NORFOLK INTERNATIONAL AIRPORT

AIRPORT MASTER PLAN

WORKING PAPER #1
AIRPORT INVENTORY

Updated
SEPTEMBER 2018

Prepared by:

CHA
design/construction solutions

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1 INTRODUCTION

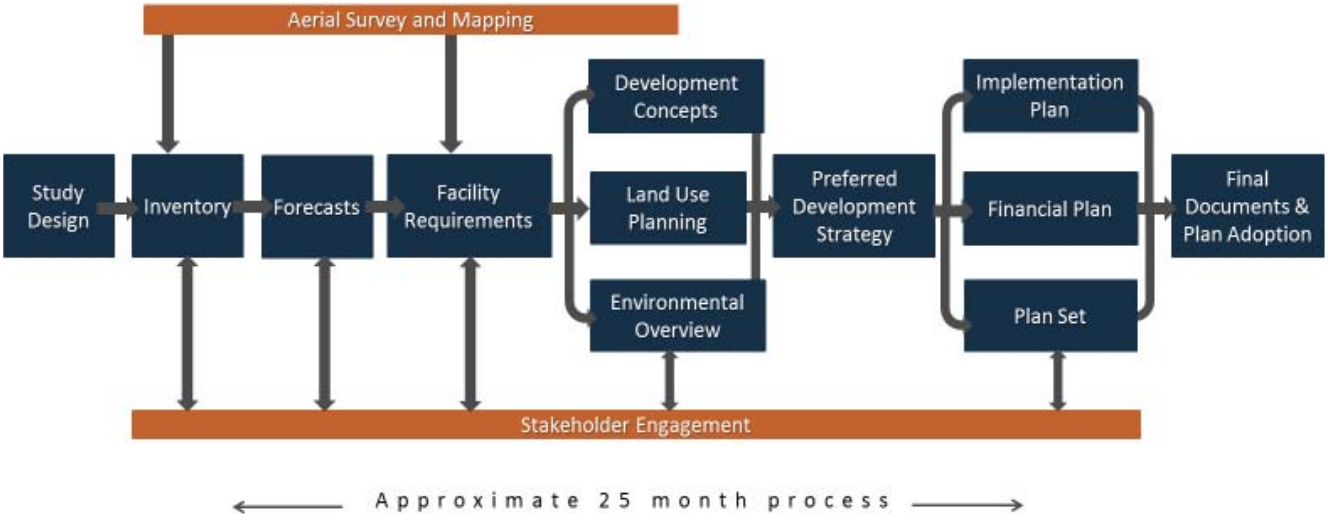
The Norfolk Airport Authority ('NAA' or 'the Authority') has retained CHA Consulting, Inc. ('CHA') to prepare a Master Plan Update (Study) for the Norfolk International Airport ('ORF' or 'the Airport'). The purpose of the study is to evaluate the current space utilization and operational characteristics of the airfield, terminal facility, support facilities, ground access, and land development considerations. It is the intent to consider all alternatives that can be developed for the best use of space and logical guidance provided for the continued improvements necessary to accommodate projected aviation activity in a logical and financially-feasible manner throughout the 20-year planning period.

This introductory chapter provides a description of the project and a background overview of the Airport and its facilities. Additional information about the Airport and the Study can be found on its website at www.norfolkairport.com/about-us/master-plan-update. The Airport's website has destination and flight information, airport maps, driving directions, ground transportation, and parking information.

1.1 PROJECT DESCRIPTION

An airport master plan is a comprehensive study of an airport that is conducted via a systematic process that evaluates existing facility and market conditions, identifies anticipated stakeholders' needs, and formulates short-, medium-, and long-term development plans to meet future aviation demand. The process, methods and ultimate products are guided by Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5070-6B, *Airport Master Plans*. Consistent with this guidance, the process followed for preparing the ORF Master Plan Update is outlined in **Figure 1-1**.

Figure 1-1 – Master Planning Process



1.1.1 Purpose and Objectives

The purpose of this study is to provide long-term guidance for continued airport improvements necessary to satisfy projected aviation demand in a logical and financially-feasible manner. Consistent with this purpose, the Authority has indicated that the goals and objectives of the study should include, at a minimum, the following:

- Airfield safety and standards, such as Runway Safety Areas (RSAs), Runway Protection Zones (RPZs), etc.
- Airfield considerations with a focus on the runway/taxiway system to meet the long-term needs of ORF's users
- Key terminal building planning issues, such as functional, safety, security, aesthetic, sustainability, and economic concerns
- Land use/economic development issues, such as infrastructure, access, and best use
- Surface access/parking considerations
- Environmental considerations, including air quality, storm water management, and sustainability
- Financial viability of recommended actions

In addition to addressing these objectives, this study will also fulfill the broad master planning goals set forth by the FAA in AC 150/5070-6B *Airport Master Plans*. These goals are:

- Document issues that the proposed development will address.
- Justify the proposed development through the technical, economic and environmental investigation of concepts and alternatives.
- Provide an effective graphic presentation of the development of the Airport and anticipated land uses in the vicinity of the Airport.
- Establish a realistic schedule for the implementation of the development proposed in the study, particularly the short-term capital improvement program.
- Propose an achievable financial plan to support the implementation schedule.
- Provide sufficient project definition and detail for subsequent environmental evaluations that may be required before the project is approved.
- Present a plan that adequately addresses the issues and satisfies local, state, and Federal regulations.
- Document policies and future aeronautical demand to support municipal or local deliberations on spending, debt, land use controls, and other policies necessary to preserve the integrity of the Airport and its surroundings.
- Set the stage and establish the framework for a continuing planning process. Such a process should monitor key conditions and permit changes in plan recommendations as required.

1.1.2 Public and Stakeholder Involvement Program

Public and stakeholder involvement is an integral part of any significant airport planning study, as it encourages information-sharing and collaboration among the community and airport stakeholders that hold a collective interest in the outcome of the Study. For the purpose of this study, stakeholders include the airport sponsor, airlines, tenants, users and travelers, local businesses, military interests, residents, resource agencies, elected and appointed officials, and the general public. A variety of forums, such as committees, public information meetings/workshops, and public awareness campaigns, are necessary to mitigate setbacks that may arise from having a large, diverse stakeholder group.

For this Study, a Planning Advisory Committee (PAC) has been established. The PAC consists of technical level representatives of the Authority, airlines, airport tenants, general aviation users, the FAA, the Virginia Department of Aviation (DOAV), the U.S. Department of Defense (DOD), and other key agencies and interest groups. In addition, the PAC includes representation from local municipalities, regional planning agencies, economic development organizations, land use and transportation planning groups, business-related organizations, and local neighborhood groups from Norfolk, Virginia Beach, and surrounding areas. The PAC will be asked to provide guidance and advice on technical and local issues and will also review working papers at various milestones throughout the course of the project to ensure that all relevant issues were adequately addressed. The PAC will also be asked to provide broad input and insight on non-technical issues affecting the community.

Up to five PAC meetings, as well as project meetings (as necessary), will be held throughout the duration of the program as part of a coordinated series of meetings at key decision points in the study process. In addition to the PAC meetings and project meetings, other forms of stakeholder involvement to be utilized during this Study include up to two individual meetings on technical issues with the airlines, FAA, DOAV, DOD, and other key stakeholders, as required by specific analysis, as well as up to three briefings for the Airport Authority Board and two briefings for special interest groups. The Airport Authority Board briefings will be scheduled, as needed, and will cover topics of special concern or interest to the Authority. The purpose of the public meetings and workshops is to provide opportunities for the Authority to engage the public in purposeful conversation about the Airport and Master Plan Update. These meetings will be conducted in an ‘open house’ format with interactive information stations staffed by Airport personnel and the consultant team. Other briefings may be organized with key agencies, stakeholders, or public officials as needed for various topics. A Master Plan Update website, located on the Authority’s website, will enable the public to conveniently access project specific information in a narrative and graphical format throughout the study’s duration. **Table 1-1** lists each of the key involvement briefings, workshops, and meetings carried out and planned, to date.

Table 1-1 – Stakeholder Involvement Meetings

Meeting	Date
Project Kickoff Meeting	06-16-2017
PAC Meeting #1 (Introduction and Inventory)	01-24-2018
PAC Meeting #2 (Forecasts)	TBD
PAC Meeting #3 (Facility Requirements)	TBD
PAC Meeting #4 (Development Alternatives)	TBD
PAC Meeting #5 (Final)	TBD
Project Meeting (As Needed)	TBD
Meetings on Technical Issues	TBD
Briefings for the Airport Authority Board	TBD
Briefings for Special Interest Groups	TBD

Source: CHA, 2017.

1.2 AIRPORT BACKGROUND

Understanding the background of an airport and the region it serves is essential in making informed decisions pertaining to airport-related improvements. This section discusses ORF in the context of its location, service area, history, and role in the National Airspace System (NAS).

1.2.1 History

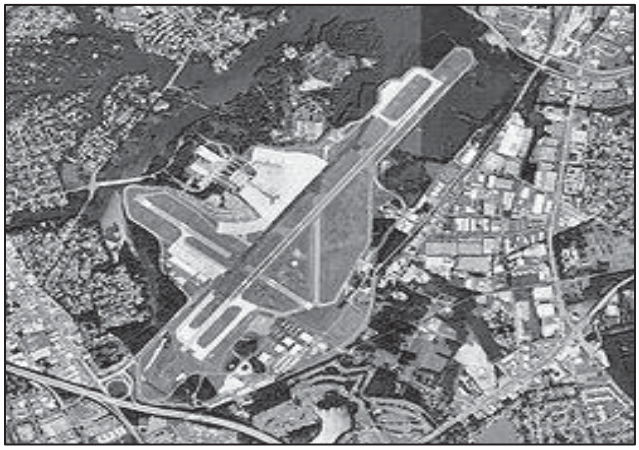
Norfolk International Airport can be traced back to the 1920s when World War I veteran, Ben Epstein, began operating an air taxi service between Norfolk and Richmond, Virginia, along with the first daily scheduled air service in the area by Luddington Line and Eastern Airlines.

In 1938, the present Airport was opened after the city-owned golf course was converted to a municipal airport with a 3,500-foot runway. One airline operated at the airport when it opened, utilizing the renovated golf clubhouse as a passenger terminal.

In the 1940s, like many airports at the time, Norfolk Municipal Airport served as a vital resource to the war efforts of World War II, with the Army Air Corps assuming control of airport operations between 1942 and 1947. As a result, the 3,500-foot runway was extended, and two additional runways were developed to accommodate the increase in air traffic and size of aircraft. The Army Air Corps released control of airport operations after the war concluded, instigating new airlines to begin providing service to-and-from Norfolk, Virginia.

In 1948, the Airport began construction of a modernized terminal building, with construction concluding in 1951. In 1950, the newly established Norfolk Port and Industrial Authority (NPIA), which would become the Norfolk Airport Authority (NAA) in 1988, was given responsibility for the Airport. Air service continuously grew during the 1960s as propeller driven aircraft were replaced by jets, persuading the NPIA to change the Airport's name to Norfolk Regional Airport. The growth prompted the Airport to build a new terminal facility in the 1970s and change the Airport's name to Norfolk International Airport. The first portions of the present-day passenger terminal opened in 1974.

Additional changes occurred at the Airport in the 1980s, including the completion of a new fixed-base operator (FBO) and general aviation (GA) facilities, a new air cargo terminal, and an expansion of airport parking facilities. Changes to the Airport continued throughout the 1990s, with expansions to the air cargo terminal and renovations to public areas of the passenger terminal. In 1990, a 10-gate extension to Concourse B was completed. On January 22, 1995, a new Air Traffic Control Tower began operation. In the early 2000s, the Airport's Arrival Terminal underwent construction. From 2000 to present day, the Airport has added new concessions, built new Aircraft Rescue and Firefighting (ARFF) facilities, and implemented renovations to the terminal building and general aviation facilities. As of May 2018, ORF owns 1,300 acres of land[1], approximately 212 acres of which are located outside of the ORF operational area.




Source: USGS Geology Survey (left), Norfolk International Airport (right)

1.2.2 Location and Service Area

Norfolk International Airport is a major airport for Southeastern coastal Virginia and northeastern North Carolina. As shown in **Figure 1-2** and **Figure 1-3**, the Airport is within 12 miles of downtown Norfolk and is located one mile east of Interstate I-64. As the primary commercial service airport in the America's First Region, which is tied to the Hampton Road's Partnership (a public-private partnership for economic development), the Airport's service area extends beyond Norfolk and into other parts of Virginia and northern North Carolina. ORF's location, regarding time[2] and distance in nautical miles (nm), in comparison to other major airports is as follows:

- Newport News/Williamsburg International Airport (PHF) – 20 nm; 40-minute drive; northwest of ORF
- Richmond International Airport (RIC) – 65 nm; 90-minute drive; northwest of ORF

[1] Norfolk Airport Authority, "Norfolk International Airport History," Norfolk International Airport website, https://www.norfolkairport.com/about-us/mission-history, accessed November 15, 2017.

[2] Drive times may be impacted during certain times of the day due to traffic congestion and/or construction activity.

The Airport is located within the Virginia Beach-Norfolk-Newport News VA-NC Metropolitan Statistical Area (MSA). The MSA, with a population of approximately 1.7 million people (Woods & Poole Economics, Inc., 2017), consists of the following cities and counties:

- Cities in Virginia – Chesapeake, Franklin, Hampton, Newport News, Norfolk, Poquoson, Portsmouth, Suffolk, Virginia Beach, and Williamsburg
- Counties in Virginia – Gloucester, Isle of Wight, James City, Mathews, Southampton, and York
- Counties in North Carolina – Camden, Chowan, Currituck, Hertford, Pasquotank, and Perquimans

1.2.3 Airport Role

In addition to connecting the America's First Region to the global transportation network, the Airport plays a significant role in the nation's air travel system. The National Plan of Integrated Airports Systems (NPIAS) identifies existing and proposed airports that are important to national air transportation and provides a forward-looking estimate of the type and cost of Airport Improvement Program (AIP)-eligible development needed to meet the needs of civil aviation. Airports included in the NPIAS are considered significant to national air transportation and are eligible to receive grants under the FAA's Airport Improvement Program (AIP).

The NPIAS further categorizes the nation's airports based on types of service provided and quantity of passengers enplaned. In the 2017-2021 NPIAS, ORF is classified as a small-hub primary commercial service airport. Small hubs are defined as airports that enplane 0.05 percent to 0.25 percent of total U.S. passenger enplanements. The 72 small hub airports account for nine percent of all U.S. enplanements. **Table 1-2** outlines the specifics of each NPIAS category and provides examples of each type in the region.

Table 1-2 – NPIAS Airport Classifications

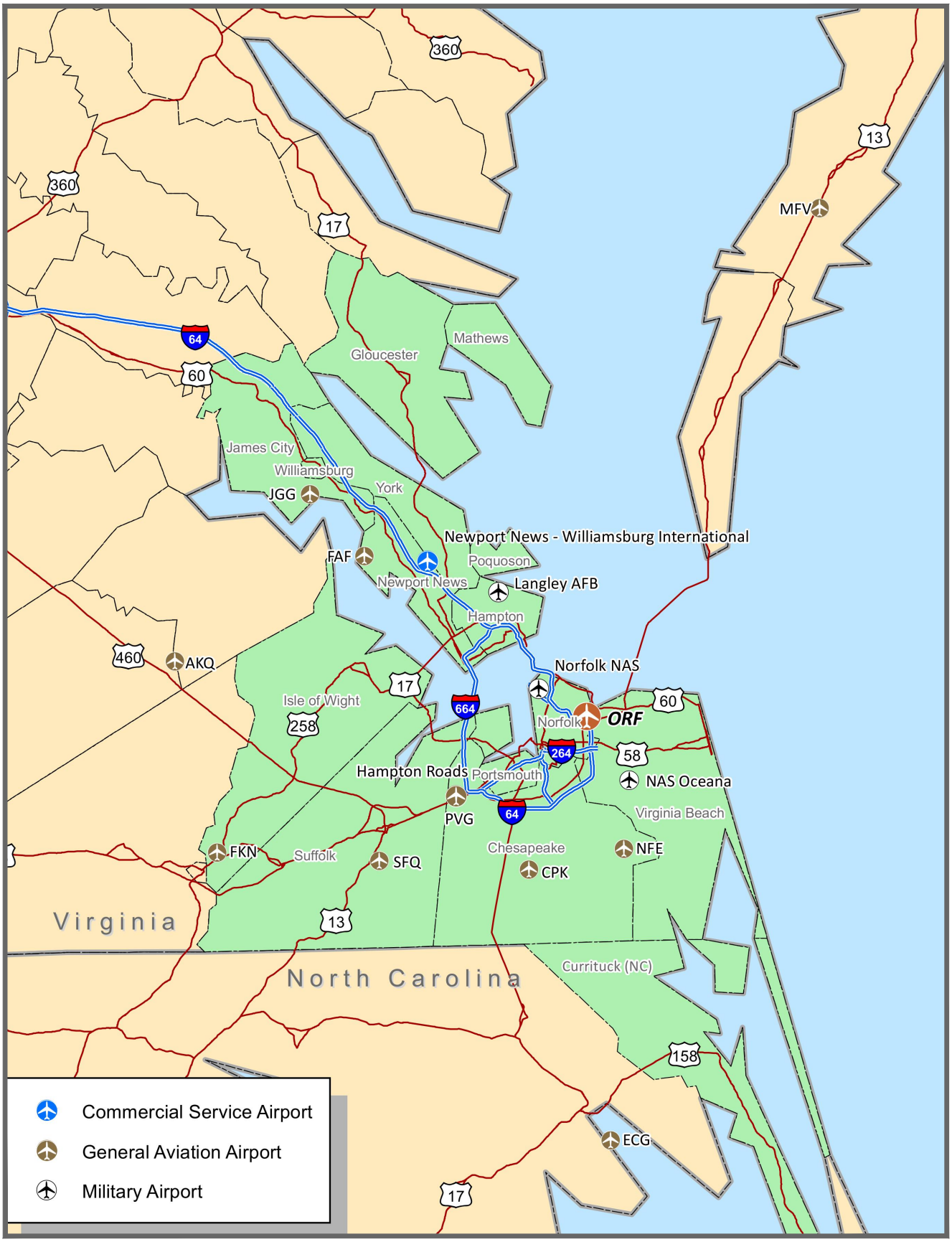
Airport Classifications		Hub Type: % of Annual Passenger Boardings	Example Airport
Commercial Service: *Publicly owned airports that have at least 2,500 passenger boardings each calendar year and receive scheduled passenger service*	**Primary**: *Have more than 10,000 passenger boardings each year*	**Large Hub**: *1% or more*	Ronald Reagan Washington National Airport (DCA) Washington Dulles International Airport (IAD)
		Medium Hub: *At least .25%, but less than 1%*	Pittsburgh International Airport (PIT)
		Small Hub: *At least .05%, but less than .25%*	**Norfolk International Airport (ORF)**
		Non-hub Primary: *More than 10,000, but less than .05%*	Newport News/Williamsburg International Airport (PHF)
	Non-primary	**Non-primary Commercial Service**: *At least 2,500, and no more than 10,000*	Shenandoah Valley Regional Airport (SHD)
Non-primary (*Except Commercial Service*)		**Reliever**	Chesterfield County Airport (FCI)
		General Aviation	Chesapeake Regional Airport (CPK)

Source: FAA 2017-2021 NPIAS Report.

