargo station managers interviewed pointed out that New York remains the center of many businesses and industries that depend on air cargo, like the garment industry and the diamond markets. Cargo operations generate essential revenue at airports that must remain open 24 hours a day during the hours that air-carrier passenger operations are at their lowest levels. Both Newark and JFK are expanding their ground-side cargo facilities in order to meet the future demand of the increased cargo operations they expect and are actively seeking.

V — Air-cargo Operations in the Washington, D.C., Area

Description of Washington Air-Cargo Operations

Washington Dulles International Airport (IAD)

The Dulles catchment area (from Pennsylvania to North Carolina) generated over $5.8 billion in air exports in 1989, according to a Virginia Department of Aviation study. Dulles (Figure 11) has grown to become the seventh largest U.S. gateway airport for nonstop passenger flights to Europe. This increase in nonstop flights leads to an increase in passenger travel, and more importantly, an increase in cargo capacity and revenues for the region.

With the transfer of Washington Dulles and Washington National Airports from the Federal Government to the Metropolitan Washington Airports Authority in 1987, a $1.5 billion capital development program was initiated. The $800 million program at Dulles includes a new international arrivals building, terminal expansion, and parking and taxiway improvements. Ultimately, two additional runways are planned for construction. With these improvements, the Authority estimates that Dulles will be able to handle up to 700,000 takeoffs and landings per year, making it one of the busiest airports in the world. Passenger load will have increased from 500,000 passengers in 1962 to 20 million by the year 2000. While domestic passenger travel increased 7.3 percent at Dulles last year, international travel jumped nearly 15 percent — double the national average. Since cargo traffic follows passenger traffic, the Washington area can expect an infusion of capital from increased trade and investments.

According to a recent study by the Virginia Department of Aviation, Dulles air cargo has averaged a 24 percent annual growth in cargo tonnage since 1982, making it the fastest-growing East Coast gateway for air freight. The airport currently handles about 370 million pounds annually. The study projects continued growth for domestic air freight due to U.S economic strength, new air freight services, and the growth of facsimile and other electronic communications. The international air freight

FIGURE 11 WASHINGTON DULLES INTERNATIONAL AIRPORT (IAD)

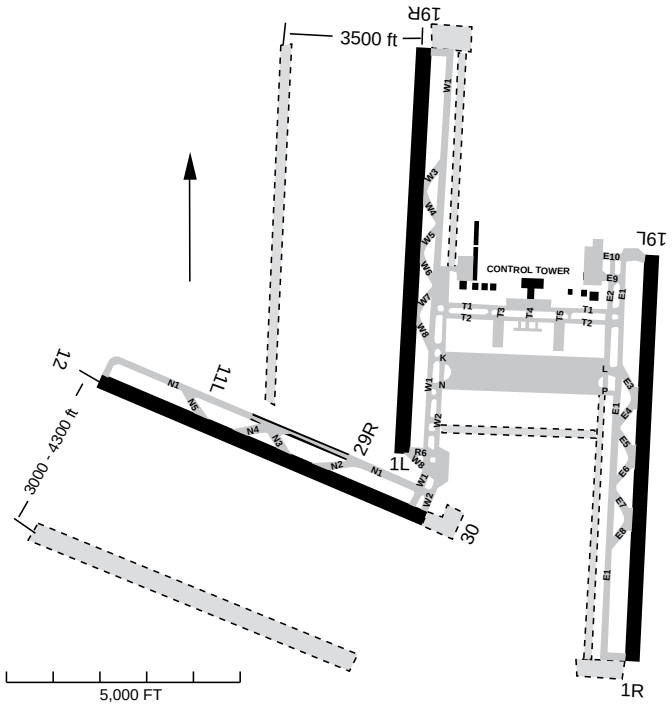
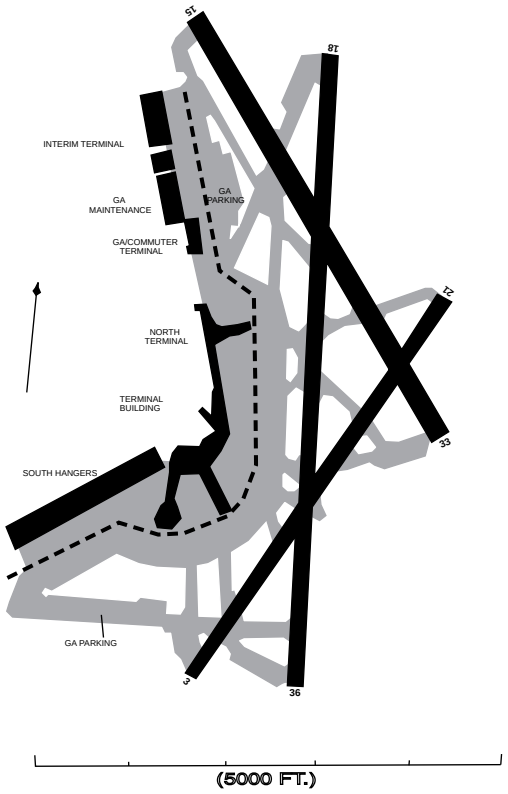


FIGURE 12 WASHINGTON NATIONAL AIRPORT (DCA)



business is expected to grow at a rate equal to or exceeding the last five years due to expansion in world trade, new international routes from Dulles, and the ability of combination, or combi carriers (passenger and freight) to compete effectively with freight-only carriers.

By the fall of 1991, Cargo Building #5 at Dulles will be completed. This building will make a radical difference, tripling the airport's capacity to handle air freight. It will include complete, state-of-the-art services, storage and office space, refrigeration for perishable goods, loading docks for eight large aircraft, and a staging area for trucks to expedite loading and unloading. Included will be a centralized customs facility with a drive-through design to expedite cargo transfer.

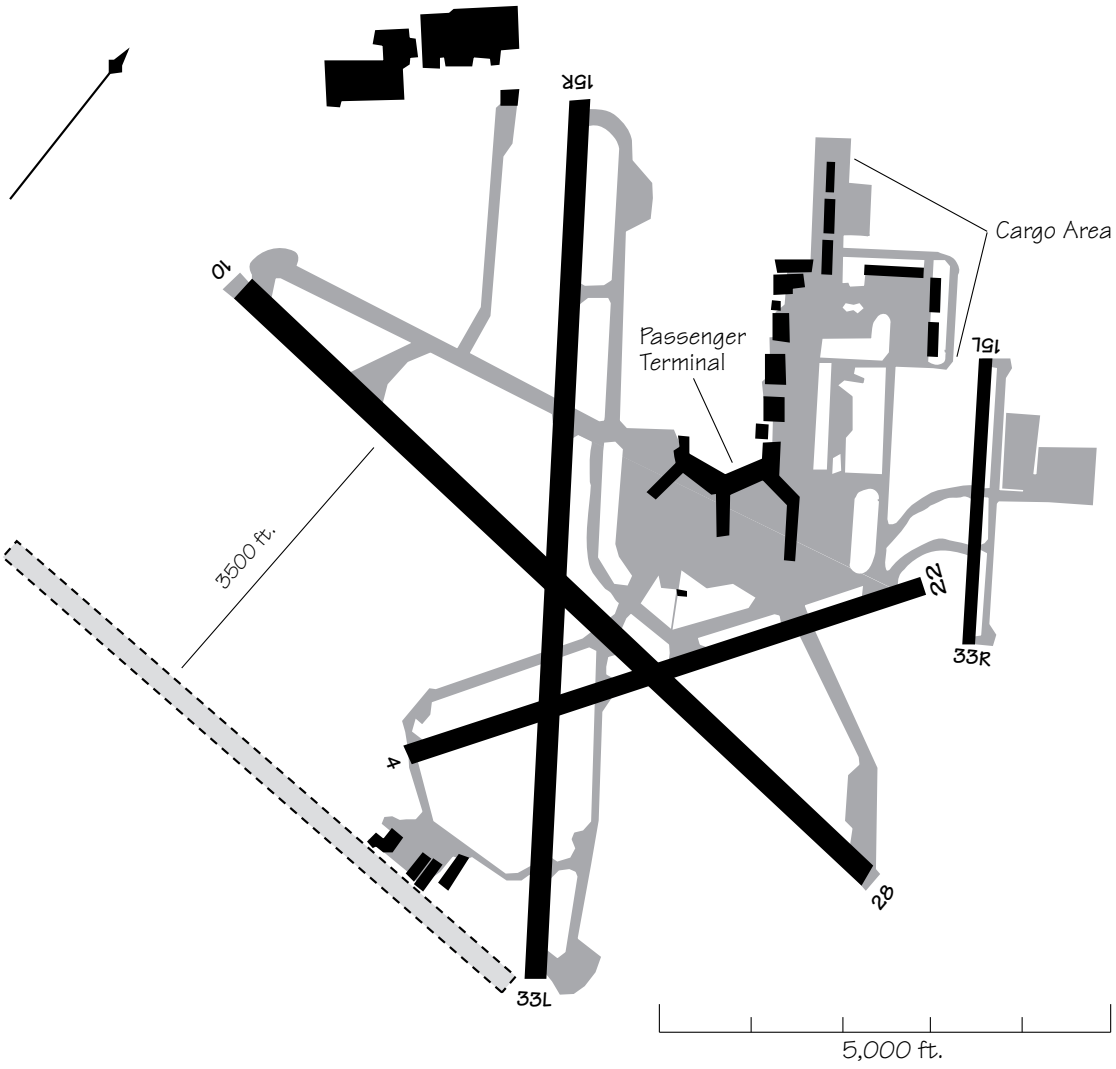
Washington Dulles is actively seeking more cargo traffic. According to the former president of the Washington Area Cargo Authority (WACA), "Dulles is a major hub with a very significant untapped cargo potential." And, the president of the Washington Airports Task Force says that "Collectively we're going to make Dulles a major world cargo center. There is a need for a major mid-Atlantic cargo hub, and Dulles is a natural to fulfill that function."

According to the Task Force, Dulles is operating near the maximum capacity of its current cargo facilities, but, when the new facility is ready in the fall of 1991, there will be room to more than triple its cargo operations. (It should be noted that at Dulles the factor that determines cargo capacity is the warehouse/cargo sorting space available, not the runway or airspace capacity.) All-cargo operations at Dulles average 50 to 60 per week. Most all-cargo operations are conducted during off-peak hours.

Washington National Airport (DCA)

Air-cargo facilities at National (Figure 12) include three buildings with more than 60,000 square feet of office, cargo, parking and storage space. The largest facilities are operated by United Airlines. Other air freight operations at the airport are conducted by American, Northwest, TWA, Delta, USAir and Eastern. U.S. Postal Service mail is the predominant cargo item leaving from and arriving at National, averaging over 8 million pounds a month. All the cargo carried from National is either belly or combi cargo. There are no all-cargo operations at this airport. Only one all-cargo flight was recorded in 1988.

FIGURE 13 BALTIMORE/WASHINGTON INTERNATIONAL AIRPORT (BWI)



Baltimore/Washington International Airport (BWI)

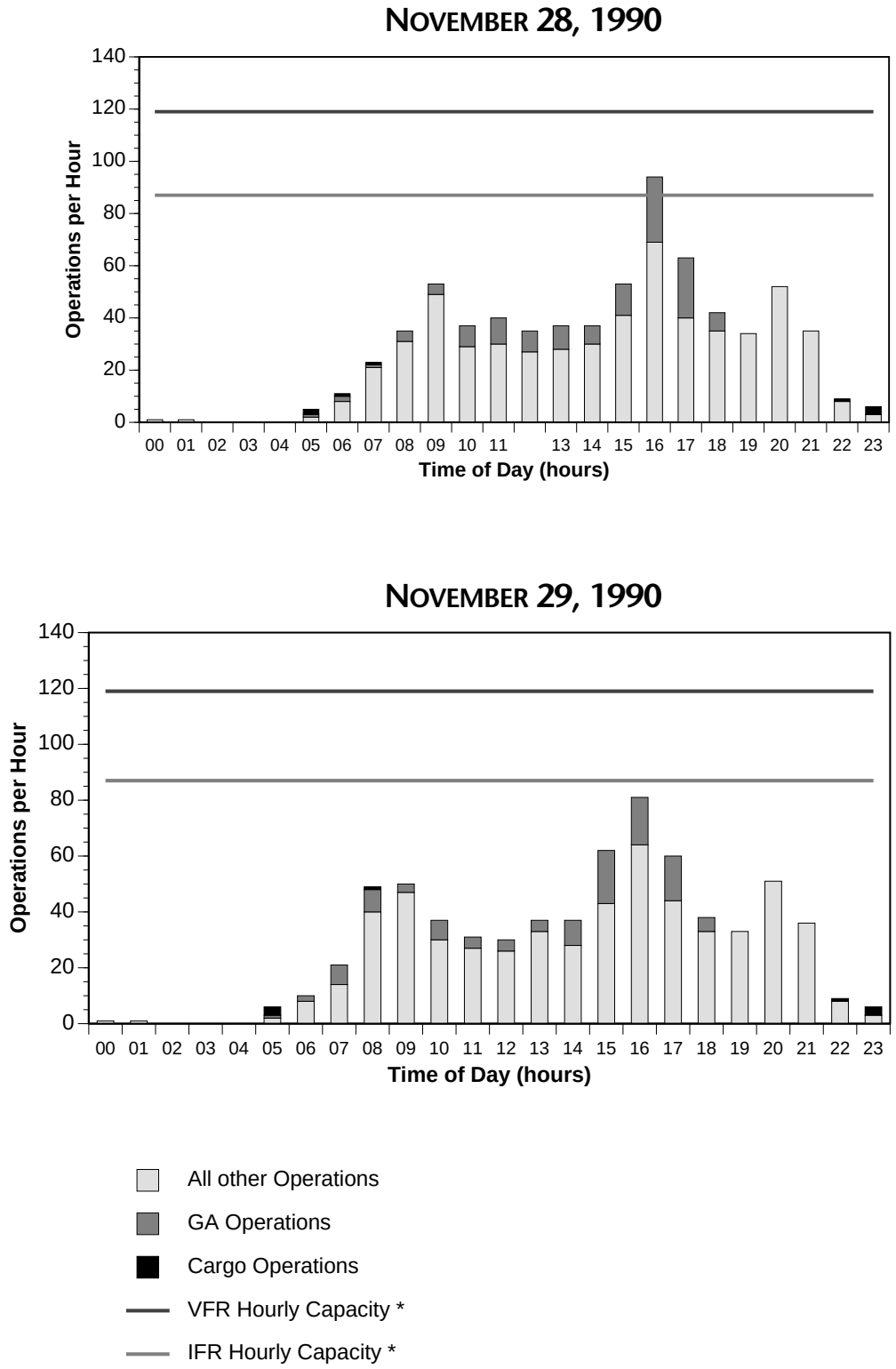
Baltimore/Washington International Airport (Figure 13) reported an increase last year of more than 2 percent in air-cargo volume, handling 244 million pounds. The airport has 330,000 square feet of cargo facilities on more than 30 acres.

BWI is also actively seeking additional cargo traffic. According to the manager of cargo development at BWI, the airport has always been one of the Nation's most progressive airports in the area of cargo. The airport's proximity to Interstate 95 and to the Port of Baltimore are advantageous to both shippers and consignees. About 10 percent of the cargo handled by BWI is air/sea merchandise, utilizing both airline and ship transportation. This special service meets the speed and handling requirements of shipments such as machine and air parts.

New to BWI this year is KLM Royal Dutch Airlines, which uses the new, extended-range Boeing 747-400. This jumbo jet can carry 295 passengers and crewmembers and up to 70,000 pounds of freight in a combi configuration. The ability to haul cargo in the rear of the main deck of the aircraft allows the plane to carry oversize items not suitable for other aircraft (specifically those which depend upon belly cargo). Of interest is the intention of KLM to expand its capacity to export American livestock.

At present, according to the airport's Planning Office, BWI is operating at about 90 percent of the capacity of their existing cargo facilities, and they are planning a large expansion of air freight facilities which will provide more direct ramp access for all-cargo aircraft. There are an average of 150 all-cargo operations at BWI each week. These all-cargo operations are ordinarily scheduled at off-peak hours.

FIGURE 14 TOTAL HOURLY OPERATIONS AT WASHINGTON DULLES INTERNATIONAL AIRPORT



* Theoretical capacity taken from the National Plan for Integrated Airport Systems (NPIAS) database maintained by the FAA.

Effects of Air-Cargo Operations on Congestion and Delay

General

Tables 13 through 18 (see Appendix A) tabulate the number of cargo operations, general aviation operations, and all other aircraft operations, broken down by hour, for the three airports in the Washington, D.C., area for a typical two-day period. Again, to more easily visualize the actual impact by hour of all-cargo operations, Figures 14 through 16 compare these operations to the airports' nominal capacity, under both VFR and IFR conditions. Air-cargo operations do not contribute significantly to delay at the Washington, D.C., area airports. All-cargo operations are scheduled predominantly at off-peak hours at both Dulles and Baltimore/Washington, between 2200 hours and 0800 hours at Dulles and 2100 hours and 0800 at Baltimore/Washington. No all-cargo operations are conducted at National.

World air-cargo operations are projected to double by the end of the century, according to Boeing's *World Air Cargo Forecast*. Even at these levels, the airports in the Washington area will still be operating under their capacity for cargo. And, there will continue to be a great deal of unused capacity at Dulles and Baltimore/Washington International, where the airport authorities are actively seeking more cargo operations.

Washington Dulles International Airport (IAD)

Only once in the observed two-day period (Figure 14) do hourly operations at Dulles even exceed its rated capacity of 87 operations per hour for IFR conditions (which were not in effect on the date indicated). This was during the 1600 hour, 11/28/90, when 94 flights arrived or departed. No all-cargo operations were recorded during this period. However, there were 25 general aviation flights in that hour. Dulles' capacity under VFR conditions is 119 operations per hour.