NORFOLK INTERNATIONAL AIRPORT
MASTER PLAN UPDATE

NOT TO SCALE

Location Map



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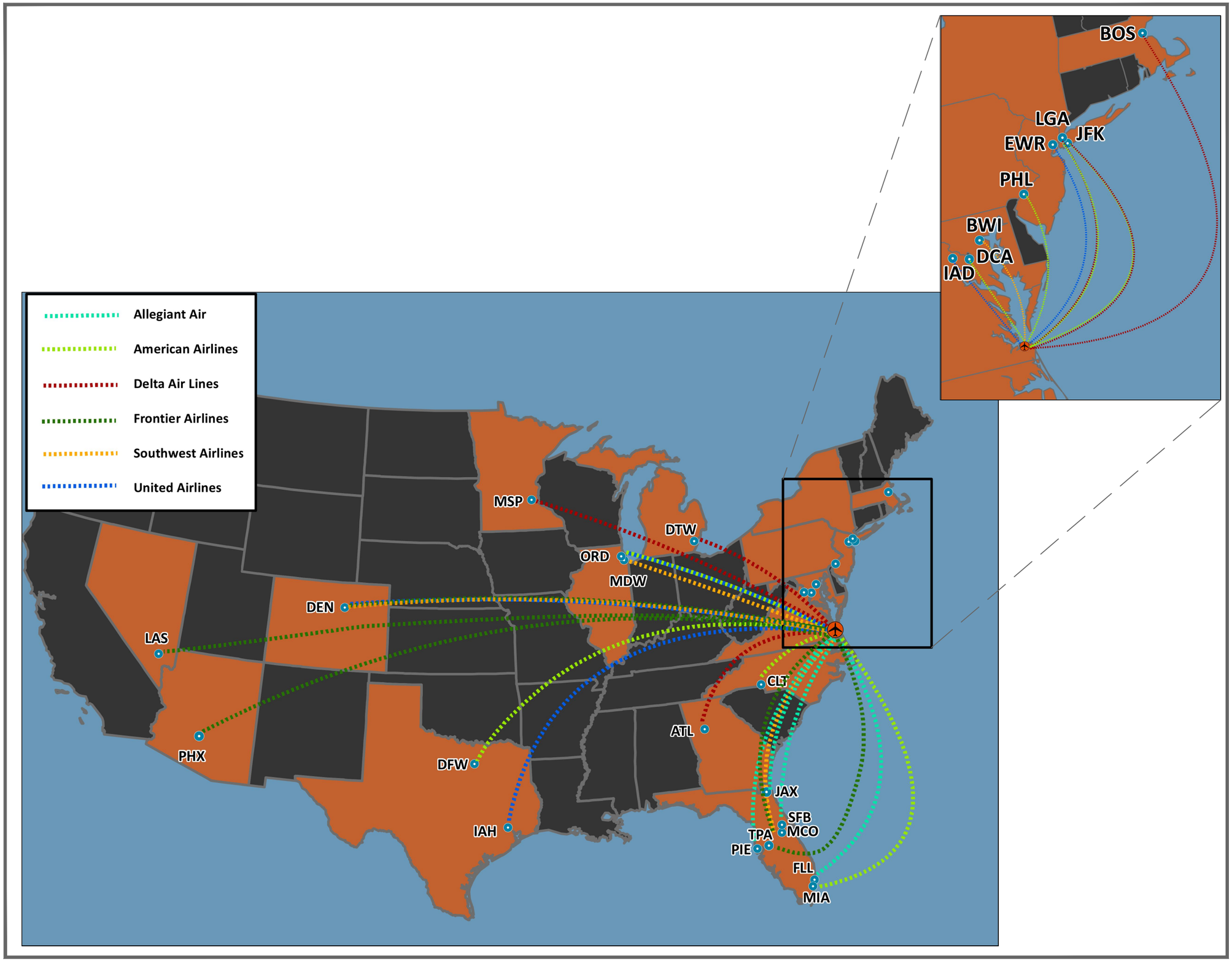


Figure 1-4
Air Service
Destinations (2018)

1.3 AIRPORT GOVERNANCE

The NAA is a political subdivision of the Commonwealth of Virginia and is an independent agency of the City of Norfolk. The Authority is governed by a Board of Commissioners consisting of up to nine members appointed by Norfolk City Council for four-year terms, as well as an Executive Director that manages routine operations at the Airport. The Board is made up of representatives from various organizations and backgrounds.

1.4 MAJOR AIRPORT TENANTS

The Airport hosts a variety of aviation and non-aviation tenants that provide services to the traveling public and aviation community. The major tenants include the airlines, air cargo operators, FBO/GA facilities, a Maintenance Repair and Overhaul (MRO) facility, concessionaires, and rental car companies.

1.4.1 Passenger Airlines

According to the FAA, as of 2018, ORF is ranked as the 70th largest primary airport in the United States in passenger arrivals and 72nd in passenger departures, serving over three-million passengers annually. Six airlines currently provide scheduled passenger service at the Airport. Between these airlines, ORF offers daily, non-stop service to 23 domestic destinations, as depicted in **Table 1-3** and **Figure 1-4**, Domestic service is primarily to key markets and hubs in the Northeast, Midwest, and South, as well as leisure markets in Florida.

As of May 2018, the commercial passenger service airlines at ORF are:

Allegiant Air (Allegiant)

American Airlines (American)

Delta Air Lines (Delta)

*Frontier Airlines (Frontier)**

Southwest Airlines (Southwest)

United Airlines (United)

* - Service begins August, 2018

Table 1-3 – Non-Stop Air Service Destinations

Airlines	Destinations
Allegiant	Fort Lauderdale-Hollywood International Airport (FLL), Jacksonville International Airport (JAX), St. Pete-Clearwater International Airport (PIE), Orlando Sanford International Airport (SFB)
American	Charlotte Douglas International Airport (CLT), Ronald Reagan Washington National (DCA), Dallas/Fort Worth International Airport (DFW), John F. Kennedy International Airport (JFK), LaGuardia Airport (LGA), Miami International Airport (MIA), Chicago O'Hare International Airport (ORD), Philadelphia International Airport (PHL)
Delta	Hartsfield-Jackson Atlanta International Airport (ATL), Boston Logan International Airport (BOS), Detroit Metropolitan Wayne County Airport (DTW), John F. Kennedy International Airport (JFK), LaGuardia Airport (LGA), Minneapolis-St. Paul International Airport (MSP)
Frontier	Denver International Airport (DEN), Orlando International Airport (MCO)
Southwest	Baltimore Washington International Airport (BWI), Orlando International Airport (MCO), Chicago Midway International Airport (MDW)
United	Denver International Airport (DEN), Newark Liberty International Airport (EWR), Washington Dulles International Airport (IAD), George Bush Intercontinental Airport (IAH), Chicago O'Hare International Airport (ORD)

Source: Airline Tenants.

1.4.2 Air Cargo Operators

ORF has two dedicated air cargo terminals and includes an aircraft parking apron dedicated to the loading and unloading of aircraft. The Airport has several types of air cargo activities being conducted including small freight operations (belly cargo), dedicated freight operations (cargo integrators, i.e., UPS, FedEx), and other all-cargo freight forwarding services. Most domestic passenger airlines listed in **Section 1.4.1** have transport cargo on scheduled passenger flights using the spare volume in the aircraft's baggage hold, or belly, that is not being used for passenger luggage. These operations include air freight and airmail services.

As of May 2018, the cargo airlines that have regular operations at ORF include:

Federal Express (FedEx)

Mountain Air Cargo (MAC)

United Parcel Service (UPS)

FedEx and UPS are known as integrated carriers. Integrated carriers are companies that transport cargo via air, as well as ground-vehicular methods, such as delivery through the United States Postal Service (USPS). Mountain Air Cargo (MAC) provides cargo flight and maintenance services in the eastern half of the United States and Caribbean Islands and is a contract carrier for FedEx.

1.4.3 Fixed-Base Operator (FBO)

Signature Flight Support, previously Landmark Aviation, is the single full-service FBO providing aviation services and amenities to the airlines, GA users, and pilots operating out of ORF. Signature Flight Support is the world's largest FBO and distribution network for business aviation services. A summary of the services offered by Signature includes aircraft fueling, deicing, maintenance, ground handling, hangar storage, and tie-down areas, as well as a business center, conference rooms with conference call capabilities, crew transportation services and capabilities, and crew rooms and rest areas.

Source: Signature Flight Support.

1.4.4 Maintenance, Repairs, and Overhaul (MRO)

The maintenance of aircraft is strictly regulated to ensure aircraft are meeting the requirements set forth to ensure airworthiness and safety while transporting passengers and cargo. The MRO facility at ORF, located in the General Aviation area, is leased to PSA Airlines.

Source: Google Earth.

1.4.5 Military

ORF does not have any designated Military facilities on the airfield. However, the Airport does recognize military personal through various services and facilities. On the second level of the Arrivals Terminal above baggage claim, active duty and retired military, as well as their families can utilize the Airport's United Service Organizations (USO) Welcome Center. Military personnel also receive discounts on ground transportation services at the Airport, as well as discounts at all of the Airport's retail shops and restaurants. The airlines providing services at ORF often extend discounted rates, per airline policy, to active duty military personnel and their dependents.

1.4.6 Rental Car Companies

As of May 2018, eight rental car companies provide services at ORF, along with one off-site service provider. Each on-site company has a separate counter in the Arrivals Terminal, dedicated ready parking in the parking garage, and return parking in a remote dedicated rental return surface lot. It should be noted that the Authority has plans to relocate the return lot to the parking garage in a combined ready/return lot within the next year. Quick Turn Around (QTA) services and vehicle maintenance for all rental car companies are handled off-site on Military Highway. The rental car operators at ORF have indicated that this split operation has created efficiency and safety issues, warranting some attention in future planning.

The rental car companies operating at ORF are:

Alamo

Avis

Budget

Dollar Rent a Car

Enterprise

Hertz

National

Thrifty

Payless (Off-Site)

1.4.7 Concessionaires

Concessionaires at an airport provide travelers in the sterile and non-sterile/non-secured areas (defined in **Section 1.4.7**), as well as meeters/greeters in the non-sterile area, with amenities such as restaurants / food vendors, newsstands, gift shops, and foreign currency exchange. The following concessionaires operate at ORF:

HMS Host

Hudson Group

Travelex

1.4.8 Department of Homeland Security

The Department of Homeland Security provides ORF with services from the Transportation Security Administration (TSA), as well as Customs and Border Protection (CBP). Airports and Airlines are required to meet security regulations established in Title 49 Code of Federal Regulations (CFR) Part 1542, *Airport Security,* and Title 49 CFR Part 1540, *Civil Aviation Security: General Rules*. As set forth in Title 49 CFR Part 1540.5, the "sterile area" refers to the most restrictive areas of the Airport (e.g. the concourses) and cannot be accessed by the public or badged personnel until being processed through security measures specified in 49 CFR Part 1542.

"Secured areas" are areas outside the concourse that are accessible only to badged personnel (proximity of baggage makeup and aircraft parking). "Non-sterile/non-secure areas" do not have regulated security measures and are accessible to the general public. The Security Identification Display Area (SIDA), means that all personnel must display a SIDA badge issued by ORF. SIDA areas can include non-secure areas, as well as airfield.

CBP is responsible for processing international passengers and baggage arriving at the Airport from international airports that do not have pre-screening facilities. CBP does not process passengers departing the Airport. Airlines are responsible for adequately screening passengers prior to departure.

1.5 REVIEW OF EXISTING STUDIES

Many detailed studies are complete or are in progress for ORF and the surrounding area.
It is important to be familiar with these studies when analyzing future needs to ensure compatibility, efficiency and synergy with local, state and federal transportation plans.
The following are a summary of these studies, that have been reviewed and taken into consideration during the Master Plan process.

1.5.1 2008 Airport Master Plan and Airport Layout Plan Update

The 2008 ORF Master Plan Update's primary goal was to provide the Authority with a flexible development plan that could accommodate both anticipated and yet unforeseeable passenger and operational needs. The plan addressed the needs of the airfield, terminal complex, cargo facilities, general aviation facilities, airport maintenance facilities, landside infrastructure, and the Arrivals Terminal, completed since the prior Master Plan study. The primary objectives included updates to the forecast to reflect significant changes in the air service industry, and analysis of the airport's existing and future runway needs. Development recommended by that Plan was estimated to cost $352. The following are key findings and recommendations of the 2008 ORF Master Plan Update:

- Develop a 6,500' parallel runway (5R-23L)
- Close Runway 14/32
- Expand existing concourses and RON parking
- Expand security screening and ground transportation facilities
- Construct an additional parking garage
- Reserve land for future air cargo facility expansion and a third passenger concourse

1.5.2 2015 ORF EIS Report

In 2015, an Environmental Impact Statement (EIS) analysis and report was completed for the construction of a parallel runway and removal of the existing Runway 14-32. The deficiencies addressed by the 2015 EIS included:

- Runway 14-32 failing to meet FAA design standards
- Impacts of forced closures of Runway 5-23 on Airport operations
- Limitation of operational efficiency, safety, and flexibility posed by the current airfield configuration
- Functional deficiency of southern access to the Airport

1.5.3 2016 Pavement Management System Update

In 2016, the Authority conducted a study to identify existing conditions of airfield pavement. This study provided the PCI (pavement condition index) data used in the development of this report. It determined that the entire terminal apron and Taxiway 'G' were at the stage of needing major rehabilitation.

1.5.4 2017 Characteristics of Passengers Using Norfolk International Airport

The objective of this Study was to provide the Authority with a better understanding of its various users. The data was gathered through a survey of passengers and other Airport users. Objectives of the survey and study included:

- Identifying leading destinations among departing passengers, and origins among arriving passengers
- Identifying modes of transportation used to arrive and depart from the Airport
- Assess satisfaction with parking facilities at the Airport
- Measure spending by out-of-town passengers

1.6 STUDY FOCUS AREA

The ORF Master Plan Update encompasses the current utilization and operational characteristics of the Airport, which includes the passenger terminal complex, general aviation facilities, landside facilities, ground access, the airfield and airfield support areas, and future land development areas. The study focus area is bounded by the following:

- North – Norview Avenue
- Northeast – Airport Parking Departure Road and the Norfolk Botanical Garden
- East – Lake Whitehurst and U.S. 60
- South – Miller Store Road
- West – Military Highway (from Hampton Roads Beltway to Croft Street)
- Northwest – Robin Hood Road (east of Gurley Street) and Airport Road

2 INVENTORY OF FACILITIES AND EXISTING CONDITIONS

The initial step in the master planning process is to develop an inventory of the existing physical conditions and operational characteristics of the Airport and its surroundings. The information presented in this chapter is the basis for evaluating the Airport's existing and future facility requirements. The following elements are detailed in this chapter:

- Airfield
  - Airport Design Criteria
  - Runway System
  - Taxiway System
  - Aircraft Parking Aprons
  - Airfield Markings
  - Airfield Signage
  - Airside Pavement Condition
- Navigational Aids (NAVAIDs) and Instrument Procedures
  - En-Route NAVAIDs
  - Standard Terminal Arrival Routes
  - Types of Instrument Approach Procedures and Instrument Approach NAVAIDs
  - Standard Instrument Departures
  - Airfield Lighting
- Terminal Facility
  - Terminal Facility Layout
  - Terminal Building Functional Areas
  - Airline Ticketing Lobby
  - Checked Baggage Screening
  - Passenger Security Screening
  - Airline Gates and Holdrooms
  - Terminal Concessions and Amenities
  - Baggage Claim
  - Rental Car Counters
  - Airport Administrative and Support Areas
  - Airline Service and Support Areas
  - Concession Storage and Support Areas
  - Back Office Space
  - Federal Inspection Services (FIS)
  - Terminal Signage and Wayfinding
- Automobile Access and Parking
- Support Facilities
  - Airport Perimeter Fence
  - Airport Equipment Storage and Maintenance
  - Air Traffic Control Tower (ATCT)
  - Aircraft Rescue and Firefighting (ARFF)
  - Aircraft Fueling
  - Snow and Ice Control
  - Air Cargo Facilities
  - General Aviation (GA) Facilities and Activities
  - MRO Facility
  - Rental Car Facilities
- Airspace Environment
- Meteorological Conditions
  - Local Climate
  - Wind Coverage

2.1 AIRFIELD

The Airport's airside and airfield facilities generally include the facilities located within the airport perimeter fence that are most closely associated with the movement and operation of aircraft, such as taxiing, takeoff, landing, and parking. Additional elements related to airfield activity and infrastructure include the runway and taxiway systems, aircraft parking aprons and hangars, and airfield pavement, markings, signage, lighting, and NAVAIDs. The existing facilities, as well as descriptions of the characteristics and conditions are depicted in **Figure 2-1** and **Figure 2-2**.

Source: NAA.

NORFOLK INTERNATIONAL AIRPORT

MASTER PLAN UPDATE

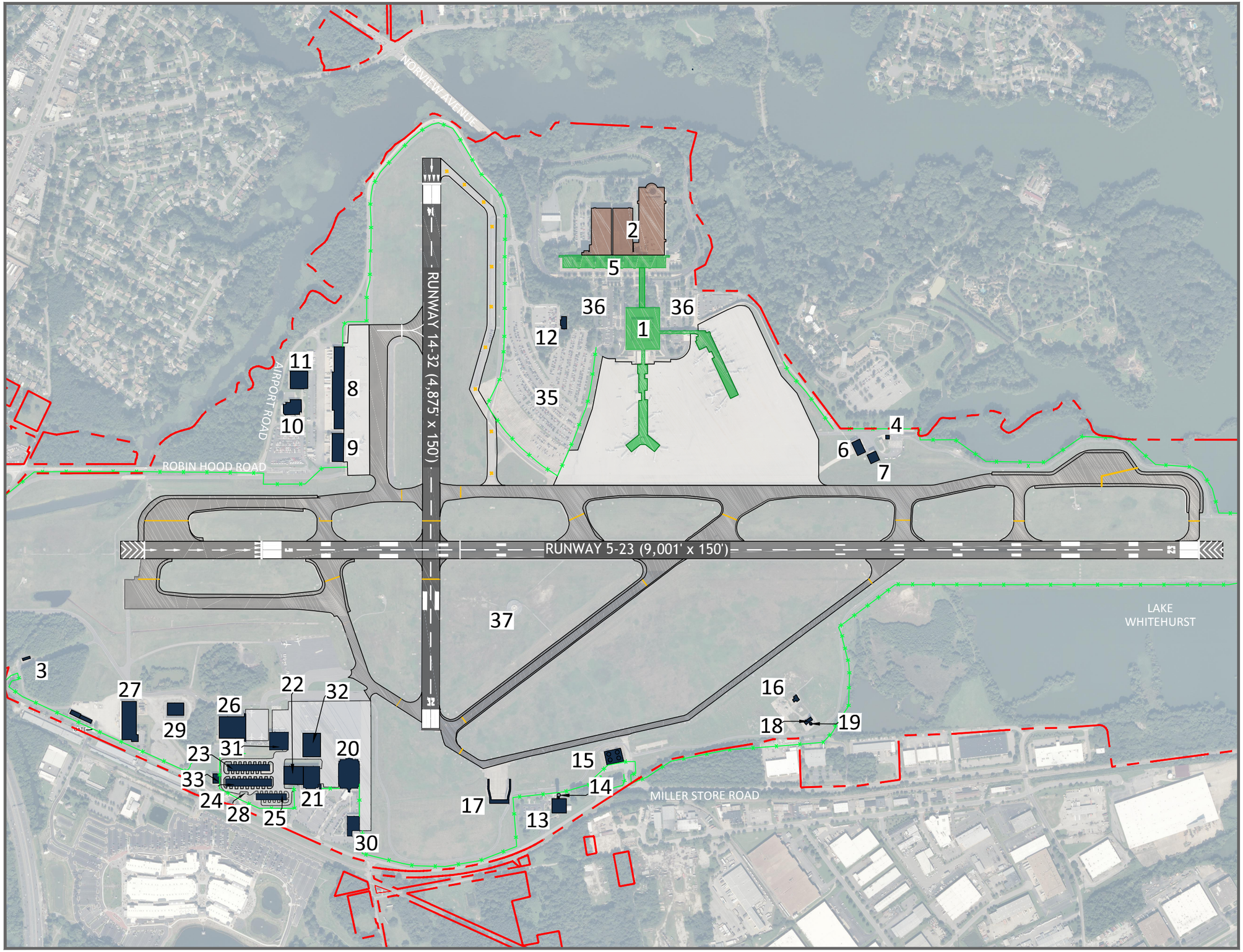
GRAPHIC SCALE (FEET)

0 500 1000

RUNWAY 24 RPZ
NORVIEW AVENUE
Parking Structures
Taxi Staging Lot
Rental Car Return/Ready Lot
Arrivals Terminal
Main Passenger Terminal
Deicing Pad - RON/Diversion Parking (Four Positions)
TNC Staging Lot
RUNWAY 14-32 (4,875' x 150')
AIRPORT ROAD
Cargo Facilities
Employee Parking
ROBIN HOOD ROAD
TAXIWAY A
TAXIWAY B
ARFF
Fueling Facility
Glycol Storage Tanks
RUNWAY 5 RPZ
RUNWAY 5-23 (9,001' x 150')
RUNWAY 23 RPZ
VORTAC
Snow Removal Equipment Storage
MRO Facility
FBO Terminal/Hangar
HAMPTON ROADS BELTWAY
Airfield Maintenance
T-Hangars (FBO)
FBO Maintenance Shop
Bulk Hangars (FBO)
Fuel Storage
MILLER STORE ROAD
RUNWAY 32 RPZ
Air Traffic Control Tower (ATCT)

- Property Line
- RPZ
- Permimeter Fence
- Terminal Complex
- Support Facilities
- Runways
- Taxiways
- Aprons

Figure 2-1
Existing Facilities



NORFOLK INTERNATIONAL AIRPORT

MASTER PLAN UPDATE

GRAPHIC SCALE (FEET)
0 600 1200

#	Name of Existing Facility
1	Main Terminal Complex
2	Automobile Parking Garage
3	Airfield Lighting Vault
4	Triturator
5	Arrivals Building and Baggage Claim
6	Aircraft Rescue and Firefighting Station
7	ARFF Storage Building
8	Air Cargo Building
9	Air Cargo Building
10	Catering Facility
11	FAA Remote Communications Facility
12	TNC Staging Area
13	FAA Support Building
14	FAA Air Traffic Control Tower
15	Fuel Farm
16	Former FAA Support Buildings (Abandoned)
17	Ground Run-Up Enclosure (GRE)
18	FAA Support Building
19	FAA ASR-9 Radar
20	GA Terminal/Hangar Facility C-1
21	Hangar C-2
22	Hangar C-2
23	T-Hangar Building #1
24	T-Hangar Building #2
25	T-Hangar Building #3
26	Aircraft Maintenance Hangar
27	Airfield Maintenance Facility
28	General Aviation Fuel Farm
29	ARFF Training Facility
30	Hangar C-5
31	Hangar C-3
32	Hangar C-4
33	FBO Maintenance Shop
34	Airfield Maintenance Building
35	Long-Term Parking Lot
36	Short-Term Parking Lot
37	VOR Facility

Figure 2-2
Building Diagram

2.1.1 Airport Design Criteria

The FAA uses a classification system, known as the Airport Reference Code (ARC), to signify the airport's highest Runway Design Code (RDC), the design standards to which the runway is to be built. RDC consists of three components: aircraft approach speed (AAC), airplane design group (ADG) relating to either the aircraft wingspan or tail height (whichever is more restrictive), and visibility minimums. ARC is determined by taking the highest RDC minus the visibility component. It affects runway and taxiway dimensions, separation standards, pavement marking standards, and other safety standards. Furthermore, it is used for planning and design only and does not limit the aircraft that may be able to operate safely at the airport. The relationship between the ARC and design standards is further described in FAA AC 150/5300-13A, *Airport Design*. The characteristics of the RDC are shown in **Table 2-1**.