According to the *Washington Dulles International Airport Capacity Plan*, October 1990, produced by the FAA and the Metropolitan Washington Airports Authority, an annual demand of 450,000 operations represents a daily demand of 1,406 operations and a peak-hour demand of 117 operations. (These figures were generated by a capacity/delay computer model to support the Capacity Plan.)

TABLE 5 AIRCRAFT OPERATIONS, WASHINGTON DULLES INTERNATIONAL AIRPORT

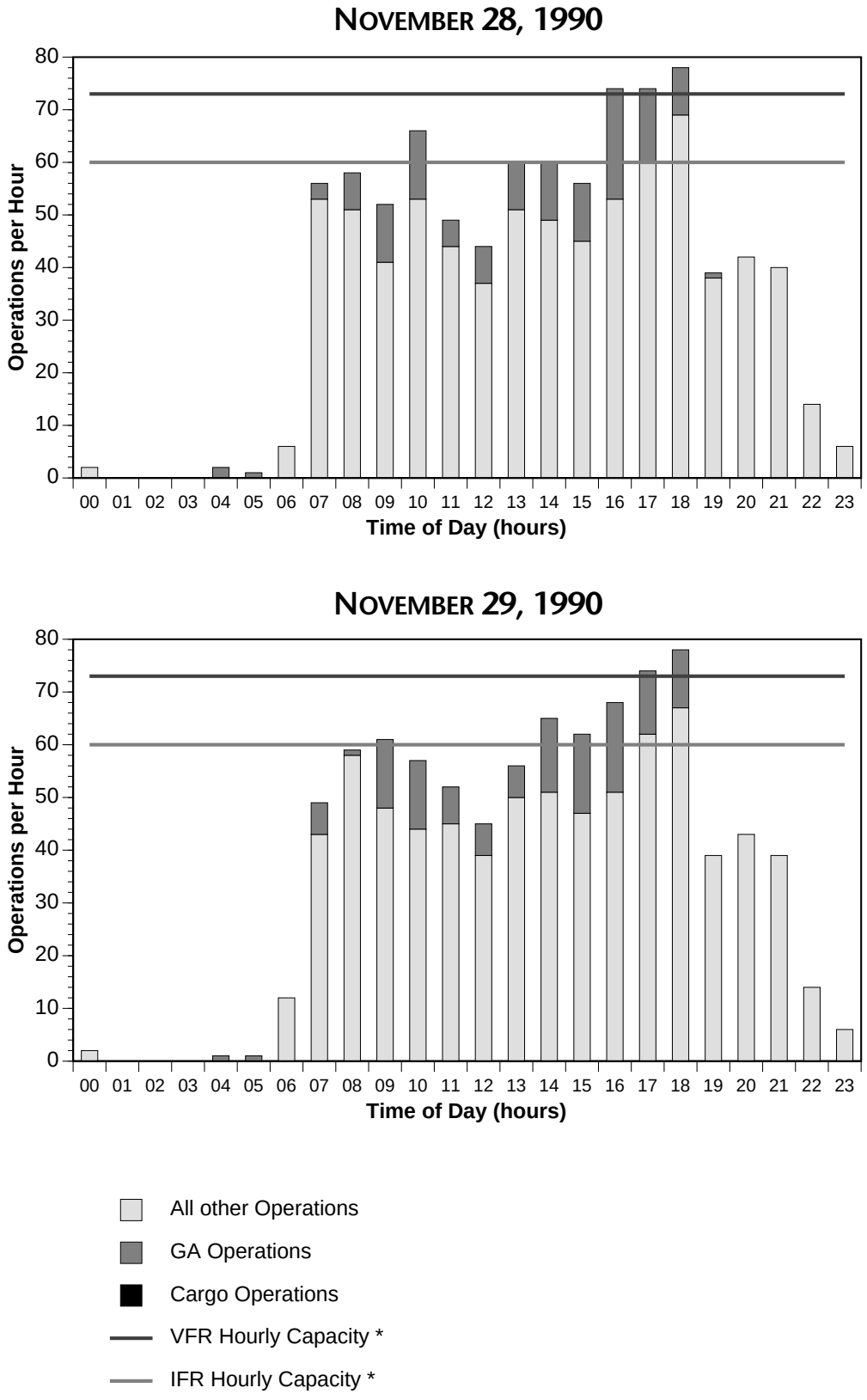
Year	Total Operations	All-cargo Operations
Actual		
1985	198,000	
1988	241,000	
Forecast	Assuming the percentage of all-cargo operations reported in 1988 (Table 2) remains constant at 3.06%	
1990	236,000	8,048
1995	408,000	12,485
2000	452,000	13,382
2005	490,000	14,994

Source for actual and forecast total operations: FAA-APO-90-6, *Terminal Area Forecasts FY 1990-2005,* July 1990.

The FAA's *Terminal Area Forecasts FY 1990-2005* estimates that Dulles will reach this level of operations about the year 2000. For Dulles, this peak-hour demand of 117 operations is still below the VFR hourly capacity of 119 operations (see Figures 12a and 12b) of the present airport configuration. Current plans for Dulles include the construction of one, and perhaps two, additional runways before FY 2000. This, and other capacity improvements planned for Dulles, will further increase the airport's capacity.

By 2005, total operations at Dulles are projected to reach 490,000 per year (see Table 5). The FAA does not forecast cargo operations, but, assuming that they remain a relatively constant percentage of total operations, all-cargo aircraft operations will more than double by 2005, from just over 7,000 operations per year in 1988 to nearly 15,000 per year. This constant percentage may result in a high estimate, because most of Dulles' growth in cargo has been from belly and combi cargo, and this trend is expected to continue. On the other hand, the new cargo facilities scheduled for completion in the fall of 1991 may attract enough all-cargo carriers to reach 15,000 annual operations by 2005. In any case, 15,000 all-cargo operations per year represents approximately 41 operations per day, or an average of just under two per hour. Since all-cargo aircraft are expected to continue to operate predominantly at night, or during off-peak hours, this level of daily operations should not become a significant factor in delay and congestion at Dulles.

FIGURE 15 TOTAL HOURLY OPERATIONS AT WASHINGTON NATIONAL INTERNATIONAL AIRPORT



* Theoretical capacity taken from the National Plan for Integrated Airport Systems (NPIAS) database maintained by the FAA.

Washington National Airport (DCA)

Washington National Airport exceeded its IFR capacity of 60 operations per hour four times on 11/28/90 and six times on 11/29/90 (Figure 15). Cargo operations were not a factor, since National has no all-cargo flights, but it is affected by general aviation. National's capacity under VFR conditions is 73 operations per hour.

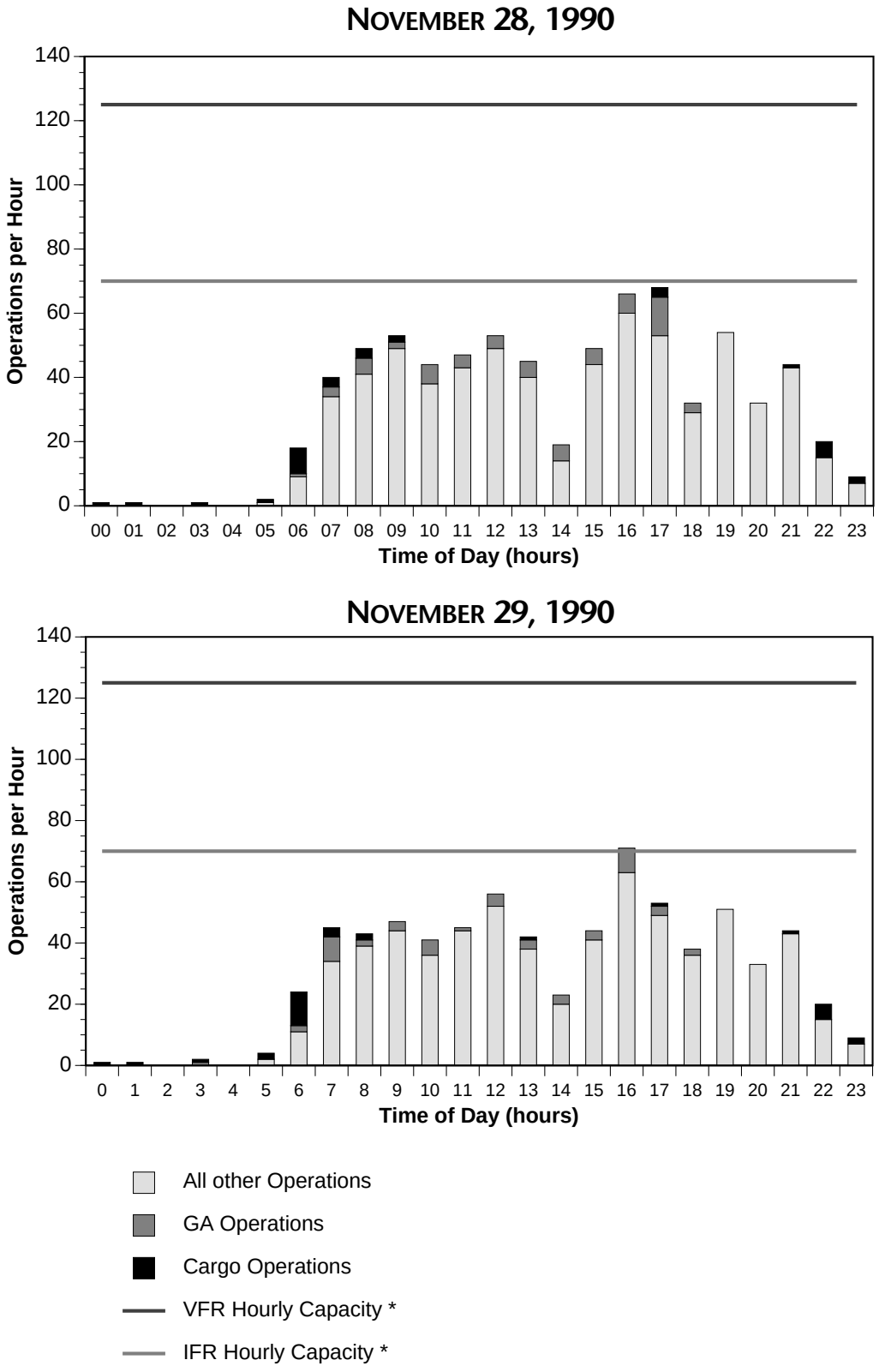
Baltimore/Washington International Airport (BWI)

Baltimore/Washington International Airport exceeded its hourly capacity of 70 operations for IFR conditions only once, during the 1600 hour, 11/29/90 (Figure 16). There were 71 flights arriving or departing in that hour, with no all-cargo operations and 8 general aviation flights. BWI's capacity under VFR conditions is 125 operations per hour.

According to the FAA's *Terminal Area Forecasts FY 1990-2005*, BWI will reach an annual demand of 425,000 operations about the year 2000 (see Table 6). This represents a 40 percent increase in annual operations over 1988 and a 34 percent increase over 1990. But, with a peak hour demand of only 73 operations on a typical day, November 29, 1990, the airport can absorb this increase within its present configuration, which has a VFR hourly capacity of 125 operations. Like Dulles, Baltimore/Washington International has plans for the construction of one additional runway before the year 2000 which will further increase the airport's capacity.

By 2005, total operations at BWI will have reached 479,000 per year (see Table 6). Following the same assumption used with Dulles, that all-cargo operations will remain a relatively constant percentage of total operations, all-cargo flights to and from BWI will increase by about 55 percent by 2005, from 8,100 operations per year to nearly 12,500 per year. This forecast level of operations, based on a steady rate of annual increase, is actually higher than the forecast provided by the Planning Office at BWI. Based on a decreasing percentage of all-cargo to total operations, BWI expects an annual level of all-cargo operations of 10,100 by 2005. But, even at 12,500 operations per year, all-cargo operations will represent only 35 operations per day, or an average of less than 1.5 per hour. Again, since all-cargo aircraft are expected to continue operating predominantly at night or during off-peak hours, this level of daily operations should not become a significant factor in delay and congestion at BWI.

FIGURE 16 TOTAL HOURLY OPERATIONS AT BALTIMORE WASHINGTON INTERNATIONAL AIRPORT



* Theoretical capacity taken from the National Plan for Integrated Airport Systems (NPIAS) database maintained by the FAA.

TABLE 6 AIRCRAFT OPERATIONS, BALTIMORE/WASHINGTON INTERNATIONAL AIRPORT

Year Actual	Total Operations	All-cargo Operations
1985	284,000	
1988	304,000	
Forecast	Assuming the percentage of all-cargo operations reported in 1988 (Table 2) remains constant at 2.6%	
1990	318,000	8,268
1995	370,000	9,620
2000	425,000	11,050
2005	479,000	12,454

Source for actual and forecast total operations: FAA-APO-90-6, *Terminal Area Forecasts FY 1990-2005,* July 1990.

Alternative Locations for Washington, D.C., Regional Air-Cargo Facility

Several potential locations for a regional air-cargo facility in the Washington, D.C., area were investigated. One of the criteria used in searching for alternatives was that any site selected should be outside the terminal area airspace of the current three major airports in the Washington area (National, Dulles, and BWI). This was done to avoid the possibility of interference with and delay of aircraft on approach to or departure from these airports.

Tipton Army Airfield (FME) Fort Meade, MD

Tipton (Figure 17) is a part of an approximately 9,000 acre portion of Fort Meade that has been earmarked for closure. However, current plans are to turn about 7,000 acres of the site over to the Park Service, sell about 1,000 acres to private developers for residential and commercial uses, and develop approximately 400 acres that include the airfield into a regional general aviation facility. The Army has used the airfield to support helicopter and light aircraft operations. Given the current plans for the land surrounding the airfield and the proximity of the National Security Agency and other parts of Fort Meade which will not be closed, there is not sufficient land available at Tipton to support a regional

FIGURE 17 TIPTON ARMY AIRFIELD (FME)

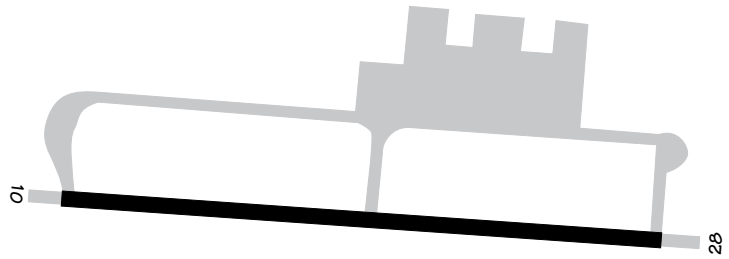


FIGURE 18 MARTIN STATE AIRPORT (MTN)

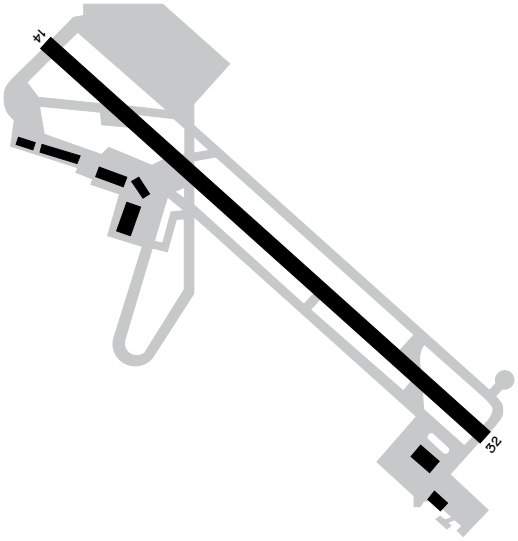
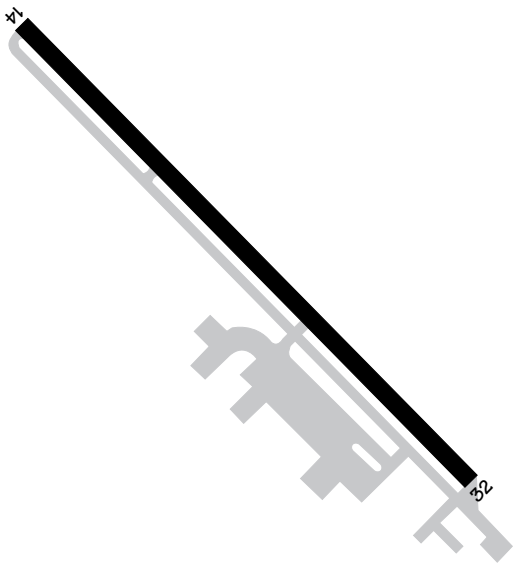


FIGURE 19 WINCHESTER REGIONAL AIRPORT (W16)



air-cargo facility that could accommodate international flight operations. In addition, a portion of the airfield floods about twice a year. Finally, Tipton is located between National and BWI airports, within the proposed Tri-Area TCA, and immediately adjacent to the proposed VFR flyway through the new TCA.

Martin State Airport (MTN)

Martin State (Figure 18) is located northeast of Baltimore on Chesapeake Bay. Its only runway is nearly 7,000 feet long, but there is very little room for expansion. Chesapeake Bay is at the south end of the runway, and a highway and rail line are located at the north end. The area around the airfield is already developed, so that noise restrictions would likely become a factor. Noise abatement procedures are already in effect. Finally, the airfield itself is located in a 100-year flood plain, and the Chesapeake Bay end of the airfield is a part of the wetlands under the jurisdiction of the Chesapeake Bay Critical Area Commission. Efforts to develop Martin State would likely run into environmental hurdles that would require years of litigation.