As previously noted, the ARC is based on an aircraft's approach speed and wingspan or tail height, whichever is most restrictive. The most demanding aircraft is commonly referred to as the critical, or design, aircraft and must account for a minimum of 500 annual itinerant operations. An itinerant operation is the takeoff or landing of an aircraft going from one airport to another, at least 20-miles from each other. The ARC consists of a letter designating the aircraft approach category and a Roman numeral designating the Airplane Design Group (ADG). ORF is currently designated with an ARC D-IV. The critical aircraft at ORF is the Boeing 757-200.

Approach categories A and B include small piston-engine aircraft and corporate jets with approach speeds of less than 121 knots, while categories C, D, and E include larger aircraft with approach speeds of 121 knots or greater (those typically associated with commercial or military use). Similarly, design groups I and II typically include small piston-engine aircraft and light to midsize corporate jets, as well as single- and twin-engine turboprop aircraft. Design groups III, IV, and V include larger corporate jets and the majority of the commercial jet fleet, as well as numerous military aircraft. Design group VI includes very large jets such as the Airbus A380 and the military C-5 transport aircraft.

TDG represents the Taxiway Design Group, which relates to the undercarriage dimensions of the aircraft. Preliminary review of operations data for 2016 indicates that the MD-88 (ADG C-III, TDG IV) is the most demanding passenger aircraft and the B757 (ADG D-IV, TDG IV) is the most demanding cargo aircraft that operates regularly at ORF with over 500 annual operations. The existing and future ARC will be analyzed in greater detail in **Chapter 4**, *Facility Requirements*.

Table 2-1 – Airport Reference Code

Approach Categories		
Approach Category	**Airspeed (Knots)**	**Example Aircraft**
A	<91	Beechcraft-E33 Bonanza, Cessna 152
B	91 ≤ 121	CRJ-200, ERJ-135/140/145
C	121 ≤ 141	B737-700W, MD-88
D	141 ≤ 166	A300, B757
E	166+	B-52H, B-2 Spirit

Airplane Design Group			
Design Group	**Tail Height (feet)**	**Wingspan (feet)**	**Example Aircraft**
I	<20	<49	Beechcraft-E33 Bonanza, Cessna 152
II	20-<30	49 ≤ 79	CRJ-700, ERJ-145
III	30-<45	79 ≤ 118	A319, CRJ-900
IV	45-<60	118 ≤ 171	Boeing 757, MD 11
V	60-<66	171 ≤ 214	A300, B757
VI	66-<80	214 ≤ 262	B-52H, B-2 Spirit

Source: FAA AC 150/5300-13 *Airport Design*.

2.1.2 Runway System

The existing airfield configuration at ORF consists of two intersecting runways, identified as Runway 5/23 and Runway 14/32. Runway 5/23 is oriented in a northeast/southwest direction, and Runway 14/32 is oriented in a northwest/southeast direction. **Table 2-2** presents the characteristics of each runway.

ORF's primary runway, Runway 5/23, is situated east of the terminal building. The runway is 150 feet wide and has a usable runway length of 8,001 feet, accompanied by a 1,000-foot-long displaced threshold, for a total pavement length of 9,001 feet. It is constructed of both asphalt and concrete, has a grooved surface, and is supplemented by 12.5-foot wide, paved shoulders along the asphalt-paved portion. The runway's load-bearing capacity is 150,000 pounds single-wheel; 200,000 pounds dual-wheel; 350,000 pounds duel tandem; and 475,000 pounds dual double tandem.

Situated south of the terminal building, Runway 14/32 is the Airport's crosswind runway. The runway is 150 feet wide and has a usable runway length of 4,300 feet, with a 575-foot displaced threshold, for a total pavement length of 4,875 feet. It is constructed of asphalt and has a grooved surface. The runway's load-bearing capacity is 75,000 pounds single-wheel and 100,000 pounds dual-wheel.

Table 2-2 – Existing Runway Specifications

	Runway 5/23	Runway 14/32
Runway Length (feet)	9,001	4,875
Displaced Threshold (feet)	1,000	575
Width (feet)	150	150
Runway End Elevation (feet above MSL)	**Runway 5:** 18.1 **Runway 23:** 15.5	**Runway 14:** 18.2 **Runway 32:** 22.1
Pavement Type	Asphalt/Concrete/Grooved	Asphalt/Grooved
Pavement Load Bearing	475,000 lbs. (Dual Double Tandem)	100,000 (Dual-Wheel)
Effective Runway Gradient	0.1%	0.1%
Aircraft Approach Category	D	C
Airplane Design Group	IV	III
Runway Markings	Precision	Non-Precision
Runway and Approach Lighting	HIRL, C/L **Runway 5:** TDZL, PAPI-4, MALSR **Runway 23:** PAPI-4, MALSR	MIRL, REIL **Runway 14:** PAPI-2 **Runway 32:** PAPI-2
Navigational Aids	ILS/DME, RNAV (RNP, GPS)	VOR/DME, RNAV (GPS)
Runway Design Code	D-IV	C-III

Sources: AirNav.com; FAA Form 5010-1, *Airport Master Record-February 2018.*

C/L – Centerline Lights
DME – Distance Measuring Equipment
GPS – Global Positioning System
HIRL – High Intensity Runway Lights
ILS – Instrument Landing System
MALSR – Medium-Intensity Approach Lighting System with Runway Alignment Indicator
MIRL – Medium-Intensity Runway Lighting
PAPI-4 – Four-Box Precision Approach Path Indicator
PAPI-2 – Two-Box Precision Approach Path Indicator
REIL – Runway End Identifier Lights
RNAV – Area Navigation
RNP – Required Navigational Performance
TDZL – Touchdown Zone Lights

2.1.3 Taxiway System

An airport's taxiway system connects the runways to aircraft parking aprons, storage hangars and other facilities. ORF has nine operative taxiways. The Airport also utilizes one taxiway holding bay at the Runway 23 approach end. A taxiway holding bay allows standing space for an aircraft that is waiting to receive takeoff clearance or small piston aircraft performing ground run-up procedures to allow aircraft already cleared for takeoff to move to their runway takeoff position. **Table 2-3** provides the characteristics and specifications of each taxiway. **Figure 2-3** displays the existing taxiway system at ORF.

Table 2-3 – Existing Taxiway Specifications

Taxiway	Description	Width (feet)	Airplane Design Group (ADG)	Taxiway Design Group (ADG)	Taxiway Shoulder (feet)
A	Provides access from TWY 'C' and from the GA area to RWY 5/23; Provides access from the GA area to RWY 32; Provides access to TWY 'J'.	75	IV	6	30
B	Provides access from RWY 5/23 to TWY 'C' / Terminal Ramp (Highspeed TWY).	75	IV	7	40
C	Parallel to RWY 5/23 and the Terminal Ramp.	75	IV	7	40
E	Provides access from RWY 5/23 to TWY 'C'	75	IV	7	40
F	Connects RWY 5/23 to RWY 32; Provides access to Ground Run-up Enclosure (GRE)	50	III	3	20
G	Provides access from RWY 5/23 to TWY 'C' / Terminal Ramp (Highspeed TWY); Connects RWY 5/23 to TWY 'F' and RWY 32.	75	IV	7	40
H	Provides access from RWY 5/23 to TWY 'C'	75	IV	6	30
J	Partial Parallel to RWY 5/23; Connects TWY 'A' and RWY 5	75	IV	6	30
V	Partial Parallel to RWY 14/32 and the Cargo Ramp; Provides access to RWY 14/32 and TWY 'C' from the Cargo Ramp	75	IV	6	30

Source: FAA Airport Diagram, AC 150/5300-13A, CHA 2017.

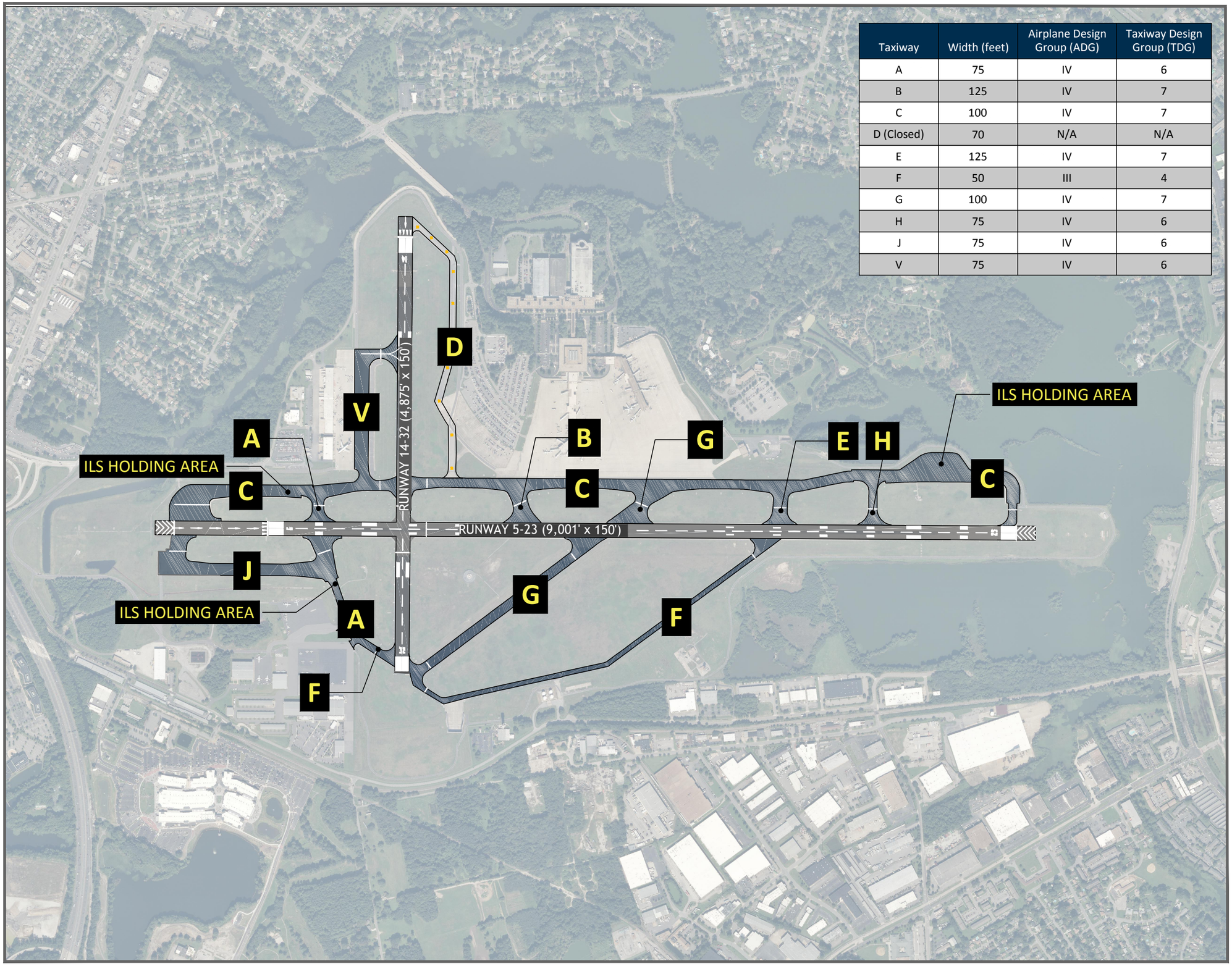
RWY – Runway

TWY – Taxiway

GRE – designated area for mitigating noise disturbance from aircraft running-up engines prior to takeoff

.

Taxiway	Width (feet)	Airplane Design Group (ADG)	Taxiway Design Group (TDG)
A	75	IV	6
B	125	IV	7
C	100	IV	7
D (Closed)	70	N/A	N/A
E	125	IV	7
F	50	III	4
G	100	IV	7
H	75	IV	6
J	75	IV	6
V	75	IV	6



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GRAPHIC SCALE (FEET)

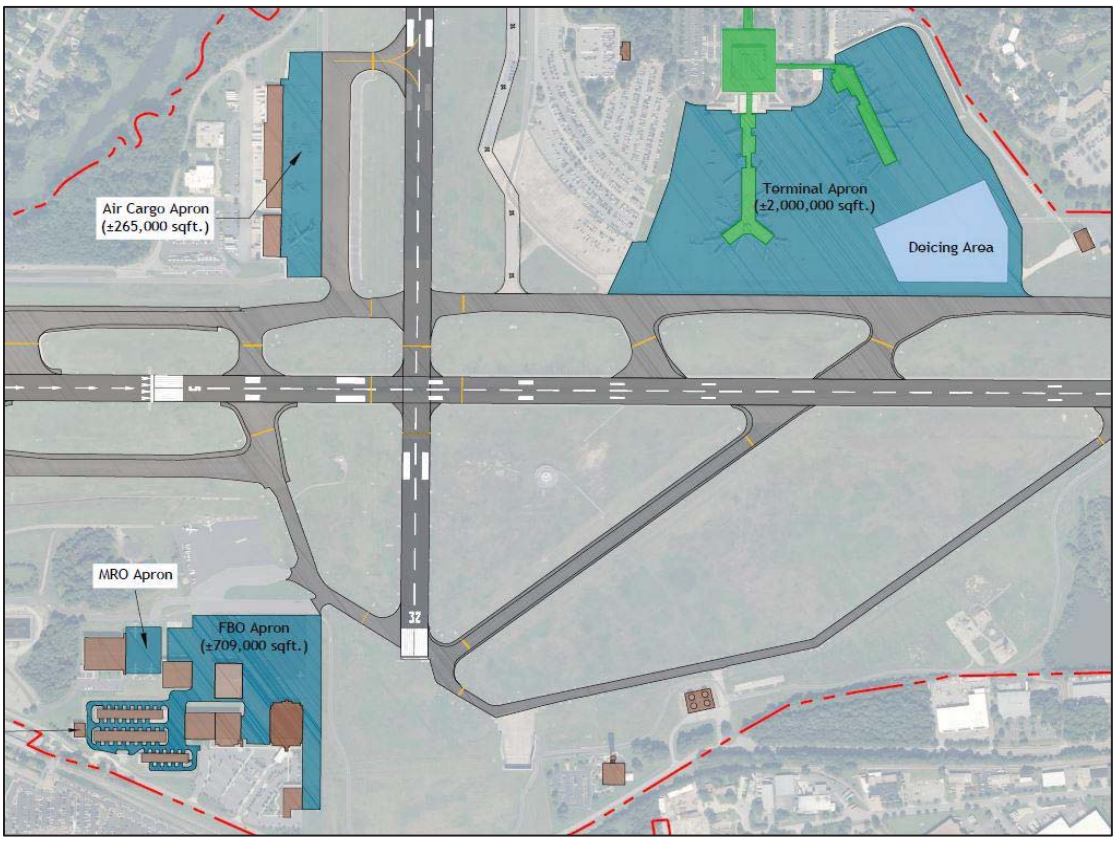
0 500 1000

Figure 2-3
Taxiway Configuration

2.1.4 Aircraft Parking Aprons

Airport aprons, also referred to as ramps, provide space for short-term and long-term aircraft parking and deicing operations, as well as the loading/unloading of passengers and goods. As depicted in **Figure 2-4** and described below, ORF has three aprons: a terminal apron, a General Aviation/Fixed Base Operator (FBO) apron, and an air cargo apron.

Figure 2-4 – Aircraft Parking Aprons



Source: Norfolk International Airport, CHA 2017.

Terminal Apron

The terminal apron consists of approximately 2,000,000 square feet of cement/concrete pavement. Activities on the terminal apron primarily include passenger airline and belly cargo loading and unloading. The terminal has 23 gate positions. **Table 2-4** provides gate specifications, while a schematic of the gate layout is presented in **Figure 2-5.** Approximately 371,591 square feet of the apron is utilized for gate parking at Concourse A, and approximately 528,842 square feet of the apron is utilized for gate parking at Concourse B. The remainder of the apron is utilized for aircraft maneuvering, Remain Overnight Parking (RON), and aircraft deicing services.

Table 2-4 – Gate Specifications

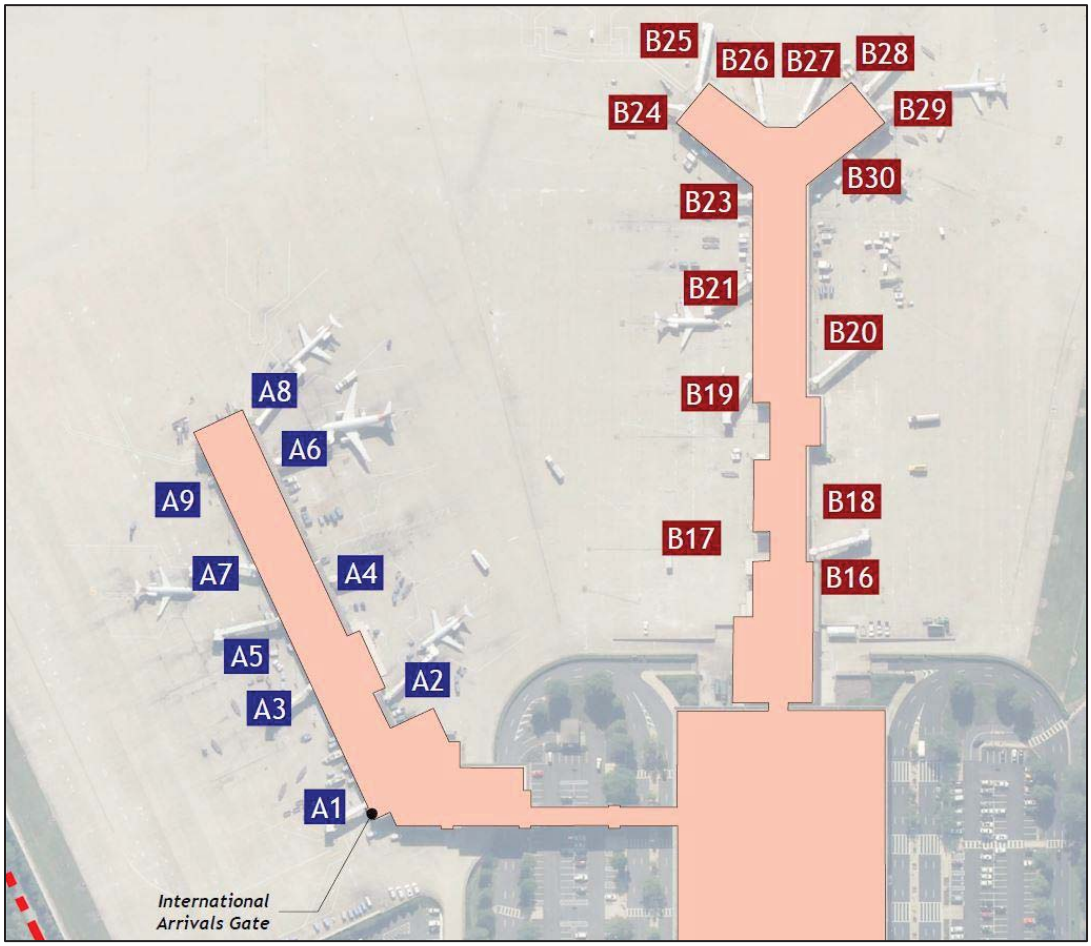
Gate Position	Apron Area (Sq. Feet)	Aircraft Design Group
Gate A1	41,370	III
Gate A2	35,096	III
Gate A3	34,155	III
Gate A4	45,195	III
Gate A5	28,980	III
Gate A6	32,747	III
Gate A7	28,834	III
Gate A8	35,616	III
Gate A9	27,712	III
Gate A (Unassigned)	29,270	III
Gate B16	31,121	II
Gate B17	37,849	III
Gate B18	37,932	III
Gate B19	44,962	III
Gate B20	59,715	III
Gate B21	40,854	III
Gate B23	42,400	III
Gate B24	31,829	III
Gate B25	26,793	III
Gate B26	31,484	II
Gate B27	33,480	III
Gate B28	30,429	II
Gate B29	30,291	III
Gate B30	49,703	III

Source: NAA, 2017.

ADG III (Example Aircraft): A320-200, Boeing 737-300, EMB 170 STD

ADG II (Example Aircraft): CRJ-700, ERJ 145

Figure 2-5 – Gate Layout



Source: Norfolk International Airport, CHA 2017.

General Aviation (GA) Use Aprons

The GA apron area is broken-up into sections including bulk hangars and T-hangars. The total apron area comprising the GA area is approximately 709,200 square feet. These aprons provide parking for transient aircraft, allow access to the GA facilities and fixed-base operator facilities, and provide space for aircraft tie-downs.

Air Cargo Use Aprons

The air cargo-dedicated area, which is shared by FedEx, Mountain Air Cargo, and UPS, is served by one apron. The apron is used for cargo transfer operations, aircraft storage, and maintenance. The apron, measuring approximately 265,000 square feet, is located on the east side of the cargo facilities and south of Runway 14/32.

Remain Overnight (RON) and Diversion Ramp Parking

At ORF, remain overnight (RON) and diversion parking support operations for commercial and general aviation traffic. RON and diversion parking at ORF varies for each airline. Typically, there are 15 RON aircraft which are parked overnight at gates or designated RON parking stands on the terminal ramp, or in hangars located on the southside of the airfield.