Winchester Regional Airport (W16)

Winchester Regional Airport (Figure 19), in northwestern Virginia, is in the middle of a capital improvement program that will include a 1,000 foot runway and taxiway extension, for a total runway length of 5,400 feet. This will include upgraded lighting and navigation aids to improve instrument approaches for all-weather operations, a new general aviation passenger terminal, and new hangar, parking, and service area. The Airport Authority sees the airport as a major corporate airport, supporting corporate and business aircraft (including jet), as well as recreational and general aviation aircraft. A commuter airline has expressed an interest in operating in and out of Winchester, and the airport could easily support a light cargo operation. However, although there is room for additional runway extension and widening, the downtown area of Winchester is only two miles from the end of the runway in the direction over which aircraft normally depart. Noise restrictions could become a problem, particularly for large jet cargo aircraft conducting operations at night.

FIGURE 20 MARTINSBURG EASTERN WVA REGIONAL AIRPORT (MRB)

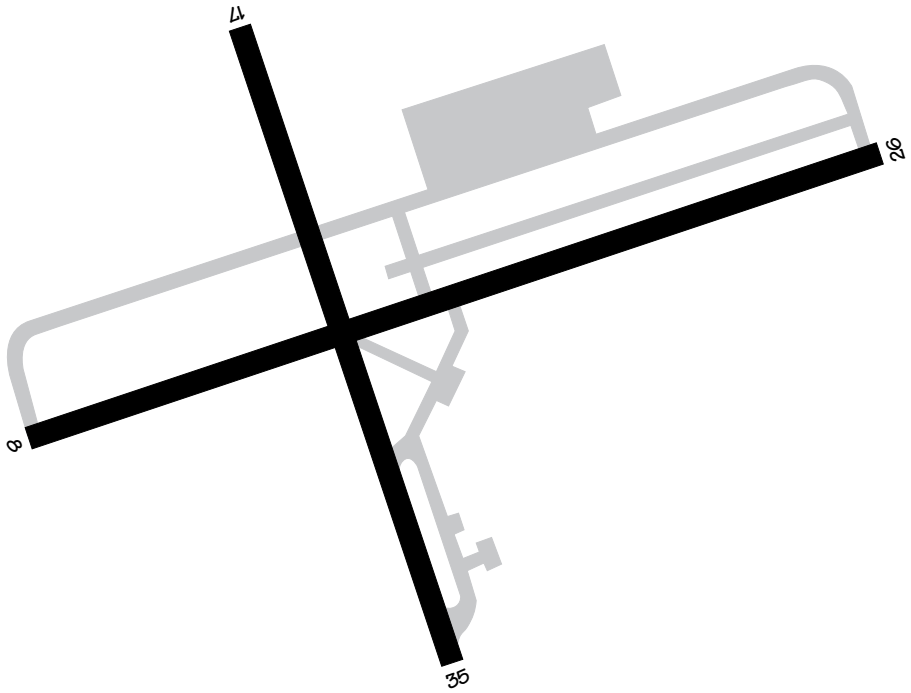
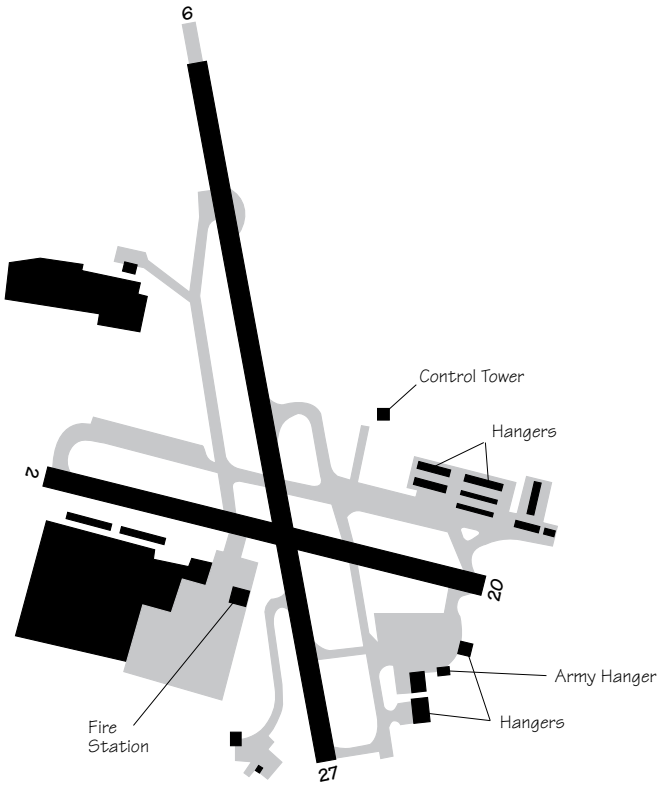


FIGURE 21 HAGERSTOWN WASHINGTON COUNTY REGIONAL AIRPORT (HGR)



Martinsburg Eastern West Virginia Regional Airport (MRB)

Martinsburg Airport (Figure 20) is located to the south of Martinsburg, West Virginia, just off U.S. Route 11, near Interstate Highway 81. It is 35 air miles from Washington Dulles International Airport, 80 miles from Washington, D.C., and 90 miles from Baltimore. The existing east-west runway is approximately 7,000 feet long and is ILS-equipped. The north-south runway is 5,000 feet long. Because U.S. Route 11 borders part of the west side of the airport, the west end of the east-west runway could only be extended about 500 feet without relocating the highway. However, there is ample land available to the east, permitting the extension of the runway to 11,000 feet. Martinsburg is one of the airports still under consideration for a large United Airlines maintenance facility.

The airport authority has learned that it would cost about $2.0 million for every 1,000 feet of runway and taxiway extension. Thus, extending the east-west runway and parallel taxiway from 7,000 to 11,000 feet would cost $8 to $10 million. The airport authority is developing an adjacent business and industrial park. In the spring of 1991, the State of West Virginia plans to begin construction of a freeway interchange from Interstate 81 that will provide improved access to the business park and the airport. According to the airport authority, any necessary cargo facilities could be funded and built by the city and county, and then provided to the cargo operators on a 25- to 30-year leaseback. Alternatively, they could be built by the cargo operators themselves. For international operations, free customs service is available, with prior notice, from the customs office at the Virginia Inland Port located about 30 miles away near Front Royal, Virginia.

Hagerstown Washington County Regional Airport (HGR)

Hagerstown Airport (Figure 21) is located north of Hagerstown, Maryland, approximately 75 miles from Baltimore, Maryland, and 75 miles from Washington, D.C. The existing east-west runway is 5,450 feet long, and the north-south runway is about 3,500 feet long. The east-west runway is ILS-equipped.

The airport authority has already acquired about 95 acres of land east of the east-west runway, and the Airport Master Plan includes a phased series of extensions to the runway and taxiway on this land. Extending the runway to 6,100 feet would cost about $3.5 million. Going beyond this length will require a fairly extensive project to tunnel U.S. Highway 11 under the runway.

Extending the runway to 7,000 feet would cost about $23 million, and an additional 1,000 feet would bring the total to $45 million. There is additional farm land available that could be acquired to further extend the runway and taxiway to 10,000 – 12,000 feet. Runway costs for this additional length would not be quite so expensive, since the land would not require as much fill and grading. The airport authority is also developing an adjacent business and industrial park, part of which would provide an excellent site for cargo facilities and taxiway access to the runway.

VI — Findings

A. It is appropriate that cargo operations be collocated with passenger operations at the busier metropolitan area airports. More than half of all air cargo is carried as belly cargo on scheduled passenger aircraft. To try to isolate cargo from passenger operations would be difficult and inefficient.

B. All-cargo aircraft operations add little to air traffic congestion and delay at busy air-carrier airports. All-cargo flights represent a relatively small percentage of the take-offs and landings at these airports, and most occur at night or during other off-peak hours.

C. Relocating cargo operations to separate regional air-cargo airports would be expensive and have a negligible effect on efforts to improve capacity at major metropolitan area airports. The FAA and the aviation industry must continue to pursue other alternatives to enhance the capacity of the national airport system.

D. Cargo operations require the same expensive airport facilities, including long runways, highway access, and support infrastructure, as passenger operations. These facilities are best shared. Many major airports actively encourage cargo, because it generates airport revenue and additional jobs.

E. There are no models of all-cargo, or primarily cargo, airports that could be considered successful at this time, other than the regional and hub sorting facilities of the integrated and small-package, express carriers. Because of the integrated, "self-feeding" nature of their operations, these carriers are not as dependent upon any one location.

F. Multi-use reliever airports, such as Fort Worth Alliance in Texas or Huntsville International in Alabama, are more likely to be useful and successful than single-purpose, air-cargo airports. Stewart International in New York has a much better chance to become a successful airport now that several air carriers have begun scheduled passenger service there.

G. Joint-use agreements at military airfields or conversion of surplus, former military airfields may offer some of the best, least-cost alternatives for multi-use reliever airports. Military runways are usually long enough and strong enough to support large jet aircraft, and most of the necessary infrastructure is already in place.

Appendix A — Tabulation of Hourly Operations

TABLE 7 ARRIVALS AND DEPARTURES BY HOUR AT JOHN F. KENNEDY INTERNATIONAL AIRPORT ON 11/28/90

	ARRIVALS				DEPARTURES				TOTAL OPERATIONS					
TIME	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO % of OPS	GEN AV % of OPS
0000	1	0	0	1	0	0	1	1	1	0	1	2	50.00%	0
0100	1	0	0	1	1	0	0	1	2	0	0	2	100.00%	0
0200	1	0	1	2	0	0	0	0	1	0	1	2	50.00%	0
0300	0	0	1	1	0	0	0	0	0	0	1	1	0	0
0400	0	0	0	0	1	0	1	2	1	0	1	2	50.00%	0
0500	3	0	5	8	2	0	0	2	5	0	5	10	50.00%	0
0600	4	0	8	12	1	1	2	4	5	1	10	16	31.25%	6.25%
0700	2	0	12	14	2	1	16	19	4	1	28	33	12.12%	3.03%
0800	0	2	15	17	2	0	19	21	2	2	34	38	5.26%	5.26%
0900	1	2	6	9	1	0	32	33	2	2	38	42	4.76%	4.76%
1000	0	0	5	5	0	3	22	25	0	3	27	30	0	10.00%
1100	0	1	12	13	1	0	7	8	1	1	19	21	4.76%	4.76%
1200	0	3	6	9	0	3	16	19	0	6	22	28	0	21.43%
1300	0	0	14	14	0	3	7	10	0	3	21	24	0	12.50%
1400	0	2	29	31	0	1	8	9	0	3	37	40	0	7.50%
1500	1	0	57	58	2	0	11	13	3	0	68	71	4.23%	0
1600	2	1	48	51	0	1	38	39	2	2	86	90	2.22%	2.22%
1700	1	2	41	44	0	0	45	45	1	2	86	89	1.12%	2.25%
1800	0	2	27	29	0	0	56	56	0	2	83	85	0	2.35%
1900	0	0	20	20	1	0	28	29	1	0	48	49	2.04%	0
2000	0	0	20	20	0	0	13	13	0	0	33	33	0	0
2100	0	0	15	15	2	0	11	13	2	0	26	28	7.14%	0
2200	2	0	7	9	2	0	18	20	4	0	25	29	13.79%	0
2300	0	0	5	5	2	0	2	4	2	0	7	9	22.22%	0
	19	15	354	388	20	13	353	386	39	28	707	774	5.04%	3.62%

TABLE 8 ARRIVALS AND DEPARTURES BY HOUR AT JOHN F. KENNEDY INTERNATIONAL AIRPORT ON 11/29/90

	ARRIVALS				DEPARTURES				TOTAL OPERATIONS					
TIME	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO % of OPS	GEN AV % of OPS
0000	1	0	0	1	1	0	0	1	2	0	0	2	100.00%	0
0100	1	0	0	1	1	0	0	1	2	0	0	2	100.00%	0
0200	1	0	1	2	0	0	0	0	1	0	1	2	50.00%	0
0300	1	0	0	1	1	0	0	1	2	0	0	2	100.00%	0
0400	0	0	0	0	1	0	0	1	1	0	0	1	100.00%	0
0500	4	0	7	11	2	0	0	2	6	0	7	13	46.15%	0
0600	4	0	5	9	1	0	5	6	5	0	10	15	33.33%	0
0700	1	0	20	21	1	0	13	14	2	0	33	35	5.71%	0
0800	0	2	14	16	3	1	26	30	3	3	40	46	6.52%	6.52%
0900	1	0	8	9	2	0	32	34	3	0	40	43	6.98%	0
1000	0	2	10	12	0	0	17	17	0	2	27	29	0	6.90%
1100	1	0	12	13	1	1	9	11	2	1	21	24	8.33%	4.17%
1200	0	0	4	4	1	0	20	21	1	0	24	25	4.00%	0
1300	0	1	17	18	0	0	7	7	0	1	24	25	0	4.00%
1400	0	2	36	38	2	0	9	11	2	2	45	49	4.08%	4.08%
1500	1	1	63	65	1	0	13	14	2	1	76	79	2.53%	1.27%
1600	0	2	45	47	0	0	38	38	0	2	83	85	0	2.35%
1700	1	1	26	28	0	0	52	52	1	1	78	80	1.25%	1.25%
1800	0	0	24	24	1	0	55	56	1	0	79	80	1.25%	0
1900	0	0	18	18	2	0	28	30	2	0	46	48	4.17%	0
2000	1	0	20	21	3	0	14	17	4	0	34	38	10.53%	0
2100	0	0	16	16	2	0	11	13	2	0	27	29	6.90%	0
2200	3	0	5	8	3	0	18	21	6	0	23	29	20.69%	0
2300	0	0	4	4	3	0	4	7	3	0	8	11	27.27%	0
	21	11	355	387	32	2	371	405	53	13	726	792	6.69%	1.64%

TABLE 9 ARRIVALS AND DEPARTURES BY HOUR AT LAGUARDIA AIRPORT ON 11/28/90

	ARRIVALS				DEPARTURES				TOTAL OPERATIONS					
TIME	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO % of OPS	GEN AV % of OPS
0000	0	0	3	3	0	0	0	0	0	0	3	3	0	0
0100	0	0	1	1	0	0	0	0	0	0	1	1	0	0
0200	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0300	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0400	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0500	0	0	0	0	0	1	0	1	0	1	0	1	0	100.00%
0600	0	1	5	6	1	1	14	16	1	2	19	22	4.55%	9.09%
0700	0	0	21	21	0	1	31	32	0	1	52	53	0	1.89%
0800	0	1	27	28	0	0	41	41	0	1	68	69	0	1.45%
0900	0	3	20	23	0	1	30	31	0	4	50	54	0	7.41%
1000	0	3	34	37	0	0	27	27	0	3	61	64	0	4.69%
1100	0	1	32	33	0	0	25	25	0	1	57	58	0	1.72%
1200	0	0	24	24	0	1	30	31	0	1	54	55	0	1.82%
1300	0	0	26	26	0	0	31	31	0	0	57	57	0	0
1400	0	0	30	30	0	0	23	23	0	0	53	53	0	0
1500	0	4	23	27	0	4	32	36	0	8	55	63	0	12.70%
1600	0	3	30	33	0	3	41	44	0	6	71	77	0	7.79%
1700	0	1	48	49	0	2	38	40	0	3	86	89	0	3.37%
1800	0	2	38	40	0	1	44	45	0	3	82	85	0	3.53%
1900	0	0	32	32	0	0	27	27	0	0	59	59	0	0
2000	0	0	26	26	0	0	23	23	0	0	49	49	0	0
2100	0	0	22	22	0	0	18	18	0	0	40	40	0	0
2200	0	0	28	28	0	0	5	5	0	0	33	33	0	0
2300	0	0	9	9	0	0	0	0	0	0	9	9	0	0
	0	19	479	498	1	15	480	496	1	34	959	994	0.10%	3.42%

TABLE 10 ARRIVALS AND DEPARTURES BY HOUR AT LAGUARDIA AIRPORT ON 11/29/90

	ARRIVALS				DEPARTURES				TOTAL OPERATIONS					
TIME	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO % of OPS	GEN AV % of OPS
0000	0	0	3	3	0	0	0	0	0	0	3	3	0	0
0100	0	0	1	1	0	0	0	0	0	0	1	1	0	0
0200	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0300	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0400	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0500	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0600	0	0	3	3	1	1	21	23	1	1	24	26	3.85%	3.85%
0700	0	3	27	30	0	0	26	26	0	3	53	56	0	5.36%
0800	0	3	24	27	0	3	35	38	0	6	59	65	0	9.23%
0900	0	1	22	23	0	2	39	41	0	3	61	64	0	4.69%
1000	0	3	37	40	0	0	23	23	0	3	60	63	0	4.76%
1100	0	0	30	30	0	1	25	26	0	1	55	56	0	1.79%
1200	0	2	25	27	0	4	35	39	0	6	60	66	0	9.09%
1300	0	3	29	32	0	4	29	33	0	7	58	65	0	10.77%
1400	0	1	32	33	0	0	23	23	0	1	55	56	0	1.79%
1500	0	2	24	26	0	2	32	34	0	4	56	60	0	6.67%
1600	0	1	34	35	0	5	36	41	0	6	70	76	0	7.89%
1700	0	2	39	41	0	3	32	35	0	5	71	76	0	6.58%
1800	0	1	29	30	0	2	41	43	0	3	70	73	0	4.11%
1900	0	0	33	33	0	0	27	27	0	0	60	60	0	0
2000	0	0	23	23	0	0	23	23	0	0	46	46	0	0
2100	0	0	25	25	0	0	18	18	0	0	43	43	0	0
2200	0	0	28	28	0	0	5	5	0	0	33	33	0	0
2300	0	0	9	9	0	0	0	0	0	0	9	9	0	0
	0	22	477	499	1	27	470	498	1	49	947	997	0.10%	4.91%