American Airlines typically has six RON aircraft. Two of the aircraft are positioned on the terminal ramp, while the remaining four aircraft park inside hangars in the GA area. Delta Air Lines leases four gates for regularly scheduled arrivals and departures. A fifth gate is leased for overnight operations. Delta utilizes all five gates (Gates B19, B21, B23, B24, & B25) for RON aircraft, with three additional RON aircraft parked on the terminal ramp. Southwest has two RON aircraft that utilize Gates A3 and A5. United regularly has two RON aircraft that each utilize one of United's leased gates (Gates B27, B28, B29, & B30), though this is increasing to five RON aircraft. Allegiant does not have scheduled RON aircraft at ORF.

An aircraft diversion is when an aircraft that was originally intended to fly to a specific airport unexpectedly experiences a situation requiring the pilot to change his or her route to an alternate airport. ORF can accommodate diverted aircraft on a case-by-case basis and, on occasion, provide terminal gate parking if available. When gate parking is not available, the diverted aircraft are parked on the northeast side of the main terminal apron where the RON parking positions and deicing operations are performed during unfavorable weather conditions.

2.1.5 Airfield Markings

FAA AC150/5340-1L, *Standards for Airport Markings*, provides the standards for surface markings used on airfield roadways and airfield pavements, such as runways, taxiways, and aprons, assuming the surfaces are built in accordance to the standard dimensions and layouts in AC 15/5300-13, *Airport Design* (this excludes privately owned apron areas). The most recent version of this guidance was published in September 2013, however, FAA released a draft version of FAA AC 150/5340-1M in March 2017, and includes new standards for enhanced taxiway centerline markings, surface-painted hold sign markings and the extension of the runway holding position markings onto the paved shoulders. These standards apply to all airports certificated under Title 14 CFR Part 139, which establishes certification requirements for airports serving scheduled air carrier operations in aircraft designed for more than nine passenger seats but fewer than 31 passenger seats. Examples of airfield markings are provided in **Table 2-5**, **Figure 2-6**, and **Table 2-6**.

Table 2-5 – Runway Markings

Type of Marking	Purpose of Marking
Designation	Numbers and letters are determined from approach direction; labeled according to Compass Rose
Centerline	Identifies the center of the runway; Provides alignment guidance during takeoff and landings
Threshold	Delineates the beginning of the runway that is available for landing
Aiming Point	Serve as a visual aiming point for a landing aircraft, located approximately 1,000 feet from the landing threshold
Touchdown Zone	Identify the touchdown zone for landing operations and are coded to provide distance information in 500 feet increments
Runway Edge Marking	Define the edge of the usable, full-strength surface

Figure 2-6 – Runway Markings

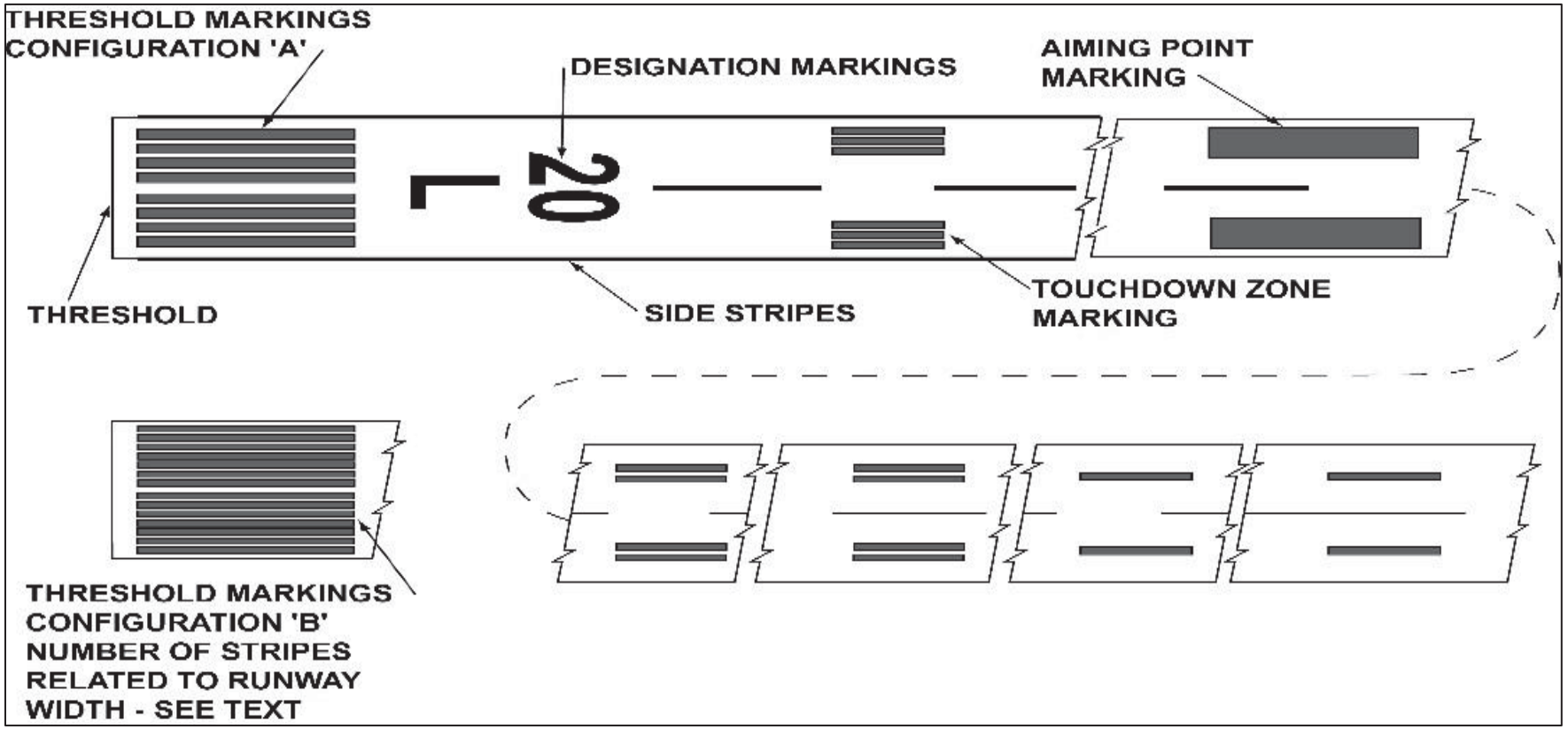
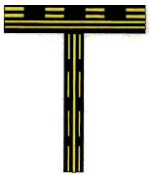
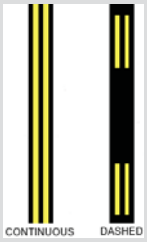
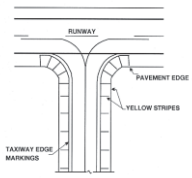
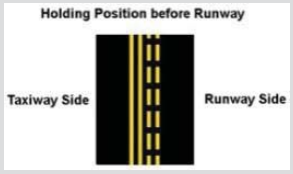
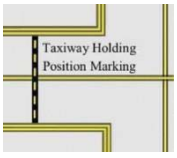


Table 2-6 – Taxiway Markings

Type of Marking	Purpose of Marking	Visual Representation of Marking
Normal Centerline	Provides a visual cue to permit taxiing along a designated path	
Enhanced Centerline	Intended to warn the pilot that he/she is approaching a runway holding position marking and should prepare to stop unless he/she has been cleared onto or across the runway by ATC; Usually at larger, commercial service airports	
Edge Markings	Continuous- Define the taxiway edge from the shoulder or other abutting paved surface not intended for use by aircraft; Dashed- Defines the taxiway edge from the adjoining pavement intended for use by aircraft	
Shoulder Markings	Identifies paved shoulders (areas intended to prevent blast and water erosion); not intended for use by aircraft (may not be full-strength pavement)	
Runway Holding Position	Indicate where an aircraft is supposed to stop when approaching a runway	
Taxiway/Taxiway Intersection	Indicate where an aircraft is supposed to stop when approaching intersecting taxiways	

2.1.6 Airfield Signage

According to Title 14 CFR Part 139.311, *Marking, Signs, and Lighting*, each certificate holder, such as ORF, must provide and maintain sign systems for air carrier operations on the airport that are authorized by the Administrator and consist of at least the following:

- Signs identifying taxiing routes on the movement area.
- Holding position signs.
- Instrument Landing System (ILS) critical area signs.

The holding position signs, as well as the ILS critical area signs, must be internally illuminated. FAA AC 150/5340-18F, *Standards for Airport Sign Systems*, contains all regulations pertaining to airfield signage for Part 139 airports, while specifications are contained in AC 150/5345-44K, *Specifications for Runway and Taxiway Signs*. A further description of typical airfield signage is included in **Table 2-7**. See AC 150/5340-18F, Glossary of sign types, for additional sign type descriptions.

Upon visual inspection, lighted airfield signage currently found on ORF's airfield consists of all required signage for a Part 139 certificated airport including airfield location signage, mandatory instruction signage, and runway hold position signage. Additional signage may be required to accommodate future improvements or additions to airfield pavements.

Table 2-7 – Airfield Signage

Type of Sign	Purpose of Sign	Visual Description of Sign
Mandatory Instruction Sign	Denote taxiway/runway intersections, runway/runway intersections, Instrument Landing System (ILS) critical areas, Precision Obstacle Free Zone (POFZ) boundaries, runway approach areas, CAT II/III operations area, military zones, and no entry zones	White Inscription/Red Background
Location Sign	Identify the taxiway or runway apron upon which the aircraft is located	Yellow Inscription/Black Background
Boundary Sign	Identify the boundary of the Runway Safety Area (RSA)/Object Free Zone (OFZ) or ILS critical are for a pilot exiting the runway	Black Inscription/Yellow Background
Directional Sign	Indicate directions of other taxiways leading out of an intersection	Black Inscription/Yellow Background; Always Contains an Arrow
Destination Sign	Indicate the direction to a remote location	Black Inscription/Yellow Background; Always Contains an Arrow
Runway Distance Remaining Sign	Provide distance remaining information to pilots during takeoff and landing operations	White Inscription/Black Background

Source: FAA AC 150/5340-18F.

2.1.7 Airfield Pavement Condition

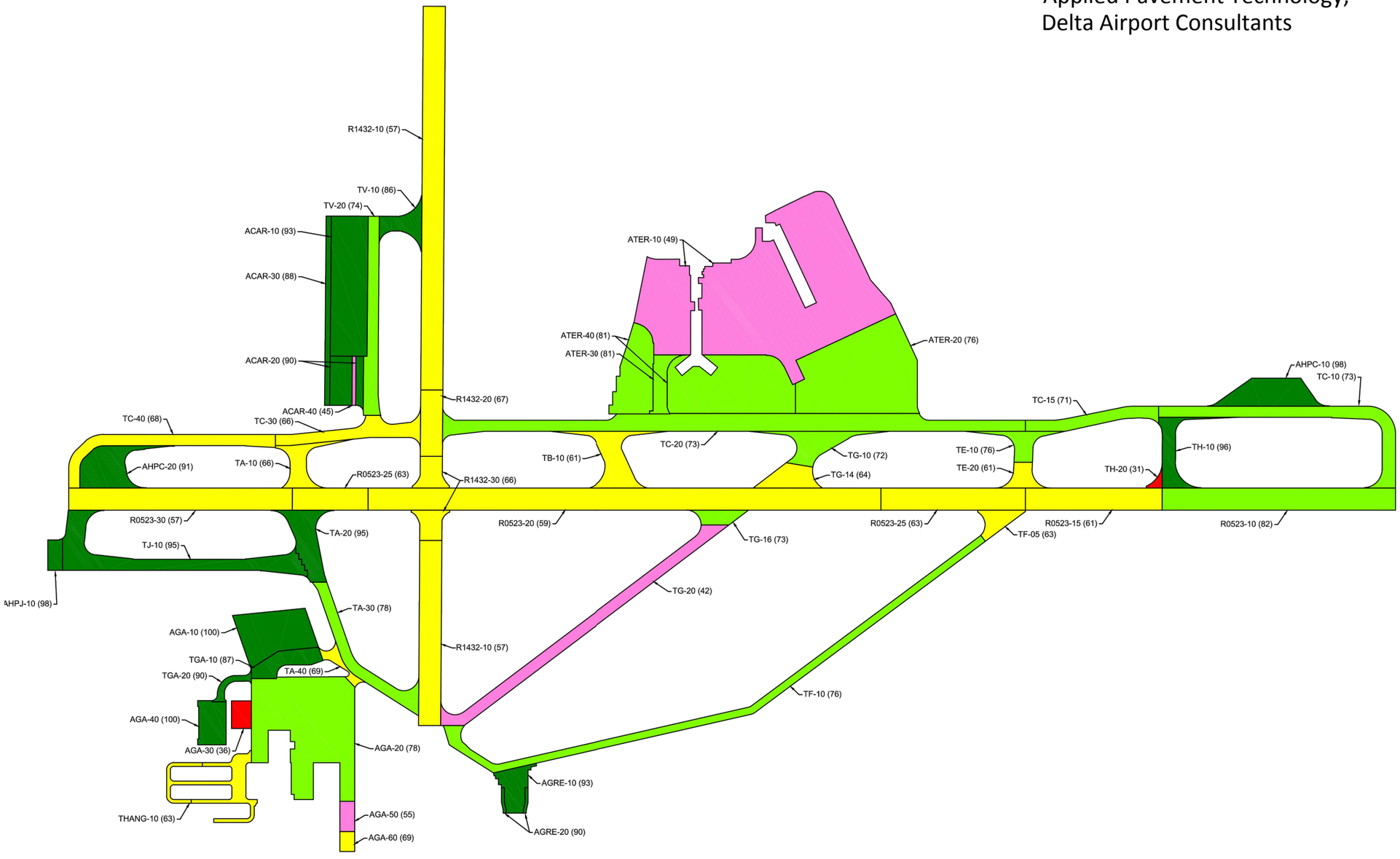
ORF has an established pavement management plan (PMP) that provides a consistent and systematic procedure for making decisions about pavement maintenance and rehabilitation. The load-carrying capacity of the pavement for unrestricted operations is expressed as a Pavement Classification Number (PCN). According to AC 150/5335-5C, *Standardized Method of Reporting Airport Pavement Strength-PCN*, in 1977, the International Civil Aviation Organization (ICAO) adopted the Aircraft Classification Number-Pavement Classification Number (ACN-PCN) method. The PCN is a five-part number which includes a numerical PCN value [indicating the load-carrying capacity of a pavement (between 0 and 100)], pavement type (flexible-F or rigid-R), subgrade category (high-A, medium-B, low-C, ultra-low-D), allowable tire pressure (unlimited/no pressure-W, high/pressure limited to 254 psi-X, medium/pressure limited to 181 psi-Y, and low/pressure limited to 73psi-Z), and the method used to determine the PCN (via technical study-T or evaluation based on using aircraft experience-U). The PCN for each runway at ORF is shown in **Table 2-8**, while existing airfield pavement conditions are shown in **Figure 2-7**.

Table 2-8 – Airside Pavement Condition

Runway	PCN Classification	Numerical Value (0-100)	Pavement Type	Subgrade Strength Category	Allowable Tire Pressure	Method
5/23	PCN 53/R/C/W/T	53	Rigid	Low	Unlimited / No-Pressure	Technical Study
14/32	PCN 27/F/A/W/T	27	Flexible	High	Unlimited / No-Pressure	Technical Study

Source: NAA, 2018.
psi: pounds per square inch

Source:
ORF 2016 Pavement Management System Update -
Applied Pavement Technology,
Delta Airport Consultants



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NOT TO SCALE

LEGEND

PAVEMENT CONDITION INDEX

PCI	REPAIR
100	
85	PREVENTIVE MAINTENANCE
70	
55	MAJOR REHABILITATION
40	
25	RECONSTRUCTION
10	
0	

Figure 2-7
Existing Pavement Airfield Pavement Conditions

2.2 NAVIGATIONAL AIDS (NAVAIDS) AND INSTRUMENT PROCEDURES

Pilots utilize a variety of navigational aids (NAVAIDs) and instrument procedures, including Very High Frequency (VHF) Omni Direction Range (VORs), standard terminal arrival routes (STARs), instrument approach procedures (IAPs) and NAVAIDs, approach lighting systems (ALS), airfield lighting, and rotating beacons. By providing point-to-point guidance information or position data, NAVAIDs assist pilots to safely and efficiently locate airports, land aircraft, taxi aircraft, and depart from airports during nearly all meteorological conditions. **Table 2-9** summarizes the Airport's existing instrument approach procedures, by runway, and the NAVAIDs required.

Table 2-9 – Navigational Aids (NAVAIDs) and Airfield Lighting

Runway	Runway Markings	Navigational Aids	Lighting	Minimum Ceiling (AGL)/ Visibility	Instrument Approach Types
5	Precision	ILS/DME, RNP, GPS	HIRL, PAPI-4, MALSR, C/L, TDZL	200 ft. / ½ mile	ILS or LOC, RNAV (RNP), RNAV (GPS)
23	Precision	ILS/DME, RNP, GPS	HIRL, PAPI-4, MALSR, C/L	200 ft. / ½ mile	ILS or LOC, RNAV (RNP), RNAV (GPS)
14	Non-Precision	GPS, VOR/DME	MIRL, PAPI-2, REIL	500 / 1 mile	RNAV (GPS), VOR/DME
32	Non-Precision	GPS, VOR/DME	MIRL, PAPI-2, REIL	500 / 1 mile	RNAV (GPS), VOR/DME

Source: FAA Airport Master Record (Form 5010), Accessed 2017.

C/L – Centerline Lights
DME – Distance Measuring Equipment
GPS – Global Positioning System
HIRL – High Intensity Runway Lights
ILS – Instrument Landing System
MALSR – Medium-Intensity Approach Lighting System with Runway Alignment Indicator
MIRL – Medium-Intensity Runway Lighting
PAPI-4 – Four-Box Precision Approach Path Indicator
PAPI-2 – Two-Box Precision Approach Path Indicator
REIL – Runway End Identifier Lights
RNAV – Area Navigation
RNP – Required Navigational Performance
TDZL – Touchdown Zone Lights

2.2.1 En-route NAVAIDs

En-Route NAVAIDs assist pilots during navigation between airports. These facilities are usually ground-based and electronically emit signals that are received by aircraft on a specific radio frequency. They are almost always used in some manner by pilots operating on Instrument Flight Rule (IFR) flight plans but can also be used during Visual Flight Rule (VFR) flights for position information. At ORF, Runway 14 and Runway 32 utilize VOR/DME, which are ground-based en-route NAVAIDs.

2.2.2 Standard Terminal Arrival Routes (STARs)

Standard Terminal Arrival Routes (STARs) are preplanned IFR air traffic control arrival procedures published for pilot use. STARs serve as a critical form of communication between pilots and ATC by providing a method and criteria for descent, routing, and communications when navigating to the destination after leaving the en-route structure. The STAR and approach procedures virtually connect to each other in such a way as to create a seamless transition.

Once a flight crew has accepted a clearance for a STAR, they have communicated with the controller what route, and in some cases what altitude and airspeed, they will fly during the arrival, depending on the type of clearance.

When air traffic is arriving to the Norfolk region, ORF's ATC has two STAR procedures: *DRONE ONE* and *TERKS TWO*. The *DRONE ONE* arrival utilizes the *RALEIGH/DURHAM and KINSTON* VORTACs (RDU and ISO, respectively), which feed traffic from the west and south. The *TERKS TWO ARRIVAL* utilizes the *MONTEBELLO (MOL) VOR/DME* intersection, which feeds traffic from the north.

2.2.3 Types of Instrument Approach Procedures (IAPs) and Instrument Approach NAVAIDs

Based on current FAA classifications, there are four types of instrument approach categories:

- **Visual (V)**: Approaches performed under visual flight rules only, when meteorological conditions include a cloud ceiling height of 1,000 feet or greater and visibility of 3 miles or greater. None of the runways at ORF operate strictly under this category.
- **Non-Precision Approach (NPA)**: Instrument approach procedures providing only lateral guidance with a ceiling minimum of 400 feet above the threshold. These can include VHF Omnidirectional Range (VOR), non-directional beacon (NDB), area navigation (RNAV), lateral navigation (LNAV), localizer performance (LP), and localizer (LOC) equipment. At ORF, Runways 5, 23, 14, and 32 all have a NPA procedure.
- **Approach Procedure with Vertical Guidance (APV)**: Instrument approach procedures providing vertical guidance minimums of 250 feet above the threshold and visibility minimums as low as ¾ mile. These can include an ILS, LNAV/Visual Navigation Aids (VNAV), Localizer Performance with Vertical Guidance (LPV) or Area Navigation (RNAV) Required Navigation Performance (RNP). Runways 5, 23, 14, and 32 maintain this type of procedure.
- **Precision Approach (PA)**: Instrument approach procedures providing vertical guidance less than 250 feet above the threshold and visibility minimums lower than ¾ mile. These can include an ILS, LPV, and Global Navigation Satellite System (GNSS) Landing System (GLS). This category applies to Runways 5 and 23.

The precision approach is one component that determines the minimum ceiling and visibility for each runway (other variables may influence the minimums - obstructions to the approach, buildings, terrain, etc.). The NAVAIDs that make up the ground-based equipment required to perform the approach procedures are divided into two categories: precision and non-precision. The NAVAIDs supporting traditional ground-based precision approaches are collectively called an Instrument Landing System (ILS). According to FAA Order 6750.16E, *Siting Criteria for Instrument Landing Systems*, the ILS provides guidance to pilots of properly equipped aircraft to assist them in landing safely under conditions of reduced ceilings and lowered visibility. The Airport operates an ILS for approaches to Runway 5 and Runway 23.