TABLE 11 ARRIVALS AND DEPARTURES BY HOUR AT NEWARK INTERNATIONAL AIRPORT ON 11/28/90

	ARRIVALS				DEPARTURES				TOTAL OPERATIONS					
TIME	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO % of OPS	GEN AV % of OPS
0000	0	0	2	2	1	0	0	1	1	0	2	3	33.33%	0
0100	0	0	1	1	1	0	0	1	1	0	1	2	50.00%	0
0200	1	0	0	1	0	0	0	0	1	0	0	1	100.00%	0
0300	1	0	0	1	0	0	0	0	1	0	0	1	100.00%	0
0400	1	0	0	1	0	0	0	0	1	0	0	1	100.00%	0
0500	2	0	2	4	0	2	1	3	2	2	3	7	28.57%	28.57%
0600	3	2	5	10	1	0	12	13	4	2	17	23	17.39%	8.70%
0700	1	2	37	40	0	0	33	33	1	2	70	73	1.37%	2.74%
0800	0	2	20	22	3	3	44	50	3	5	64	72	4.17%	6.94%
0900	0	3	31	34	1	1	48	50	1	4	79	84	1.19%	4.76%
1000	0	7	31	38	0	0	19	19	0	7	50	57	0	12.28%
1100	1	1	23	25	0	2	36	38	1	3	59	63	1.59%	4.76%
1200	0	3	32	35	1	2	34	37	1	5	66	72	1.39%	6.94%
1300	0	1	28	29	1	3	31	35	1	4	59	64	1.56%	6.25%
1400	0	3	33	36	0	2	19	21	0	5	52	57	0	8.77%
1500	0	5	28	33	0	6	30	36	0	11	58	69	0	15.94%
1600	3	0	31	34	0	5	38	43	3	5	69	77	3.90%	6.49%
1700	2	6	58	66	0	5	59	64	2	11	117	130	1.54%	8.46%
1800	3	3	48	54	2	2	47	51	5	5	95	105	4.76%	4.76%
1900	0	0	36	36	0	0	23	23	0	0	59	59	0	0
2000	0	0	22	22	2	0	32	34	2	0	54	56	3.57%	0
2100	0	0	35	35	1	0	8	9	1	0	43	44	2.27%	0
2200	0	0	15	15	0	0	17	17	0	0	32	32	0	0
2300	1	0	11	12	2	0	0	2	3	0	11	14	21.43%	0
	19	38	529	586	16	33	531	580	35	71	1,060	1,166	3.00%	6.09%

TABLE 12 ARRIVALS AND DEPARTURES BY HOUR AT NEWARK INTERNATIONAL AIRPORT ON 11/29/90

	ARRIVALS				DEPARTURES				TOTAL OPERATIONS					
TIME	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO % of OPS	GEN AV % of OPS
0000	0	0	2	2	1	0	0	1	1	0	2	3	33.33%	0
0100	0	0	1	1	0	0	0	0	0	0	1	1	0	0
0200	1	0	0	1	1	0	0	1	2	0	0	2	100.00%	0
0300	1	0	0	1	0	0	0	0	1	0	0	1	100.00%	0
0400	2	0	0	2	0	0	0	0	2	0	0	2	100.00%	0
0500	3	0	2	5	1	0	1	2	4	0	3	7	57.14%	0
0600	3	1	5	9	0	0	16	16	3	1	21	25	12.00%	4.00%
0700	0	2	45	47	0	0	27	27	0	2	72	74	0	2.70%
0800	3	1	16	20	2	3	40	45	5	4	56	65	7.69%	6.15%
0900	0	1	30	31	5	0	48	53	5	1	78	84	5.95%	1.19%
1000	0	2	34	36	1	1	24	26	1	3	58	62	1.61%	4.84%
1100	0	6	28	34	0	0	39	39	0	6	67	73	0	8.22%
1200	0	2	30	32	0	3	32	35	0	5	62	67	0	7.46%
1300	0	5	30	35	0	3	32	35	0	8	62	70	0	11.43%
1400	0	1	38	39	0	6	23	29	0	7	61	68	0	10.29%
1500	0	1	37	38	0	5	27	32	0	6	64	70	0	8.57%
1600	1	4	43	48	0	5	46	51	1	9	89	99	1.01%	9.09%
1700	2	2	37	41	0	6	47	53	2	8	84	94	2.13%	8.51%
1800	4	1	38	43	0	2	49	51	4	3	87	94	4.26%	3.19%
1900	0	0	35	35	0	0	23	23	0	0	58	58	0	0
2000	0	0	23	23	2	0	32	34	2	0	55	57	3.51%	0
2100	0	0	35	35	1	0	8	9	1	0	43	44	2.27%	0
2200	0	0	15	15	0	0	17	17	0	0	32	32	0	0
2300	1	0	11	12	2	0	0	2	3	0	11	14	21.43%	0
	21	29	535	585	16	34	531	581	37	63	1,066	1,166	3.17%	5.40%

TABLE 13 ARRIVALS AND DEPARTURES BY HOUR AT WASHINGTON DULLES INTERNATIONAL AIRPORT 11/28/90

	ARRIVALS				DEPARTURES				TOTAL OPERATIONS					
TIME	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO % of OPS	GEN AV % of OPS
0000	0	0	1	1	0	0	0	0	0	0	1	1	0	0
0100	0	0	1	1	0	0	0	0	0	0	1	1	0	0
0200	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0300	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0400	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0500	2	0	2	4	0	1	0	1	2	1	2	5	40.00%	20.00%
0600	1	0	1	2	0	2	7	9	1	2	8	11	9.09%	18.18%
0700	0	0	9	9	1	4	9	14	1	4	18	23	4.35%	17.39%
0800	0	3	25	28	0	1	6	7	0	4	31	35	0	11.43%
0900	0	1	15	16	0	3	34	37	0	4	49	53	0	7.55%
1000	0	7	11	18	0	1	18	19	0	8	29	37	0	21.62%
1100	0	8	18	26	0	2	12	14	0	10	30	40	0	25.00%
1200	0	0	10	10	0	8	17	25	0	8	27	35	0	22.86%
1300	0	7	16	23	0	2	12	14	0	9	28	37	0	24.32%
1400	0	4	18	22	0	3	12	15	0	7	30	37	0	18.92%
1500	0	7	29	36	0	5	12	17	0	12	41	53	0	22.64%
1600	0	12	31	43	0	13	38	51	0	25	69	94	0	26.60%
1700	0	12	12	24	0	11	28	39	0	23	40	63	0	36.51%
1800	0	5	11	16	0	2	24	26	0	7	35	42	0	16.67%
1900	0	0	30	30	0	0	4	4	0	0	34	34	0	0
2000	0	0	27	27	0	0	25	25	0	0	52	52	0	0
2100	0	0	9	9	0	0	26	26	0	0	35	35	0	0
2200	0	0	7	7	1	0	1	2	1	0	8	9	11.11%	0
2300	0	0	3	3	3	0	0	3	3	0	3	6	50.00%	0
	3	66	286	355	5	58	285	348	8	124	571	703	1.14%	17.64%

TABLE 14 ARRIVALS AND DEPARTURES BY HOUR AT WASHINGTON DULLES INTERNATIONAL AIRPORT 11/29/90

	ARRIVALS				DEPARTURES				TOTAL OPERATIONS					
TIME	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO % of OPS	GEN AV % of OPS
0000	0	0	1	1	0	0	0	0	0	0	1	1	0	0
0100	0	0	1	1	0	0	0	0	0	0	1	1	0	0
0200	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0300	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0400	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0500	3	0	2	5	0	1	0	1	3	1	2	6	50.00%	16.67%
0600	0	2	1	3	0	0	7	7	0	2	8	10	0	20.00%
0700	0	1	6	7	0	6	8	14	0	7	14	21	0	33.33%
0800	0	6	34	40	1	2	6	9	1	8	40	49	2.04%	16.33%
0900	0	0	14	14	0	3	33	36	0	3	47	50	0	6.00%
1000	0	6	11	17	0	1	19	20	0	7	30	37	0	18.92%
1100	0	3	16	19	0	1	11	12	0	4	27	31	0	12.90%
1200	0	1	9	10	0	3	17	20	0	4	26	30	0	13.33%
1300	0	2	18	20	0	2	15	17	0	4	33	37	0	10.81%
1400	0	5	16	21	0	4	12	16	0	9	28	37	0	24.32%
1500	0	9	29	38	0	10	14	24	0	19	43	62	0	30.65%
1600	0	7	36	43	0	10	28	38	0	17	64	81	0	20.99%
1700	0	6	11	17	0	10	33	43	0	16	44	60	0	26.67%
1800	0	3	10	13	0	2	23	25	0	5	33	38	0	13.16%
1900	0	0	29	29	0	0	4	4	0	0	33	33	0	0
2000	0	0	26	26	0	0	25	25	0	0	51	51	0	0
2100	0	0	10	10	0	0	26	26	0	0	36	36	0	0
2200	0	0	7	7	1	0	1	2	1	0	8	9	11.11%	0
2300	0	0	3	3	3	0	0	3	3	0	3	6	50.00%	0
	3	51	290	344	5	55	282	342	8	106	572	686	1.17%	15.45%