Two components of an ILS include: a localizer (LOC) and a glide slope (GS). A localizer is situated 1,000 feet past the departure-end of the runway that has the approach and provides lateral positioning guidance to pilots. It utilizes radio frequencies (RF) to transmit signals to aircraft by focusing the RF beam down the centerline of the runway toward the approach end of the runway for approximately 10 miles, focused within 35 degrees to the left or right of the runway centerline. The glide slope is located near the runway approach end at a distance from the threshold to provide optimum crossing height, with a preferred offset of 400 feet from the runway centerline. It transmits a signal for approximately 10 nautical miles, with a horizontal coverage of eight degrees on each side of the localizer course, measured from the origin of the glide slope beam. The glide slope must be established between 2.0 and 4.0 degrees and is typically established with a glide path angle of 3.00 degrees.

Additionally, all runways at ORF utilize Global Positioning System (GPS) based technology to enable vertically-guided instrument approach procedures with approach capabilities similar to ILS approaches without the need for the traditional ground-based ILS NAVAID components.

Approach Lighting Systems (ALS)

The third component of an ILS, in addition to the localizer and glideslope, is the approach lighting system (ALS). The ALS provides a lighted approach path along the extended centerline of the runway. Runway alignment indicator lights flash in sequence as a series of white lights moving toward the runway threshold, which emphasize runway centerline alignment. Roll indication is emphasized by a single row of white lights located on either side of, and symmetrically, along the column of approach lights.

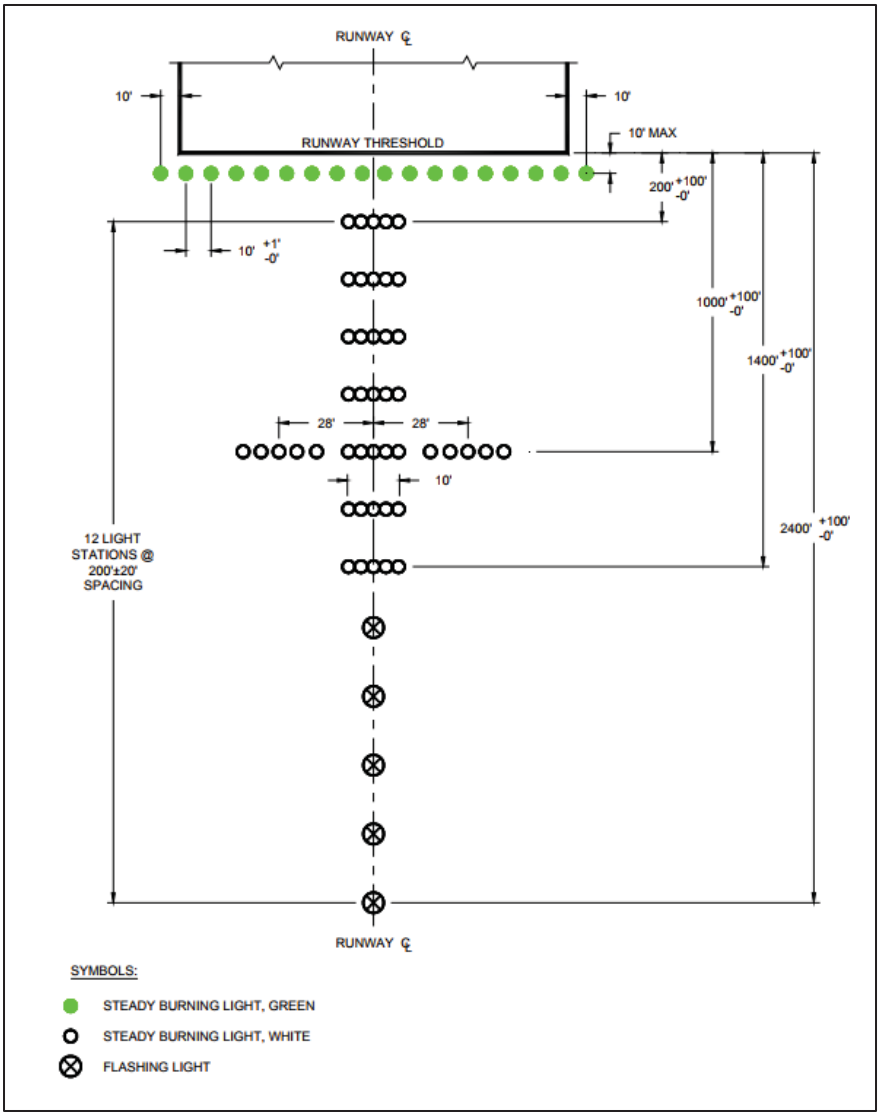
Typically, airports with non-precision approaches utilize Medium Intensity Approach Lighting Systems (MALS), along with Runway Alignment Indicator Lights (RAILS). Together, these systems form the Medium Intensity Approach Lighting Systems with Runway Alignment Indicator Lights (MALSR) that are utilized for precision runways, such as Runway 5 and Runway 23 at ORF.

According to FAA Order 6850.2B, *Visual Guidance Lighting Systems*, the MALSR consists of a threshold light bar and seven five-light bars located on the extended runway centerline, the first bar being located 200 feet from the runway threshold, with the remaining bars each at 200-foot intervals out to 1,400 feet from the threshold. One additional five-light bar is located on each side of the centerline bar, 1,000 feet from the runway threshold, to form a 66-foot-long crossbar known as a roll bar. The individual lights in all bars are approximately 2½ feet apart and are aimed into the approach to the runway, away from the runway threshold. All lights in the MALSR system are steady burning white, except for the threshold lights, which have green filters. The threshold lights are a row of lights on 10-foot centers located coincident with and within the runway edge lights near the threshold and extend across the runway threshold.

At ORF, the runway centerline lights within the displaced area of Runway 5 are non-compliant with two conditions set-forth in AC 150/5340-30H, *Design and Installation Details for Airport Visual Aids* According to regulations and standards set forth in paragraph 3.3 (a), for threshold displacements over 700 feet, the centerline lights in the displaced area are to be circuited separately from the centerline lights in the non-displaced runway area and the MALSR lights are to interlock with the runway centerline on the displaced area to ensure that when the approach lights are "on," the displaced area centerline lights are "off," and vice versa. In 2010, as a result of Runway 5 being non-compliant with both the previously mentioned standards, the Norfolk Airport Authority submitted a request to the FAA Washington Airports District Office (WAS-ADO) to re-approve and extend the time of the Modification of Standards (MOS) to continue the use of the existing configuration of the runway centerline lights within the displaced area of Runway 5 at ORF. The FAA approved the MOS under the condition that the non-standard conditions will be eliminated when the existing MALSR is replaced with a High Intensity ALS with Sequenced Flashers (ALSF-II) system.

RAIL's consist of five sequenced flashers located on the extended runway center line, the first being located 200 feet beyond the approach end of the MALS with successive units at each 200-foot interval, out to 2,400 feet from the runway threshold. All lights are aimed into the approach to the runway, away from the runway threshold, and flash in sequence toward the threshold at the rate of twice per second. A diagram for the commonly used MALSR configuration is depicted in **Figure 2-8**.

Figure 2-8 – MALSR Configuration



Source: FAA Order 6850.2B, *Visual Guidance Lighting Systems*.

2.2.4 Standard Instrument Departures (SIDs)

Standard Instrument Departure (SID) routes, also known as departure procedures, are published flight procedures followed by aircraft on an IFR flight plan immediately after takeoff from an airport. They provide an easy to understand departure procedure that airports use to balance terrain and obstacle avoidance, noise abatement (if necessary), and other airspace management considerations. SIDs are always printed graphically, rather than textually.

ORF has one SID procedure for departing IFR aircraft. The SID, identified as *KISRR THREE*, instructs aircraft to maintain runway heading after departure and expect ATC to advise the radar vectors to the assigned departure. FAA Joint Order (JO) 7400.2L, *Procedures for Handling Airspace Matters*, identifies specific turns off each runway end to avoid residential areas. Pilots should reference any Special Take-Off Minimums/Departure Procedures that may apply.

2.2.5 Airfield Lighting

In addition to the visual aids previously described, lighting on the airfield includes the rotating beacon, Precision Approach Path Indicator (PAPI) lights, runway threshold lighting, runway edge lighting, Runway End Identifier Lights (REILs), runway centerline lights, Runway Touchdown Zone Lights (TDZLs), taxiway edge lighting and apron lighting. Each of the lighting systems/types are described below:

Rotating Beacon:

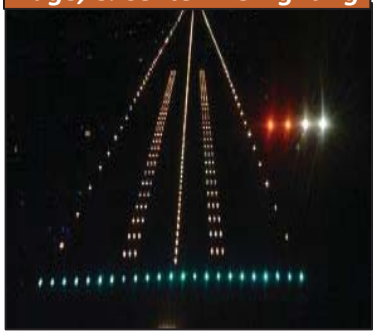
The rotating beacon functions as the universal indicator for locating an airport at night. For a civilian airport, it has one clear and one green lens, 180 degrees apart, and is generally visible 10 miles from the airport. According to the Aeronautical Information Manual, October 2017, at Class C airports, the operation of the airport beacon during the hours of daylight often indicates that the ground visibility is less than three miles, and/or the ceiling is less than 1,000 feet. The rotating beacon at ORF is located south of the airfield and on the south side of Miller Store Road, near the GA facilities and the Airfield Maintenance facilities.

ORF's Rotating Beacon

Precision Approach Path Indicator (PAPI) Lights:

A PAPI is a system of lights located near a runway end. It provides pilots with visual glide slope guidance information during an approach to the runway. PAPIs typically have an effective visual range of at least three miles during the day and up to 20 miles at night and inform pilots if they are high, low or on the correct approach descent path for the threshold. Runways 5 and 23 are equipped with PAPI-4 (four-light unit) systems, while Runways 14 and 32 are equipped with PAPI-2 (two-light unit) systems.

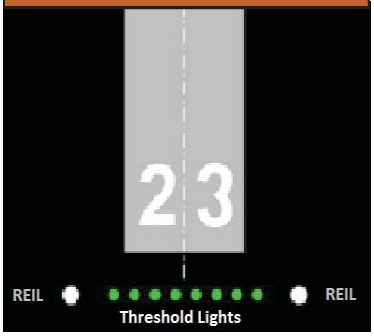
PAPIs; Runway Threshold, Edge, & Centerline Lighting



Runway Threshold Lighting:

Runway threshold lighting emits green light outward from the runway and red light toward the runway to mark the ends of the runway. The green lights indicate the landing threshold to arriving aircraft, whereas the red lights indicate the end of the runway for departing aircraft. The red and green lights are usually combined into a single fixture and special lenses or filters are used to emit the desired light in the appropriate direction. For displaced thresholds, the red lights and green lights are in separate fixtures. The fixtures containing the green lights are positioned at the displaced threshold, while the fixtures containing the red lighting are located in the area before the threshold. At ORF, Runways 23 and 32 have standard runway threshold lighting. Runway 5 has a 1,000-foot displaced threshold, and Runway 14 has a 575-foot displaced threshold; Therefore, they utilize the displaced threshold lighting system.

Threshold & REIL Lighting



Runway Edge Lighting:

Runway edge lighting is white in color and is used to outline the edges of a runway during periods of darkness or restricted visibility. The runway edge lights are positioned parallel to the runway centerline at least two feet from the edge of the full-strength pavement designated for runways not used by jet aircraft and 10 feet from the edge of the full-strength pavement designated for runways used by jet aircraft. The spacing of the light units must not exceed 200 feet. These systems are classified according to their intensity, or brightness: High-Intensity Runway Light (HIRL), Medium-Intensity Runway Light (MIRL), and Low-Intensity Runway Light (LIRL). Some airports utilize a pilot-controlled system where the light-intensity can be changed, or stepped up/down, by clicking a button located on the radio. Runway 5/23 is equipped with a HIRL system, while Runway 14/32 is equipped with a MIRL system.

Runway End Identifier Lights (REILs):

The primary function of the REIL is to provide rapid and positive identification of the end of the runway. The REIL system consists of two synchronized, unidirectional flashing white lights that are positioned on each corner of the runway landing threshold, facing the approach area and aimed at an angle of 10 to 15 degrees. Runway 14/32 is equipped with REILs.

Runway Centerline Lights:

Runway centerline lights are required for Category (CAT) II and III precision approach runways, as well as CAT I approaches, where the Runway Visual Range (RVR) is less than 2,400 feet. The lighting system consists of embedded lights located along the centerline at 50-foot, equally spaced, longitudinal intervals. The lights are white in color, except for the last 3,000 feet. From 3,000 feet to 1,000 feet, the centerline lights consist of alternating red and white lights, with the last 1,000 feet being all red. Runway 5/23 has runway centerline lights.

Runway Touchdown Zone Lights (TDZL):

The TDZLs indicate the touchdown zone when landing under adverse visibility conditions. They consist of two rows of transverse light bars disposed symmetrically about the runway centerline. The system consists of steady-burning white lights beginning 100 feet beyond the landing threshold and extend to 3,000 feet beyond the landing threshold or to the midpoint of the runway, whichever is less. All ORF runways have touchdown point markings, but only Runway 5 has TDZLs.

Taxiway Edge Lighting:

Taxiway lighting delineates the taxiway's edge and provides guidance to pilots during periods of low visibility and at night. The most commonly used type of taxiway lighting is a series of blue fixtures, which are sometimes supplemented by blue edge reflectors, set at 200-foot intervals along the taxiway edges, but not more than 10 feet outward from the edge of the full-strength pavement. All the Airport's taxiways are equipped with Medium-Intensity Taxiway Lighting (MITL) systems.

Taxiway Edge Light

Apron Lighting:

Apron floodlight systems illuminate the Terminal Apron, the General Aviation Apron, and the Air Cargo Apron.

2.3 TERMINAL FACILITY

An assessment of the ORF terminal was completed based on site visits and tenant interviews, as well as analysis of historical airport data and reviews of previous studies. The intention of this effort is to develop a general understanding of the existing terminal facility.

Documents Reviewed:

- GA Aircraft Requirements, 2006
- Airline Operational Surveys, January/March 2008
- Norfolk International Airport Master Plan Update, October 2008
- Norfolk International Airport Supplemental Technical Analyses, December 2008
- Norfolk International Airport Executive Summary, December 2008
- Modification of Standards: MALSRs, September 2010
- ORF Revised Airfield Plan, December 2010
- ORF Existing ALP, October 2011
- Norfolk International Airport Parking Space Inventory, July 2016
- Air Carrier Schedules, 2017

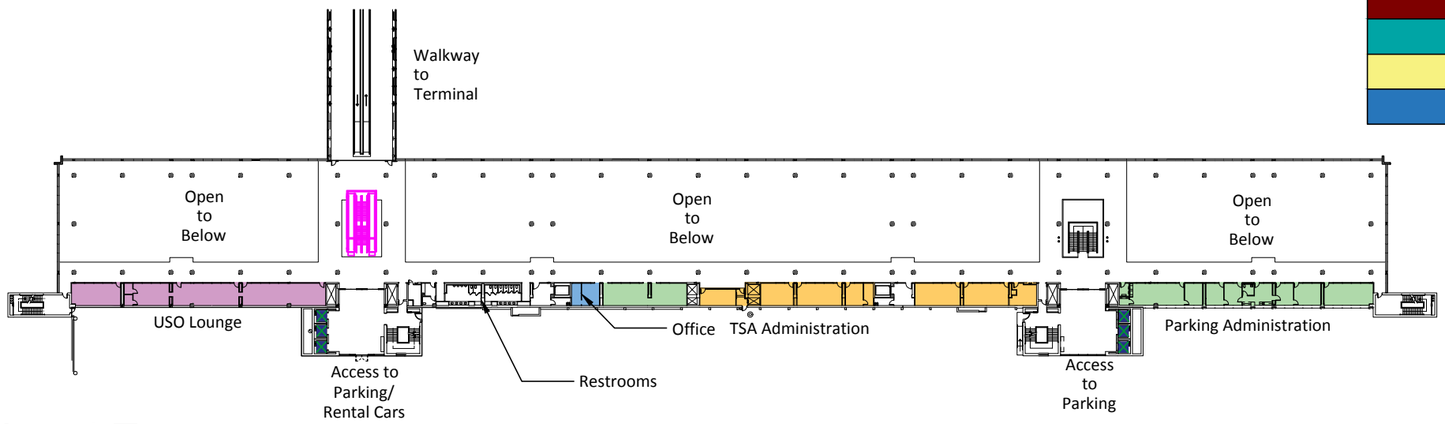
Tenants Interviewed:

- Norfolk Airport Authority (NAA)
- Allegiant Air
- American Airlines
- Delta Air Lines
- Southwest Airlines
- United Airlines
- Transportation Security Administration (TSA)
- Customs and Border Protection (CBP)
- HMS Host
- Hudson Group
- Avis/Budget Car Rental
- Enterprise/Alamo/National Car Rental
- Hertz/Dollar/Thrifty Car Rental

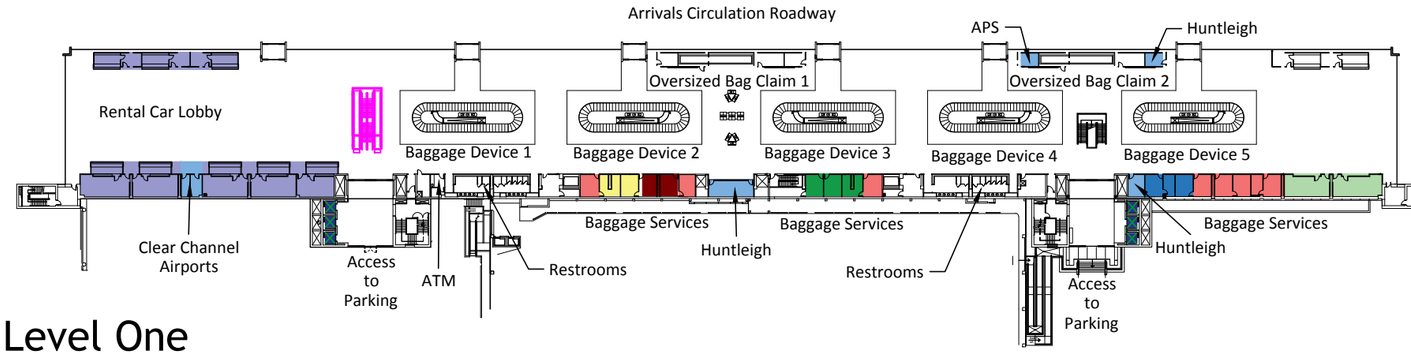
2.3.1 Terminal Facility Layout

The terminal facility at ORF is separated into an Arrivals Terminal and Main Passenger Terminal. The Arrivals Terminal is primarily utilized by passengers concluding their flight at ORF and contains baggage claim services, as well as rental car and transportation network companies. The Main Passenger Terminal serves as the primary terminal for passenger processing, passenger security screening, and passenger enplaning and deplaning. The terminal is based on a pier layout. **Figure 2-9** depicts the layout for the Arrivals Terminal, while **Figure 2-10**, **Figure 2-11**, and **Figure 2-12** depict the layout for the three levels of the Main Passenger Terminal Building.

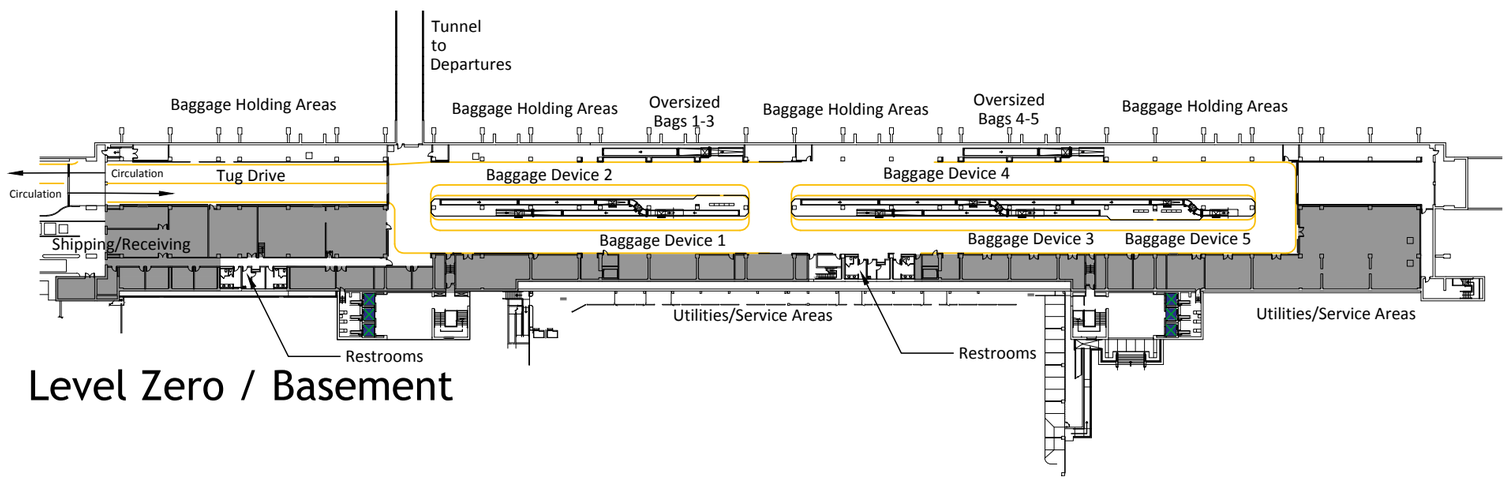
	American Airlines
	Delta Air Lines
	Allegiant Air
	Southwest Airlines
	United Airlines



Level Two



Level One



Level Zero / Basement

NORFOLK INTERNATIONAL AIRPORT

MASTER PLAN UPDATE

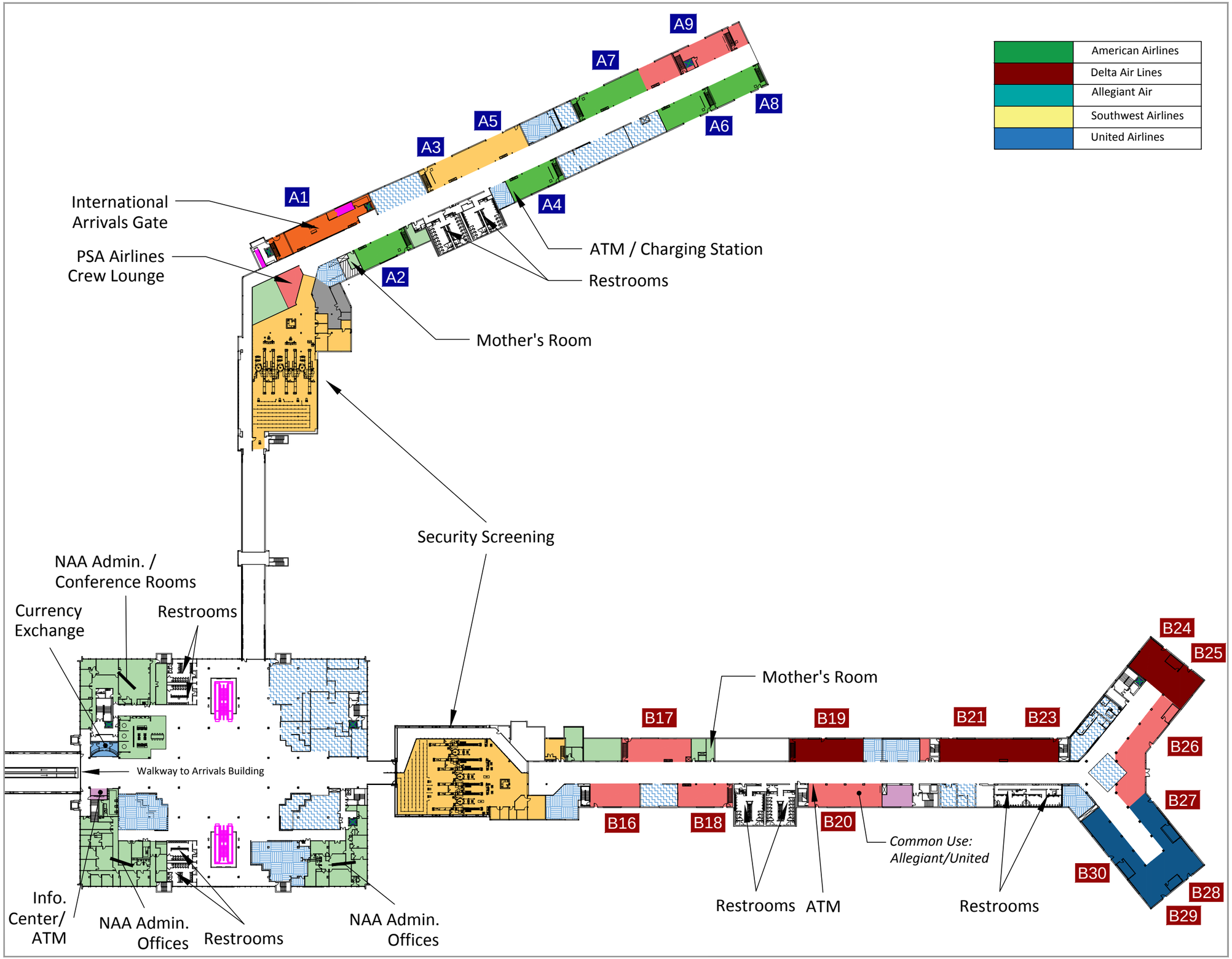
GRAPHIC SCALE (FEET)

0 50 100

LEGEND

- Common Use Airline
- Concessions/Other Tenants
- Rental Car
- Norfolk Airport Authority
- Utilities/Storage
- Security/Regulatory
- Other Airport Services
- Circulation
- Elevator
- Escalator

Figure 2-9
Arrivals Terminal



NORFOLK INTERNATIONAL AIRPORT

MASTER PLAN UPDATE

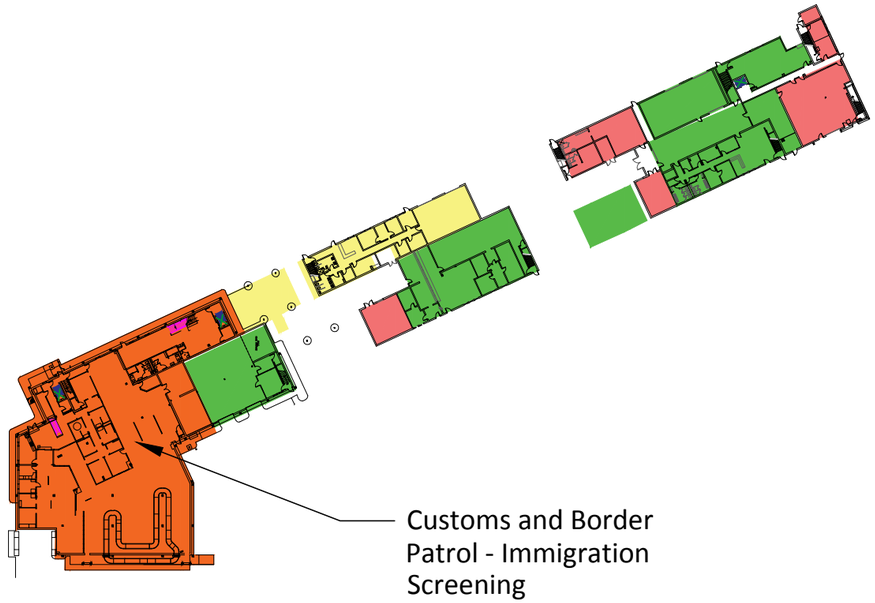
GRAPHIC SCALE (FEET)

0 50 100

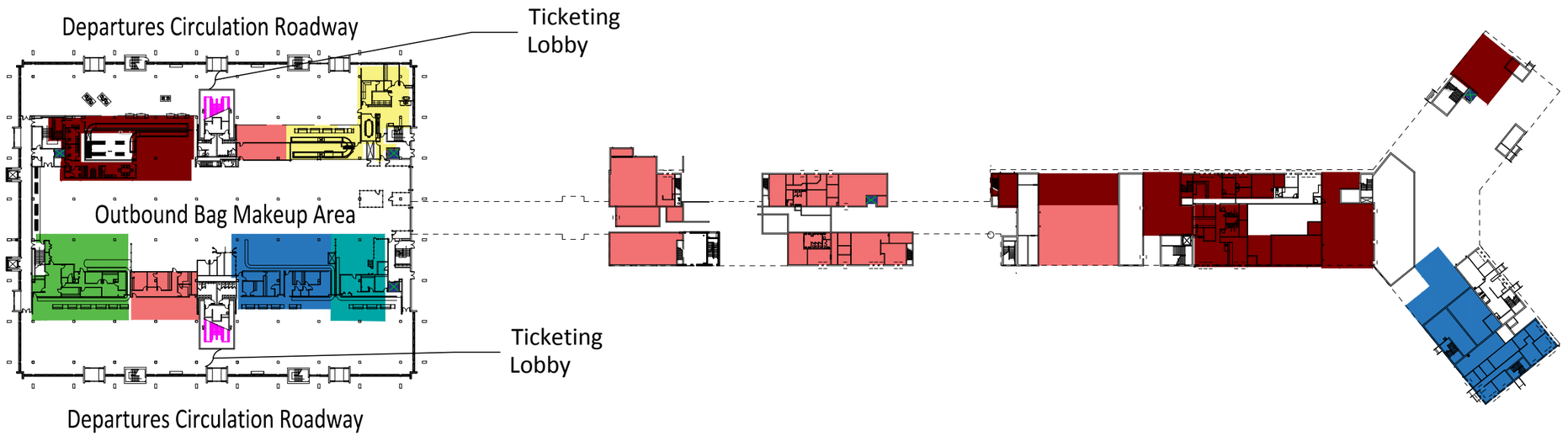
LEGEND

- Common Use Airline
- HMS Host Concessions (Dining)
- Hudson Group Concessions (Retail)
- Norfolk Airport Authority
- Utilities
- Transportation Security Administration
- Customs and Border Patrol
- Other Airport Services
- Circulation
- X1 Passenger Gate
- Elevator
- Escalator

Figure 2-10
Departure Building - Level Two



	American Airlines
	Delta Air Lines
	Allegiant Air
	Southwest Airlines
	United Airlines



NORFOLK INTERNATIONAL AIRPORT

MASTER PLAN UPDATE

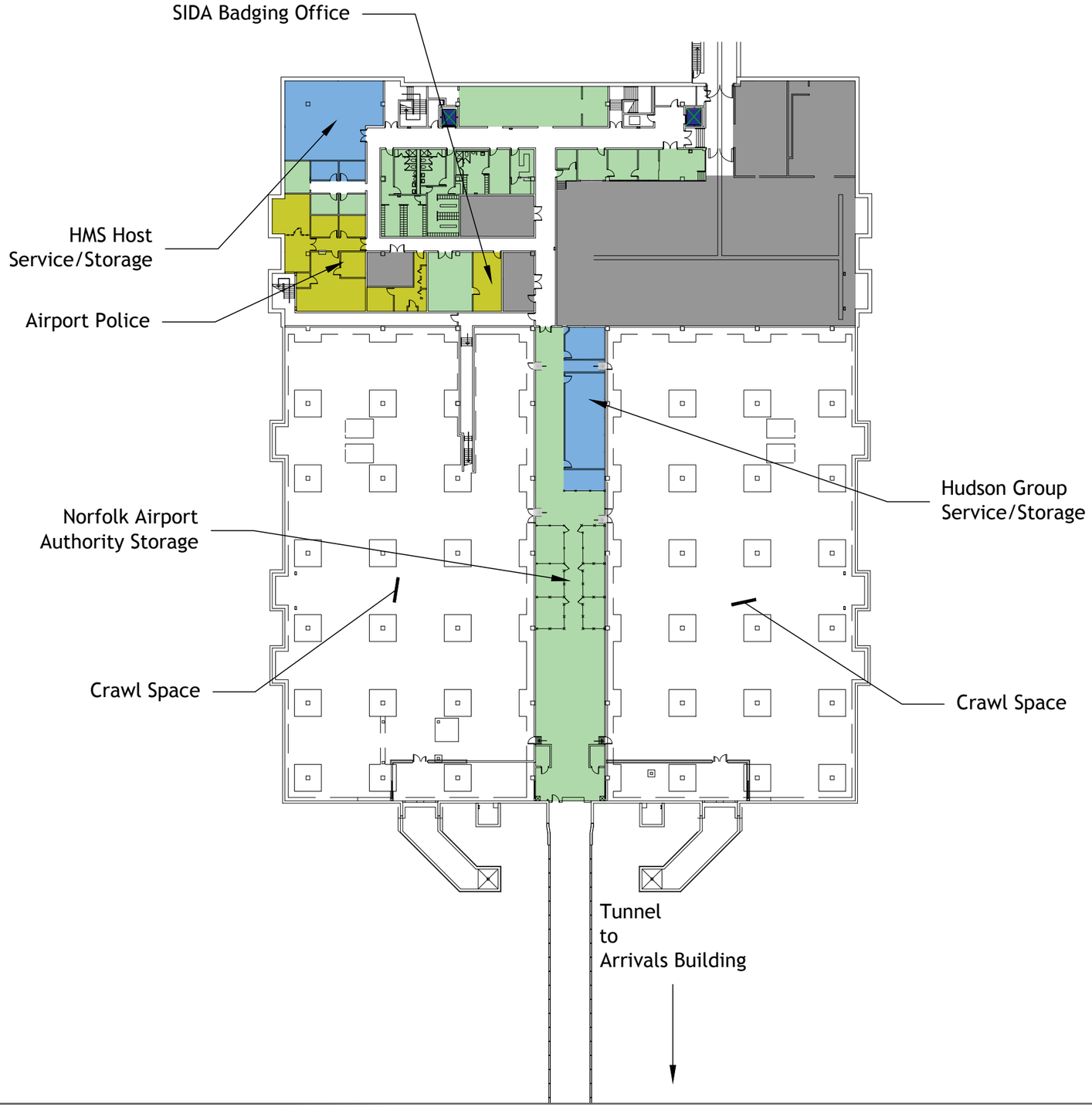
GRAPHIC SCALE (FEET)

0 50 100

LEGEND

- Common Use Airline
- Concessions
- Norfolk Airport Authority
- Utilities
- Customs and Border Patrol
- Circulation
- Elevator
- Escelator

Figure 2-11
Departure Building - Level One



NORFOLK INTERNATIONAL AIRPORT

MASTER PLAN UPDATE

GRAPHIC SCALE (FEET)

0 25 50

LEGEND

- Concessions
- Norfolk Airport Authority
- Utilities
- Airport Police
- Circulation
- Elevator

Figure 2-12
Main Passenger Terminal -
Lower Level / Basement

2.3.2 Main Passenger Terminal Building and Arrivals Building Functional Areas

The Airport terminal is comprised of several areas, each accommodating multiple stakeholder functions including law enforcement, airline services, administrative services, concessions, ground transportation services, CBP offices and processing areas, and TSA security screening and administrative offices. **Table 2-10**, **Table 2-11**, and **Table 2-12** provide an inventory of the terminal facility, listed by location, primary function, and area.

Table 2-10 – Main Passenger Terminal Building Functional Areas

Location and Use	Element Length (LF)	Area (SF)
Main Passenger Terminal: Lower Level		
Airport Police Department		2,160
Storage Space		12,075
TOTAL LOWER LEVEL		**14,235**
Main Passenger Terminal: First Level		
Airline Ticketing Functions		
Airline Ticket Counters – LF & SF	238	3,230
Airline Ticket Offices		7,170
Departures Curbside (East and West)	600	
Outbound Airline Baggage Makeup	-	7,578
Airline Operation Space		
Concourse A		15,685
Concourse B		21,575
TOTAL FIRST LEVEL	**838**	**55,238**
Main Passenger Terminal: Second Level (Non-Sterile Area)		
ATRIUM SERVICES		
Airport Administration		14,240
Conference Center		2,164
ATM/Foreign Currency Exchange/Mailbox Area		690
Business Center		2,165
CONCESSION SPACE		
Burger King		2,435
Discover Hampton Roads		1,980
The Local at ORF		8,457
Starbucks		1,048
Tech on the Go/Hudson News		2,430
TOTAL SECOND LEVEL (NON-STERILE)		**35,627**

Table 2-11 – Main Passenger Terminal Building Functional Areas (Continued)

Location and Use	Element Length (LF)	Area (SF)
Main Passenger Terminal: Second Level (Passenger Security Screening & Sterile Area)		
PASSENGER SECURITY SCREENING		
TSA Screening for Concourse A		10,752
TSA Screening for Concourse B		10,720
TSA Office Space		1,750
AIRLINE GATES/HOLDROOMS		
Concourse A		13,375
Concourse B		22,270
CONCESSION SPACE		
$10 Boutique (Concourse B)		515
Back Bay Bistro (Concourse B)		2,475
Great American Bagel (Concourse A)		450
Here's to the Heroes (Concourse A)		1,415
Hudson News (Concourse A)		925
Hudson News (Concourse B-Location 1)		800
Hudson News (Concourse B-Location 2)		920
James River Grill (Concourse A)		1,880
MKT at ORF (Concourse B)		850
Starbucks (Concourse A)		940
Starbucks (Concourse B)		950
Tech on the Go (Concourse A)		455
Unoccupied (Concourse A)		130
Mother's Rooms		363
TOTAL SECOND LEVEL (STERILE)		**72,655**
TOTAL MAIN PASSENGER TERMINAL FUNCTIONAL SPACE	**820**	**142,128**

Table 2-12 – Arrivals Terminal Building Functional Areas

Location and Use	Element Length (LF)	Area (SF)
Arrivals Terminal: First Level		
AIRLINE BAGGAGE CLAIM		
Baggage Claim		19,385
Arrivals Curbside	730	40,356
GROUND TRANSPORTATION CENTER		
Rental Car Counter Services		5,943
Rental Car Counters – Linear Footage	163	
Transportation Services		292
TOTAL FIRST LEVEL	**893**	**65,976**
Arrivals Terminal: Second Level		
ADMINISTRATIVE OFFICES		
Airport Parking Office		2,506
TSA Administration		2,828
MILITARY		
USO Welcome Center		2,000
TOTAL SECOND LEVEL		**7,334**
TOTAL ARRIVALS TERMINAL FUNCTIONAL SPACE		**73,310**
Unsure of Location or has Multiple Locations		
Concession Storage		2,217
Public Restrooms		11,600
Escalators		1,280
TOTAL		**15,097**
TOTAL AIRPORT FUNCTIONAL SPACE (MAIN PASSENGER TERMINAL, ARRIVALS, & OTHER)	**1,731**	**230,535**

Source (Tables 2-8, 2-9, & 2-10): NAA, 2017.

2.3.3 Airline Ticketing Lobby

The ticketing lobby is located on the first level of the Main Passenger Terminal and serves as the primary space for departing passengers to check-in for flights, obtain boarding passes, and drop-off baggage to be checked and screened prior to enplaning. The ticketing lobby can be accessed by various means. When parking in the Airport's parking garage, passengers will make their way from the Arrivals Terminal to the Main Passenger Terminal via a pedestrian bridge, which disperses into the atrium on the second level of the Main Passenger Terminal. Passengers can then take an elevator, escalator, or stairs down to the ticketing lobby. The most direct method of accessing the ticketing lobby is via one of the eight enclosed passageways between the outer door and inner door, also known as vestibules. The vestibule configuration for the Main Passenger Terminal is as follows: three to the south, two to the west, and three to the north. The ticketing lobby has a square/rectangular shape.

Within the first floor of the Main Passenger Terminal, there are two separate ticketing lobbies on the north and south sides, with a combined five commercial air carrier ticket counters in service. In the west side lobby, Delta operates from three counters, each measuring approximately 18 feet. Southwest operates from the opposite side of the lobby from one counter measuring approximately 46 feet in length. At the south side lobby, American operates from one counter measuring approximately 60 feet. Allegiant and United are co-located at the opposite side, with Allegiant operating from one ticket counter measuring approximately 36 feet, and United operating from two counters, measuring approximately nine feet and 33 feet. Located between the north and south ticket lobbies is the outbound baggage makeup area, a common space shared by the carriers.

Airlines also provide passengers with access to self-serve, automated kiosks. The kiosks provide passengers with capabilities and amenities including checking-in for flights and printing boarding passes, as well as making alterations to seat assignments. With the exception of two kiosks, passengers are also able to check baggage and print checked baggage tags.

2.3.4 Checked Baggage Screening

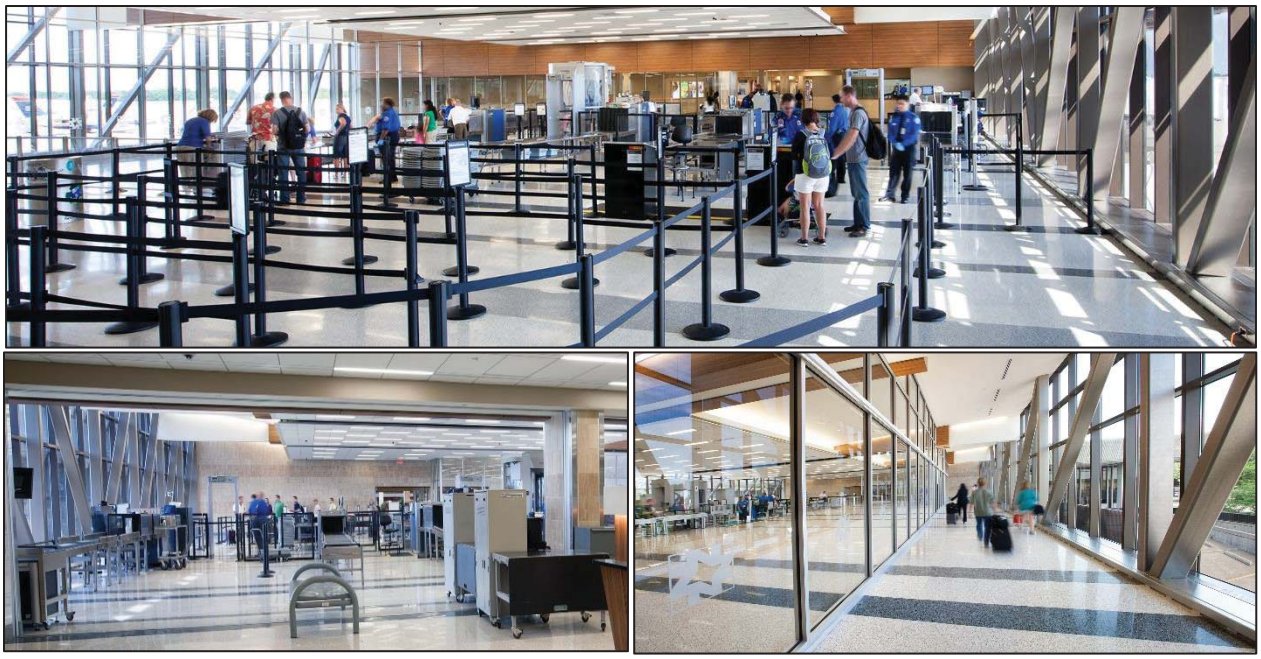
To meet federal mandates, all checked baggage must go through the sort-controlled Checked Baggage Inspection System (CBIS). Bags are screened by one of the seven CT-80 Explosive Detection System (EDS) machines, operated by TSA personnel. The bag scan machines for Allegiant, American, Southwest, and United are positioned in front of the airline ticket counters, between the queue space. To maximize the use of the queuing area, TSA and the airlines are in the process of relocating the baggage screening machines from the ticketing lobby floor to a secure area behind the ticket counters, in line with the baggage conveyor belt system. To date, only the baggage screening device for Delta has been relocated. In addition, the Authority is working with United, Allegiant, and TSA to procure a second EDS machine for joint use on the east side of the ticketing lobby. Currently, there is one EDS machine for both carriers. The baggage transfer process will be further explained in **Section 2.3.8**.