TABLE 15 ARRIVALS AND DEPARTURES BY HOUR AT WASHINGTON NATIONAL AIRPORT 11/28/90

	ARRIVALS				DEPARTURES				TOTAL OPERATIONS					
TIME	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO % of OPS	GEN AV % of OPS
0000	0	0	2	2	0	0	0	0	0	0	2	2	0	0
0100	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0200	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0300	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0400	0	1	0	1	0	1	0	1	0	2	0	2	0	100.00%
0500	0	0	0	0	0	1	0	1	0	1	0	1	0	100.00%
0600	0	0	1	1	0	0	5	5	0	0	6	6	0	0
0700	0	2	19	21	0	1	34	35	0	3	53	56	0	5.36%
0800	0	5	21	26	0	2	30	32	0	7	51	58	0	12.07%
0900	0	8	23	31	0	3	18	21	0	11	41	52	0	21.15%
1000	0	9	25	34	0	4	28	32	0	13	53	66	0	19.70%
1100	0	4	26	30	0	1	18	19	0	5	44	49	0	10.20%
1200	0	1	17	18	0	6	20	26	0	7	37	44	0	15.91%
1300	0	3	29	32	0	6	22	28	0	9	51	60	0	15.00%
1400	0	5	17	22	0	6	32	38	0	11	49	60	0	18.33%
1500	0	5	23	28	0	6	22	28	0	11	45	56	0	19.64%
1600	0	9	29	38	0	12	24	36	0	21	53	74	0	28.38%
1700	0	6	23	29	0	8	37	45	0	14	60	74	0	18.92%
1800	0	6	36	42	0	3	33	36	0	9	69	78	0	11.54%
1900	0	1	22	23	0	0	16	16	0	1	38	39	0	2.56%
2000	0	0	22	22	0	0	20	20	0	0	42	42	0	0
2100	0	0	23	23	0	0	17	17	0	0	40	40	0	0
2200	0	0	14	14	0	0	0	0	0	0	14	14	0	0
2300	0	0	6	6	0	0	0	0	0	0	6	6	0	0
	0	65	378	443	0	60	376	436	0	125	754	879	0	14.22%

TABLE 16 ARRIVALS AND DEPARTURES BY HOUR AT WASHINGTON NATIONAL AIRPORT 11/29/90

	ARRIVALS				DEPARTURES				TOTAL OPERATIONS					
TIME	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO % of OPS	GEN AV % of OPS
0000	0	0	2	2	0	0	0	0	0	0	2	2	0	0
0100	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0200	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0300	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0400	0	1	0	1	0	0	0	0	0	1	0	1	0	100.00%
0500	0	0	0	0	0	1	0	1	0	1	0	1	0	100.00%
0600	0	0	2	2	0	0	10	10	0	0	12	12	0	0
0700	0	3	14	17	0	3	29	32	0	6	43	49	0	12.24%
0800	0	6	21	27	0	3	29	32	0	9	50	59	0	15.25%
0900	0	8	28	36	0	5	20	25	0	13	48	61	0	21.31%
1000	0	8	19	27	0	5	25	30	0	13	44	57	0	22.81%
1100	0	5	27	32	0	2	18	20	0	7	45	52	0	13.46%
1200	0	2	16	18	0	4	23	27	0	6	39	45	0	13.33%
1300	0	2	28	30	0	4	22	26	0	6	50	56	0	10.71%
1400	0	3	23	26	0	11	28	39	0	14	51	65	0	21.54%
1500	0	7	26	33	0	8	21	29	0	15	47	62	0	24.19%
1600	0	8	25	33	0	9	26	35	0	17	51	68	0	25.00%
1700	0	6	26	32	0	6	36	42	0	12	62	74	0	16.22%
1800	0	9	33	42	0	2	34	36	0	11	67	78	0	14.10%
1900	0	0	23	23	0	0	16	16	0	0	39	39	0	0
2000	0	0	23	23	0	0	20	20	0	0	43	43	0	0
2100	0	0	22	22	0	0	17	17	0	0	39	39	0	0
2200	0	0	14	14	0	0	0	0	0	0	14	14	0	0
2300	0	0	6	6	0	0	0	0	0	0	6	6	0	0
	0	68	378	446	0	63	374	437	0	131	752	883	0	14.84%

TABLE 17 ARRIVALS AND DEPARTURES BY HOUR AT BALTIMORE-WASHINGTON INTERNATIONAL AIRPORT ON 11/28/90

	ARRIVALS				DEPARTURES				TOTAL OPERATIONS					
TIME	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO % of OPS	GEN AV % of OPS
0000	0	0	0	0	1	0	0	1	1	0	0	1	100.00%	0
0100	0	0	0	0	1	0	0	1	1	0	0	1	100.00%	0
0200	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0300	0	0	0	0	1	0	0	1	1	0	0	1	100.00%	0
0400	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0500	1	0	0	1	0	0	1	1	1	0	1	2	50.00%	0
0600	4	1	2	7	4	0	7	11	8	1	9	18	44.44%	5.56%
0700	0	1	19	20	3	2	15	20	3	3	34	40	7.50%	7.50%
0800	3	4	24	31	0	1	17	18	3	5	41	49	6.12%	10.20%
0900	0	0	21	21	2	2	28	32	2	2	49	53	3.77%	3.77%
1000	0	3	10	13	0	3	28	31	0	6	38	44	0	13.64%
1100	0	2	37	39	0	2	6	8	0	4	43	47	0	8.51%
1200	0	2	26	28	0	2	23	25	0	4	49	53	0	7.55%
1300	0	2	4	6	0	3	36	39	0	5	40	45	0	11.11%
1400	0	5	11	16	0	0	3	3	0	5	14	19	0	26.32%
1500	0	3	34	37	0	2	10	12	0	5	44	49	0	10.20%
1600	0	4	29	33	0	2	31	33	0	6	60	66	0	9.09%
1700	2	4	11	17	1	8	42	51	3	12	53	68	4.41%	17.65%
1800	0	1	23	24	0	2	6	8	0	3	29	32	0	9.38%
1900	0	0	27	27	0	0	27	27	0	0	54	54	0	0
2000	0	0	24	24	0	0	8	8	0	0	32	32	0	0
2100	0	0	10	10	1	0	33	34	1	0	43	44	2.27%	0
2200	4	0	14	18	1	0	1	2	5	0	15	20	25.00%	0
2300	1	0	6	7	1	0	1	2	2	0	7	9	22.22%	0
	15	32	332	379	16	29	323	368	31	61	655	747	4.15%	8.17%

TABLE 18 ARRIVALS AND DEPARTURES BY HOUR AT BALTIMORE-WASHINGTON INTERNATIONAL AIRPORT 11/29/90

	ARRIVALS				DEPARTURES				TOTAL OPERATIONS					
TIME	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO	GEN AV	OTHER	TOTAL	CARGO % of OPS	GEN AV % of OPS
0000	0	0	0	0	1	0	0	1	1	0	0	1	100.00%	0
0100	0	0	0	0	1	0	0	1	1	0	0	1	100.00%	0
0200	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0300	0	0	0	0	1	1	0	2	1	1	0	2	50.00%	50.00%
0400	0	0	0	0	0	0	0	0	0	0	0	0	—	—
0500	2	0	0	2	0	0	2	2	2	0	2	4	50.00%	0
0600	6	2	2	10	5	0	9	14	11	2	11	24	45.83%	8.33%
0700	0	4	21	25	3	4	13	20	3	8	34	45	6.67%	17.78%
0800	1	1	22	24	1	1	17	19	2	2	39	43	4.65%	4.65%
0900	0	2	22	24	0	1	22	23	0	3	44	47	0	6.38%
1000	0	5	7	12	0	0	29	29	0	5	36	41	0	12.20%
1100	0	0	38	38	0	1	6	7	0	1	44	45	0	2.22%
1200	0	1	24	25	0	3	28	31	0	4	52	56	0	7.14%
1300	0	1	6	7	1	2	32	35	1	3	38	42	2.38%	7.14%
1400	0	1	15	16	0	2	5	7	0	3	20	23	0	13.04%
1500	0	1	32	33	0	2	9	11	0	3	41	44	0	6.82%
1600	0	3	32	35	0	5	31	36	0	8	63	71	0	11.27%
1700	1	1	8	10	0	2	41	43	1	3	49	53	1.89%	5.66%
1800	0	1	29	30	0	1	7	8	0	2	36	38	0	5.26%
1900	0	0	23	23	0	0	28	28	0	0	51	51	0	0
2000	0	0	25	25	0	0	8	8	0	0	33	33	0	0
2100	0	0	10	10	1	0	33	34	1	0	43	44	2.27%	0
2200	4	0	14	18	1	0	1	2	5	0	15	20	25.00%	0
2300	1	0	6	7	1	0	1	2	2	0	7	9	22.22%	0
	15	23	336	374	16	25	322	363	31	48	658	737	4.21%	6.51%