2.3.5 Passenger Security Screening

ORF has two separate TSA passenger screening checkpoints: one for Concourse A and one for Concourse B. Prior to accessing either concourse, all enplaning passengers must pass through the TSA security screening checkpoint (SSCP) that corresponds to the concourse where their departing gates are located. The checkpoint for Concourse A has three pre-screening stands and Concourse B has two pre-screening stands located outside the checkpoints, where passengers have their travel documents verified prior to proceeding through the SSCP. TSA pre-check passengers and employees/crews have separate lanes at both checkpoints that are commonly accommodated by the active stand during non-peak hours. During peak hours, pre-check and employee lanes are accommodated via separate lanes and stands.

The checkpoint for Concourse A consists of four passenger screening lanes (with room for an additional fifth lane when capacity warrants expansion) containing two passenger walk-through metal detectors, and one Millimeter Wave Advanced Imaging Technology (AIT) scanner. Concourse B checkpoint consists of four passenger screening lanes (with room for up to six lane) containing a total of two passenger walk-through x-ray machines and one AIT scanner. Separate Advanced Technology (AT) X-ray systems, utilized to detect threats in carry-on baggage by providing a high-definition x-ray image, are also located at each checkpoint, four at the checkpoint for Concourse A and four for the checkpoint at Concourse B. Once on the sterile side, passengers circulate to their respective gate areas. Passengers are unable to access the alternate concourse without being reprocessed through the SSCP at the respective concourse. Arriving passengers exit the concourse via exit hallways, located adjacent to each of the SSCPs. After exiting, arriving passengers will disperse in the Main Passenger Terminal. Meeter/greeter seating is located throughout the lobby area.

The Authority has space available, and a plan in place to expand each other the security checkpoints in both concourses when capacity throughput warrants opening more security lanes to maintain a high level of service at the Airport. These expansion plans will be reflected in the Demand Capacity and Alternatives analysis of this Master Plan Update.



Source: NAA, 2017.

2.3.6 Airline Gates and Holdrooms

ORF currently has 23 air carrier gates, with an additional gate dedicated to Federal Inspection Services (FIS). The existing Gates are dispersed throughout concourse A and B, with Gates 1 through 9 (future) on Concourse A and Gates 16 through 30 on Concourse B. As currently constructed, there are Gates 7, 9, and 11 on the end of Concourse A. The Airport has identified a potential extension to Concourse A that will consolidate Gates 7 and 9 into larger holdrooms, to accommodate larger airframes, while eliminating Gate 11. American and Southwest operate from Concourse A, while Allegiant, Delta, and United operate from Concourse B.

A fully-functioning FIS facility is located at Gate A1. It is used for international flights and charters but can be used as a swing-gate, or a multi-function gate, when needed. Multi-function gates, are gates within the terminal concourse that can be used for multiple purposes. As international flights arrive, these gates allow temporary barriers to separate international passengers that have not been pre-cleared and provides access to CBP booths via separate corridors. The FIS can process up to 175 passengers per hour (PPH).

All active gates are located on the second level of the of each concourse and are equipped with passenger boarding bridges, except for Gates A9, B17, and B18. When occupied, these gates would utilize ground-level boarding via stairs accessible from the Concourse. The active gates are also equipped with a conveyance system to carry gate-checked baggage from the gate area to the ramp level. Gates A9, B16, B17, B18, and B26 are currently unoccupied.

Table 2-13 presents the current air carrier gate assignments based on existing lease agreements.

Table 2-13 – Air Carrier Gate Assignments

Concourse A Holdroom/Gate	Airline	Boarding Bridge Owner	Concourse B Holdroom/Gate	Airline	Boarding Bridge Owner
Gate A1	CBP: FIS Facility	NAA	Gate B16	Unoccupied	NAA
Gate A2	American	American	Gate B17	Unoccupied	-
Gate A3	Southwest	NAA	Gate B18	Unoccupied	-
Gate A4	American	American	Gate B19	Delta	NAA
Gate A5	Southwest	NAA	Gate B20	Common Use*	NAA
Gate A6	American	American	Gate B21	Delta	Delta
Gate A7	American	NAA	Gate B23	Delta	Delta
Gate A8	American	American	Gate B24	Delta	NAA
Gate A9	Unoccupied	-	Gate B25	Delta	NAA
			Gate B26	Unoccupied	NAA
			Gate B27	United	NAA
			Gate B28	United	NAA
			Gate B29	United	NAA
			Gate B30	United	NAA

Source: NAA, 2017.

** - Gate currently occupied by Allegiant Air and United Airlines*

2.3.7 Terminal Concessions and Amenities

Concessions throughout the terminal facility provide a varied selection of goods and services for passengers, employees, and meeters/greeters. Concessionaires include food and beverage services, magazine, book, and gift shops.

Hudson Group currently operates retail concessions throughout the Airport. A gift shop, as well as a separate, co-located retail and news shop, are located prior to screening in the atrium at the center of the Main Passenger Terminal. Two news shops and one gift shop are located in Concourse B. Concourse A currently has one news store and two retail stores. In the future, Hudson Group would like to open a larger store on Concourse A. They do not see a need for additional pre-security sales space. Normal operating hours for Hudson Group retail services are 3:30AM to 8:30PM, local time, with the busiest times typically being 2:00PM to 4:00PM on Concourse A and 3:00PM to 5:00PM on Concourse B.

HMS Host currently operates food and beverage concessions at the Airport. Three food and beverage concessions are located prior to screening in the main lobby of the Main Passenger Terminal. Four additional food and beverage concessions operate out of Concourse A, as well as three additional on Concourse B. In the future, HMS Host would like to operate a second full-service restaurant on Concourse B. The kitchen facilities are currently inadequate, per HMS designs. HMS Host's dining services on Concourses A and B are typically busiest around 11:00am, as well as 4:00pm to close, which is dependent on flight delays. **Table 2-14** depicts the current concessions and amenities within the airport terminal facility, including location.

Table 2-14 – Current Concessions

Concession/Amenity	Type	Operator	Location
Main Passenger Terminal/Atrium – Pre-Security			
Burger King	Food/Beverage	HMS Host	South Corner of Atrium
Discover Hampton Roads	Gift	Hudson Group	West Corner of Atrium
The Local at ORF	Full-Service Food & Beverage	HMS Host	East Corner of Atrium
Starbucks (24-Hours)	Café	HMS Host	East Corner of Atrium
Tech on the Go/Hudson News	Retail/News	Hudson Group	South Corner of Atrium
Travelex	Foreign Currency Exchange	Travelex	North Side of Atrium
Concourse A			
Great American Bagel	Food/Beverage	HMS Host	Gate A7
Here's to the Heroes	Full-Service Food & Beverage	HMS Host	Gate A3
Hudson News	News	Hudson Group	Gate A5
James River Grill	Full Service Food & Beverage	HMS Host	Between Gates A4 & A6
Starbucks	Café	HMS Host	Between Gates A4 & A6
Sweet Indulgences	Candy Store	Hudson Group	Between SSCP & Gate A2
Tech on the Go	Retail	Hudson Group	Gate A4
Concourse B			
$10 Boutique	Gift	Hudson Group	Between Gates B19 & B21
Back Bay Bistro	Full-Service Food & Beverage	HMS Host	Gate B23
Hudson News - Location 1	News	Hudson Group	Between Gates B19 & B21
Hudson News - Location 2	News	Hudson Group	Across from Gate B27
MKT at ORF	Express Food & Beverage	HMS Host	Across from Gate B21
Starbucks	Café	HMS Host	Between Gates B16 & B18
FAO Sweets (Summer 2018)	Candy Store	Hudson Group	Near SSCP

Source: Hudson Group/HMS Host, 2017.

Additional Amenities

Additional amenities being developed within the concourses include designated Mother's Rooms and Service Animal Relief Areas. There is currently a Mother's Room in Concourse A, next to Gate A2, and in Concourse B, next to Gate B17. The NAA is currently in the process of developing a Business Center in the Main Passenger Terminal Atrium pre-security screening, in the northeastern quadrant. This will be located adjacent to the Authority's existing conference center. NAA also operates an Information Center, previously located in the Baggage Claim area, now located at the entry to the Level 2 Atrium, from the Arrivals Building. Travelex operates a Currency Exchange directly across from the Information Center, and there is an ATM located in the Baggage Claim, Atrium, Concourse A, and Concourse B. The USO Lounge is located on the upper level of the Arrivals Building.

Concession Storage and Support Areas

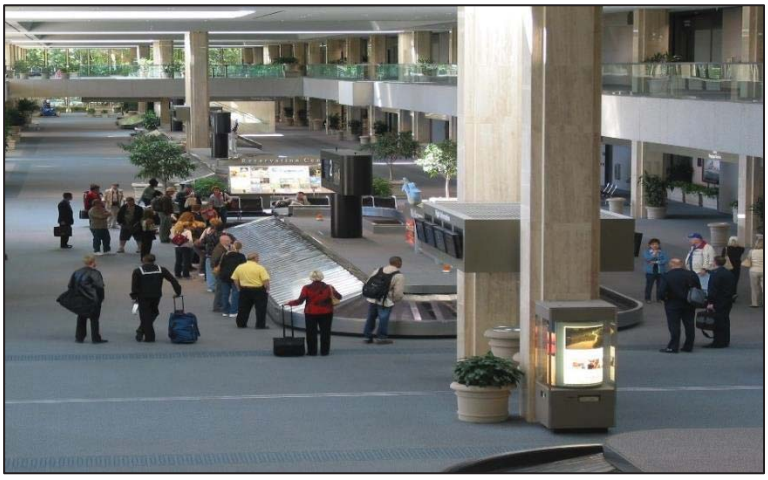
Each concessionaire has its own storage area, which is not accessible or in view of the public. Prior to being transported from the storage area, located in a non-SIDA location, to the stores on the Concourses, TSA requires that all merchandise, boxes, bags, and containers be scanned at the security checkpoint to ensure that ORF's safety and security is not being compromised. Since each concessionary item must be individually scanned by TSA, concessionaires are limited to screening only during non-peak hours. After being cleared, the items are permitted to be taken to the Concourses.

Hudson Group currently has a storage area pre-security behind Discover Hampton Roads in the basement of the Departures Terminal, as well as a storage area post-security, which have both reached capacity.

HMS Host's current food and beverage storage, located pre-security in a central storage area in the basement of the Airport, has reached capacity. When transporting goods to and from the storage area, employees must utilize a freight elevator.

2.3.8 Baggage Claim

The baggage claim area is located on the first floor of the Arrivals Terminal and serves as the location for deplaning passengers to retrieve their checked baggage. Arriving passengers can access baggage claim by passing through the Main Passenger Terminal lobby, located on the second level, and proceeding across the pedestrian bridge that connects to the Arrivals Terminal. Seating for meeters/greeters is available throughout the baggage claim area. Currently, there are five baggage claim carrousels and two oversized baggage claim areas. The five carrousels are identified numerically from one to five, staring at the north end of baggage claim. The baggage claim units are centered in the Arrivals Terminal, each measuring approximately 20 feet by 73 feet. The oversized baggage claims, each approximately 1,550 square feet, are located against the wall on the east side of the Arrivals Terminal. International arrivals utilize a separate baggage claim area housed within the FIS facility, and is controlled by CBP (see **Section 2.3.13**).



Baggage Makeup Areas

Each airline operating at ORF has its own baggage makeup space, located behind the ticketing lobby. The space includes a conveyer system that collects passengers' checked luggage from the ticketing counter, runs back parallel to the airline office and support facilities, and discharges into baggage make-up area beneath the Main Terminal Building. Delta Air Lines has an enclosed baggage make-up room to process outbound baggage prior to loading luggage on the bag carts to transport to the aircraft. The general baggage make-up area is comprised of two lanes, each one adjacent to the airline operating areas on the north and southsides of the building. Each baggage makeup room has access to the terminal aprons via ramps from the lower level of the Main Terminal building underneath Concourse B. As previously noted, baggage screening machines, currently located in the ticketing lobby queuing area, are in the process of being relocated to the baggage makeup area. Due to the size of the machines, the amount of usable space in Delta's baggage makeup room has been greatly reduced.

The other airlines advised that the current space in the baggage makeup rooms, without having the TSA baggage screening machine, is adequate but constrained during peak hours.

Inbound Baggage Systems

Inbound baggage, which has been loaded to baggage tugs from the aircraft, is transported from the Terminal Apron to the Arrivals Building via an underground tunnel on the northside of the Terminal Apron. Direct access to the tunnel is available from both sides of Concourse A, and the north side of Concourse B. Due to gate layout and movement restrictions at the end of Concourse B, airline and baggage operations on the south side of Concourse B must return to the baggage make-up ramp and cross under Concourse B to the north in order to access the baggage tunnel to the Arrivals Building.

Inbound baggage has access to the Arrivals building via a tug ramp on the north end of the building. There are five baggage devices with a circulation road that navigates around the central devices returning to the tug ramp with 2-way traffic. Once unloaded, baggage tugs are stored in the GSE areas for each airline, or under the Main Terminal Building in the baggage make-up area.

2.3.9 Rental Car Counters

Rental car counters are located along the east and west walls on the north end of the first level of the Arrivals Terminal. Currently, eight rental car companies operate at the Airport, each one having a separate reservation desk. Along the west wall, in order from south to north and measuring approximately 22 linear feet each, are the counters for Avis, Hertz, Enterprise, Budget, and Alamo. Along the east wall, in order from south to north and measuring approximately 17.5 linear feet each, are the counters for National, Dollar, and Thrifty.

2.3.10 Airport Administrative and Support Areas

Airport administration is located on the second level of the Departures Terminal, in three separate areas surrounding the atrium. This area includes administrative offices, a conference center, a break room, a future business center, and restroom facilities.

2.3.11 Airline Service and Support Areas

Beyond those operated by the Airport, airlines and tenants also lease dedicated space for service and support functions. During the summer 2018, PSA Airlines will operate a crew lounge in Concourse A, adjacent to the security screening area.

2.3.12 Back Office Space

Tenants at the Airport, such as airlines, concessionaires, and rental car providers, each utilize back office space within the terminal. Airline storage space is located in the secure area. However, the airlines have offices in both the secure and non-secure areas of the terminal. Rental car offices are in the non-secure area of the terminal and are sometimes shared depending on lease agreements. TSA Administration and Airport Parking office spaces are located on the second level of the Arrivals Terminal. Employees can only access office space for their respective employer.

2.3.13 Federal Inspection Services (FIS)

ORF has a fully-functioning FIS facility at Gate A1. Based on discussions with the Airport's CBP representative, there are approximately 20 full-time employees. However, the staffing levels are based on the capacity and demand for each international operation. The number of staff at a given time are based on demand of number of operations and passengers. The fully-equipped FIS meets the needs for the Airport's current demand and can handle up to 175 passengers per hour. The Airport does not currently have scheduled international service, however, on occasion, diversions do occur. In the event a flight is diverted to ORF, CBP will process the passengers and baggage. CBP also handles approximately three charter flights per year and can accommodate aircraft as large as a Boeing 747, with constraints. After being processed, passengers will gather luggage from a baggage claim area designated for international arrivals only.

The current FIS facility will need to be upgraded before being able to process scheduled international service.

2.3.14 Terminal Signage and Wayfinding

A main contributor to customer and passenger satisfaction is effective wayfinding. Signage and wayfinding in the airport terminal should be clear and intuitive. Efficient wayfinding systems can create a sense of comfort and security. Too much information can have the opposite effect and cause confusion and disorientation. It is important that the airport's signage and wayfinding system is simple and well organized. Airport wayfinding systems can include the following types of signage: directional signs, identification signs, informational signs, and regulatory signs. Signage and wayfinding regarding vehicular circulation and parking will be discussed later in this chapter.

When approaching the Airport, signage will increase to include information pertaining to the Arrivals Terminal and Main Passenger Terminal, as well as their relative functions. Outside the Main Passenger Terminal, signage designates the entryway closest to each airline ticket counter, in addition to signage for airlines providing curb-side check-in. Inside the Main Passenger Terminal, enplaning passengers can utilize signage to locate the airline ticketing counters, airport security, or the appropriate gate departure concourse. Signage also depicts directions and information for various concessions and amenities such as food and beverage providers, technology charging stations, ATM machines and a foreign currency exchange location (Western Union at Travelex), a mail drop-box, and the conference center. Deplaning passengers can utilize signage in the Main Passenger Terminal to locate the gate for a connecting flight or to exit the concourse for baggage claim or ground transportation located in the Arrivals Terminal.

Once in the Arrivals Terminal, passengers utilize Airport signage to locate the appropriate baggage claim device based on their flight information. The rental car agencies, as well as the shuttle and transportation network companies, have designated signage to aid passenger flow in the Arrivals Terminal. Signage for other amenities wayfinding and location information for the United Service Organizations (USO) Lounge, ATM machines, and the Airport Information desk.

Signage and wayfinding in the Arrivals Terminal also assists passengers and other customers needing to access the Main Passenger Terminal. Signage at ORF also includes regulatory signage depicting prohibited areas, secure areas, employee or airport authorized areas only, etc.

2.4 AUTOMOBILE ACCESS AND PARKING

This section of the report details the existing inventory of parking, both on- and off-Airport, as well as the existing traffic conditions at the departure and arrival levels of the Airport. The data presented was gathered from a variety of sources, including on-site observations by CHA, information provided by the Norfolk Airport Authority, and other public data sources.

The on-site observations were conducted on Tuesday, January 23, 2018 and Wednesday, January 24, 2018, days of the week identified by the NAA as typical busy weekdays at ORF.

2.4.1 Existing ORF Parking

The on-Airport parking facilities are owned and operated by the NAA and provide parking for a combination of public parkers, NAA and other airport employees, rental cars, and taxis. In addition, the NAA maintains an employee parking lot off-site at the corner of N. Military Highway and Robin Hood Road. A taxi queuing lot is located on Airport Road, adjacent to the Long-Term Lot.

The Airport parking functions consist of three parking garages and six surface parking lots (five on-site and the off-site Employee Lot). In total, ORF controls 8,582 parking spaces, of which 7,258 (85%) are for public parking, 636 (7%) are for rental cars and 688 (8%) are for Airport employee and NAA parking.

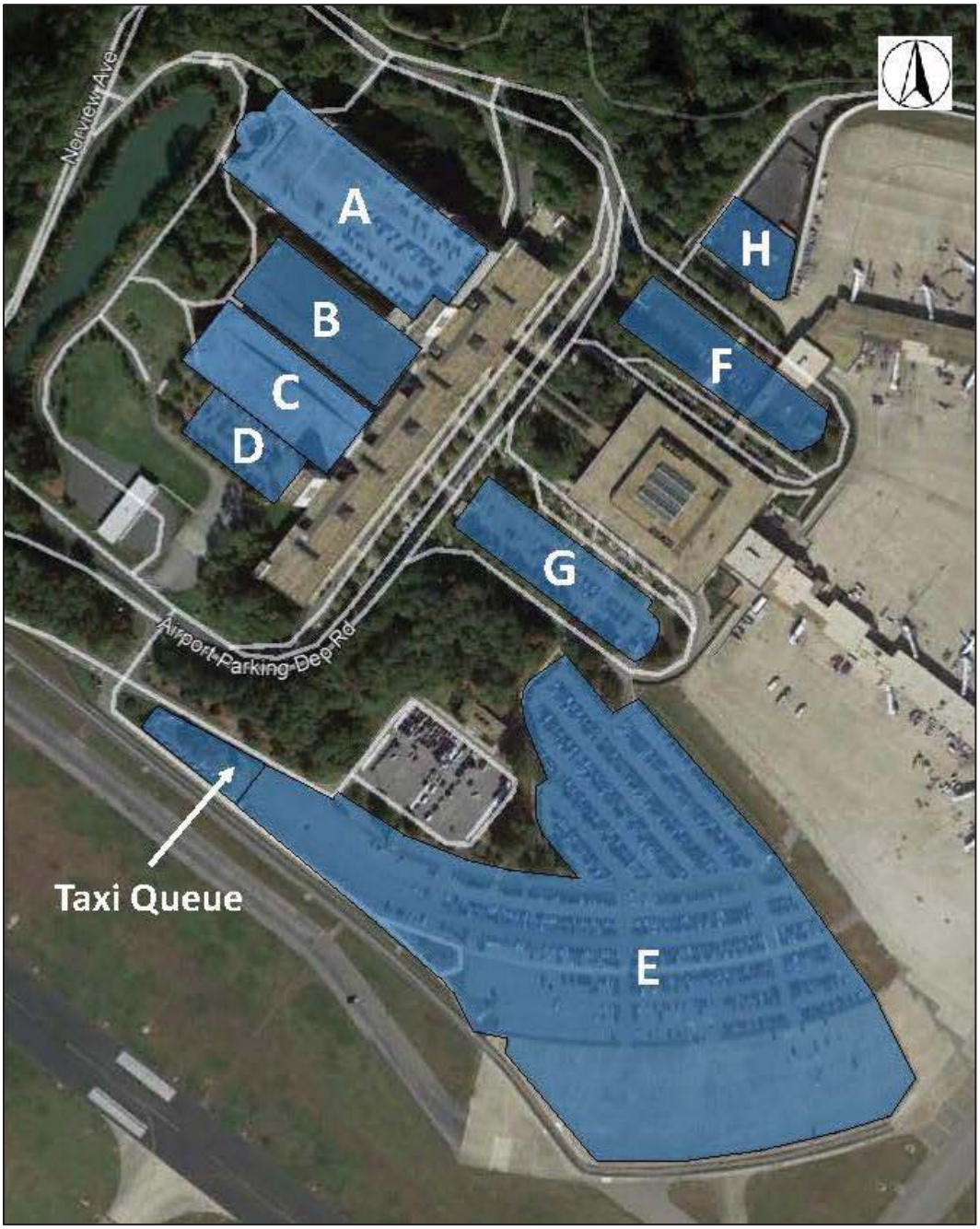
Table 2-15 presents a detailed breakdown of the existing ORF parking inventory by facility and type of user served. As shown in the "Facility ID" column in the table, each parking facility has been assigned a letter designation, which helps to identify the geographical locations of the on-Airport parking facilities in **Figure 2-13**, as well as the off-site Employee Lot in **Figure 2-14**.

Table 2-15 – Existing NAA Parking Facilities

Facility ID	Facility Name	Short-Term	Long-Term	Accessible Parking (ADA)	Employee	Reserved or Permit	Rental Car	TOTAL SPACES
A	Garage A	275	2,260	37	0	0	636	**3,208**
B	Garage B	0	1,090	21	0	2	0	**1,113**
C	Garage C	0	1,089	21	0	0	0	**1,110**
D	Surface Lot D	0	72	4	0	6	0	**82**
E	Long-Term Lot	0	1,999	42	0	11	0	**2,052**
F	Departures North	146	0	6	0	0	0	**152**
G	Departures South	171	0	6	0	0	0	**177**
H	Permit Lot	0	0	5	0	87	0	**92**
I	Employee Lot	0	0	12	580	4	0	**596**
TOTAL PARKING		**592**	**6,510**	**154**	**580**	**110**	**636**	**8,582**

Source: NAA, 2018.

Figure 2-13 – ORF On-Airport Parking Facilities



Source: DESMAN, 2018.

Figure 2-14 – Off-Site Employee Parking Lot

Source: DESMAN, 2018.

A few items of note related to the existing parking inventory:

- In Garage A, the rental car ready spaces are located on the ground level and rental car return is on the second level, which are physically separated from the short- and long-term spaces. The short-term spaces are also physically separated from the long-term spaces in this facility.
- While the Long-Term Lot is shown as one facility, it is possible to block off the southern portion of the Lot, while still allowing access to the rest of the facility.
- All three garages, including the Short-Term Garage, and Surface Lot D share a common exit plaza where customer payments are processed. Garage A also has a separate exit lane from the rental car level of the Garage which allows rental car customers to avoid exiting through the regular exit plaza.
- All of the public parking facilities typically have cashiers stationed at the exits to collect payments, in addition to automated payment machines located in a number of the exit lanes.

ORF does not offer shuttle buses to move public parkers from any of the previously mentioned parking facilities due to the walking distances being in close proximity to the terminal building. However, shuttle buses are provided to transport employees to and from the off-site Employee Lot.

2.4.2 Observed Utilization of Parking

The on-site observations of parking and traffic activity at ORF parking facilities on a Tuesday and Wednesday were intended to capture and understand typical levels of parking demand at the Airport. While the absolute peak activity period for most airports in the U.S. is around the Thanksgiving holiday, in terms of providing an adequate quantity of parking capacity, the objective is to try and accommodate the typical peak demand, not these periods of extraordinary demand. If airports constructed enough parking spaces to accommodate these occasional demand spikes, a large number of spaces would sit empty for all but a few days out of the year.

Table 2-16 presents a summary of the number of vehicles observed parking in each of the NAA's parking facilities on Tuesday, January 23, 2018 and Wednesday, January, 24, 2018, between 12PM and 2PM, Eastern Standard Time (EST). For comparison, further on-site observations will take place during the peak demands of summer and Thanksgiving.

Table 2-16 – Observed Utilization of ORF Parking Facilities

Facility ID	Facility Name	Inventory	Parked Vehicles January 23rd	Utilization %	Parked Vehicles January 24th	Utilization %
A	Garage A	3,208	2,652	83%	2,704	84%
B	Garage B	1,113	624	56%	669	60%
C	Garage C	1,110	235	21%	271	24%
D	Surface Lot D	82	64	78%	70	85%
E	Long-Term Lot	2,052	919	45%	691	34%
F	Departures North	152	46	30%	39	26%
G	Departures South	177	95	52%	96	54%
H	North Lot	92	60	65%	62	67%
I	Employee Lot	596	236	40%	258	43%
TOTALS		**8,582**	**4,931**	**57%**	**4,860**	**57%**
Public Parking Spaces		**7,258**	**3,999**	**55%**	**3,904**	**54%**
All Other Spaces		**1,324**	**932**	**70%**	**956**	**72%**

Source: NAA, 2018.

Ideally, during a typical peak demand period, 5%-15% of the spaces in a parking facility remain available to accommodate new parkers. Maintaining an inventory of available spaces, even during the peak demand period, makes it easier for parkers to find a space, reduces the amount of time drivers spend searching for empty spaces and generally results in a more positive parking experience. This concept, referred to as "practical capacity", refers to that point at which a parking facility or system has reached its functional limit and is unable to efficiently or safely accommodate additional parking demand.

As shown in the table, with an observed peak utilization of 3,999 spaces, ORF's public parking inventory is currently operating at approximately 55% of capacity. This data indicates that, at present, ORF has an ample supply of parking to accommodate it existing needs.

2.4.3 Current Parking Rates

Table 2-17 presents the current rates charged for public parking in each of the ORF facilities.

Table 2-17 – Existing ORF Public Parking Facility Rates

Facilities	Current Parking Rates
Garage A Short-Term Departures North Departures South	Free for the first 15 minutes; $1.00 per 30 minutes; $24.00 maximum per day
Garage A Long-Term Garage B Garage C Surface Lot D Long-Term Lot	Free for the first 15 minutes; $1.00 per 30 minutes; $9.00 maximum per day

Source: NAA, 2018.

2.4.4 Off-Airport Competing Parking

In addition to researching public data sources, CHA spent time in the field working to identify private property owners offering long-term off-Airport parking. However, companies do not appear to be offering off-airport competing parking locations in the vicinity of ORF.

2.4.5 Curb-Front Traffic

In order to determine the capacity of the airport curb front to accommodate future levels of vehicular activity, it is necessary to first understand the functionality of the curb front during current periods of peak demand. For this reason, observations of traffic flow and congestion were performed at the Airport on the same days as the observations of parking activity, Tuesday, January 23, 2018 and Wednesday, January 24, 2018.

On both days, over the course of day, CHA never observed any significant traffic issues of note. At no time did passenger pick-up or drop-off activity, whether by personal vehicle, hotel shuttle, rideshare vehicle, or other means, appear to significantly block traffic or create significant congestion on the roadways near the Airport terminal.

2.5 SUPPORT FACILITIES

Support facilities provide vital functions related to the overall operation of the Airport, and typically include facilities related to: airport fencing, airport equipment storage and maintenance, Air Traffic Control (ATC), Aircraft Rescue and Firefighting (ARFF), aircraft fueling, snow and ice control, air cargo, FBO/GA and Maintenance/Repair/Overhaul (MRO) services, and rental cars. **Figure 2-1** depicts the location of key facilities around the airfield.

The following tenants were interviewed in addition to those previously mentioned in **Section 2.3**:

- Signature Flight Support – Fixed Base Operator (FBO)
- United Parcel Service (UPS)

2.5.1 Airport Perimeter Fence

As required by TSA, the airfield is currently protected by a chain-link fence that encloses the runways, taxiways, and aircraft movement and non-movement areas. The airfield fence, which has 16 gates that provide access to various points of the airfield, is eight feet high, with various areas of fencing reaching 10 feet high for wildlife hazard mitigation. The entire airfield fence is topped with three-strands of barbed wire, totaling one-foot high.

Source: Google Earth

2.5.2 Airport Equipment Storage and Maintenance

Located on the southeast end of the airfield are ORF's maintenance and equipment storage facilities. The Airport's airfield maintenance area consists of two facilities: one on the north side and one in the southeast corner. The northern facility is approximately 40,000 square feet and includes three bay doors and two roll-up doors. This facility houses the Airport's snow removal equipment. The southeastern facility is approximately 6,000 square feet and includes seven bay doors, serves as the sand storage facility, and houses the Airport's maintenance and utility vehicles.

Source: Google Earth.

2.5.3 Air Traffic Control Tower (ATCT)

The current ATCT opened on January 22, 1995 and is located on the east side of the airfield. In addition to administrative and support facilities for local FAA operations at ORF, this facility includes the Norfolk Tower Terminal Radar Approach Control (TRACON). The 134-foot-high facility manages traffic in a 30 to 50 nautical mile radius around ORF, with radar coverage provided by an ASR-9 terminal system with a six-level weather detection capability. The ATCT is in operation 24 hours a day, 365 days a year.

Source: Google Earth.

2.5.4 Aircraft Rescue and Firefighting (ARFF)

ARFF vehicles are designed to provide an invaluable service to the commercial and private users of the Airport and the passengers and cargo they transport. The aviation industry is reliant on prompt and effective fire and rescue services during aircraft emergencies. These services include fire containment and suppression, passenger and crew rescue, airframe and cargo preservation, and maintenance of the site to aid in after-incident investigations. The vehicles that airport fire departments employ serve as the medium to deliver firefighters, specialized tools and equipment, and firefighting agents to the scene of an aircraft incident. They must be designed to perform specific functions, constructed for longevity and ease of maintenance, and tailored to the airport's needs.

Within three minutes from the initial alarm, a minimum of one required ARFF vehicle must reach the midpoint of the farthest runway serving air carrier aircraft from its assigned post or must reach any other specified point of comparable distance on the movement area that is available to air carriers and begin application of the extinguishing agent. Within four minutes from the initial alarm, all other required vehicles must reach the previously stated locations and begin application of the extinguishing agent. ORF has one ARFF facility on the north side of the airfield, northeast of the terminal building. The location of the ARFF facility allows firefighting equipment to access any airfield pavement within the required time established by Federal regulations.

A training aircraft for the ARFF department is located on the southeast side of the airfield, north of the Airfield Maintenance building.

The document used to determine an airport's index is Title 14 CFR Part 139.315, *Aircraft Rescue and Firefighting: Index Determination*. ORF operates as an ARFF Index C. The requirements for ARFF vehicles to transport a specific quantity and type of firefighting agents are established by Title 14 CFR Part 139.317, *Airport Rescue and Firefighting: Equipment and Agents*. As an ARFF Index C, the Airport can choose to have a minimum of either three or two vehicles. However, specifications of the vehicles depend upon the total number of vehicles chosen. ORF has chosen to keep a minimum of three ARFF vehicles.

ORF currently has a rapid intervention vehicle and four ARFF trucks meeting the specifications as described below:

- Two vehicles carrying the following extinguishing agents:
  - 500 pounds of sodium-based dry chemical, halon 1211, or clean agent or
  - 450 pounds of potassium-based dry chemical and water with a commensurate quantity of Aqueous Film Forming Foam (AFFF) to total 100 gallons for simultaneous dry chemical and AFFF application

- Two vehicles carrying an amount of water and commensurate quantity of AFFF so the total quantity of water for foam production carried by all three vehicles is at least 3000 gallons

Source: Google Earth.

2.5.5 Aircraft Fueling

Signature Flight Support is responsible for operating the fuel farm, the GA fuel farm, and the fuel dispensing area at ORF. These operations include services to commercial, GA, and cargo aircraft. The Airport's fuel farm is located north of the Air Traffic Control Tower and includes four above-ground fuel tanks with fuel storage capacities of 210,000-gallons per tank (Jet-A).

Fuel is transported from the fuel farm and GA fuel farm via underground pipes to a dispensing area located north of the ARFF facility. Fuel is then transported from the dispensing area to aircraft via specialized fuel trucks, which make approximately 13 to 15 deliveries per day. The types of trucks and their carrying capacities are as follows:

- One 750-gallon truck (Avgas)
- One 1,000-gallon truck (Avgas)
- Ten 5,000-gallon trucks (Jet-A)
- One 10,000-gallon truck (Jet-A)

The GA fuel farm is located in the General Aviation Area, south of the T-Hangars. This fueling location includes three underground storage tanks with fuel storage capacities as follows:

- Two 10,000-gallon tanks (Jet-A)
- One 10,000-gallon tank (Avgas)

Source: Google Earth.

2.5.6 Snow and Ice Control

As guided by FAA AC 150/5200-30D, *Airport Winter Safety and Operations,* snow, ice, and slush should be removed as expeditiously as practicable to maintain runways, high-speed turnoffs, and taxiways in a "no worse than wet" (i.e., no contaminant accumulation) condition. To meet these guidelines during the winter months, personnel at ORF are on-call at all times for snow removal to ensure adequate response to weather events. In addition to regularly mandated inspections, airfield conditions are monitored throughout the day, or as often as needed by the on-duty airfield maintenance and airport operations personnel. The inspections are conducted visually and with runway friction measuring equipment. Airfield conditions are transmitted electronically to pilots via NOTAMS (Notice to Airmen). Other sources of information include reports from the National Weather Service (NWS), the Airport's Automated Surface Observation System (ASOS) weather station, and pilot reports (PIREPs). Based on these observations and information, Airport personnel can determine the proper equipment and surface treatment to be used. Approved equipment for contaminant removal includes: high-speed rotary plows, snow plows, material spreaders, and runway brooms. Approved chemicals include: fluid deicers/anti-icers and solid deicers/anti-icers. Fluid deicers/anti-icers consist of glycol-based fluids, potassium acetate base, and potassium formate-based fluids. Solid de-icer/anti-icers consists of sodium formate and sodium acetate.

Most equipment is stored in the airfield maintenance building so that it is protected from weather and to prolong it operational life expectancy.

Aircraft Deicing

Deicing operations at ORF are confined to the main terminal apron, and the cargo apron on the west side of the airfield. The Airport's main deicing facility/pad is located on the northeast side of the main terminal apron and consists of four deicing positions, which are utilized on a first-come-first-serve basis. Signature Flight Support provides the deicing services for aircraft operating at ORF including Allegiant, American, Delta, United, FedEx, and UPS.

Southwest handles its own deicing services. Signature provides deicing services via two 1,100-gallon deicing trucks.

Sweeper trucks are utilized to collect glycol from the pavement after application and to transfer the collected material to the glycol storage tanks near the fuel dispensing area. After deicing services have ceased for the season, the glycol tanks are taken to an off-site facility where the recovered fluid is analyzed and disposed of accordingly. Although Signature provides deicing services, each airline stores its own glycol. Delta and Southwest have their own storage tanks located beside the fuel farm, while the storage tanks for American and United are located under the concourse.

Deicing services on the cargo apron are authorized in the non-movement area parallel to Taxiway 'V'. Deicing services are not permitted within 100 feet of a storm-drain or on the GA side of the airfield at ORF.

2.5.7 Air Cargo Facilities

ORF leases property to Aeroterm for air cargo in a dedicated area that is shared by FedEx, Mountain Air Cargo, and UPS. The cargo area is located on the west side of the airfield, south of the terminal. It consists of two multipurpose processing buildings, providing users with 88,000 square feet of space. The western facility is the largest of the two facilities, measuring approximately 65,000 square feet. FedEx is the primary operator of the facility, along with Mountain Air Cargo (MAC), which is a major contract carrier for FedEx. The second building, measuring approximately 23,000 square feet, is primarily operated and maintained by UPS. Adjacent to the air cargo facilities is an aircraft ramp which is approximately 265,000 square feet. The ramp provides the cargo operators with direct access to Taxiway 'V', which connects directly to Taxiway 'C' and Runway 14/32.

Source: Google Earth.

Air cargo service destinations are depicted in **Table 2-18**.

Table 2-18 – Cargo Service Destinations

Airlines	Destinations
Federal Express (FedEx)	Indianapolis International Airport (IND), Memphis International Airport (MEM), Dare County Regional Airport (MEO), McGhee Tyson Airport (TYS)
United Parcel Service (UPS)	Louisville International Airport (SDF), Richmond International Airport (RIC), Roanoke-Blacksburg Regional Airport (ROA)

Source: FedEx, UPS, U.S. DOT, T-100 statistics, CHA.

** MAC is a contract carrier for FedEx and is not included in the table as its operations are unscheduled, have varying destinations, and are inconsistent.

Non-aviation tenants also utilize the cargo facilities, including Quantem, Wright Bros. Aero, Philadelphia Truck Lines, and Coinmach.

2.5.8 General Aviation (GA) Facilities and Activities

Signature Flight Support, the airports sole FBO, operates a 29.5-acre site which includes hangars, a terminal building, and apron space.

The FBO operates six bulk-storage hangars, three sections of T-hangars, and a large aircraft parking apron. The largest hangar on the southwest side of the GA area is used for MRO services and is leased to PSA Airlines (see **Section 2.5.9**). Five additional box hangars ranging from approximately 18,000 square feet to 46,500 square feet are used for aircraft storage. Three T-hangars, ranging from approximately 12,700 square feet to 24,200 square feet are used for small aircraft storage and leased by the FBO. A large apron area that can provide up to 36 tie-down positions (depending on aircraft size), is used for short term storage of transient aircraft parking.

Signature primarily hosts corporate jets and on standard to busy days, has 35 to 50 itinerant aircraft, with 50 percent remaining overnight.

In addition to supporting GA parking and infrastructure, Signature provides fueling and deicing services to tenants and operators at ORF, in addition to ground handling services for UPS. Small flight schools will periodically sublease approximately 10 aircraft from the FBO. A detailed depiction of Signature Flight Support's facilities is shown in **Figure 2-15**.

NORFOLK INTERNATIONAL AIRPORT

MASTER PLAN UPDATE

GRAPHIC SCALE (FEET)

0 500 1000

Taxiway A

TOF

32

MRO Facility

Bulk Hangars (FBO)

T-Hangars (FBO)

FBO Maintenance Shop

GA Fuel Farm

FBO Terminal/Hangar

Bulk Hangars (FBO)

Property Line

GA Facilities

Runway

Taxiway

Figure 2-15
GA Facilities

2.5.9 MRO Facility

ORF leases property for one MRO-dedicated facility, located in the General Aviation Area and measuring approximately 49,000 square feet, to PSA Airlines. It is a full-service, overnight MRO facility that provides maintenance support for all aircraft operating at the Airport.

2.5.10 Rental Car Facilities

When picking up rental cars, passengers first proceed to the rental car counters, located in the Arrivals Terminal. Bypass booths have been installed in the Airport Parking Garage that allow VIP customers to go straight to the Ready booth and bypass the rental car counters, saving the customer time. After being processed, passengers pick up rental cars at the Rental Car Ready lot, located in the Airport Parking Garage.

In addition to the rental car counters and bypass booths, the rental car companies utilize a Rental Car Return Facility, as well as an off-site QTA. Rental cars can be returned to the proper rental car company at the Rental Car Return Facility (ready/return lot), located on the north side of Airport Road. When dropping off vehicles, passengers will see signage in the parking lot corresponding to each rental car agency. A consolidated rental return building is located at the Rental Return Lot, where passengers can complete rental return paperwork.

After rental cars have been returned, the vehicles are taken to a remote QTA facility, located west of Airport property on Military Highway. The Airport is currently in the process of converting the second floor of Garage A to a return facility, where passengers can drop-off vehicles. This process is expected to be completed by the end of CY2018. When finished, both the ready and return operations will be in Garage A.

2.6 AIRSPACE ENVIRONMENT

The National Airspace System (NAS) is made up of a network of air navigation facilities, Air Traffic Control (ATC) facilities, airports, technology, and appropriate rules and regulations that are needed to operate the system. The FAA created the NAS to protect persons and property on the ground, and to establish a safe and efficient airspace environment for civil, commercial, and military aviation within the United States. Airspace is broken down into two categories: regulatory and non-regulatory. Within the regulatory airspace category, there are two types of airspace, controlled and uncontrolled. Categories and types of airspace are defined based on their complexity or density of aircraft movements, or the nature of the operations conducted within the airspace, which dictates the level of safety required and the level of national and public interest.

The purpose of controlled airspace is to provide adequate separation between IFR and VFR aircraft, thus, IFR services are available, but not required, within all controlled airspace. Airspace designated as Class A, B, C, D, and E is controlled airspace.

VFR aircraft operating in Class B, C, or D airspace must be in contact with ATC. This gives ATC the authority to manage IFR and VFR traffic in the proximity to airports and ensure proper separation.

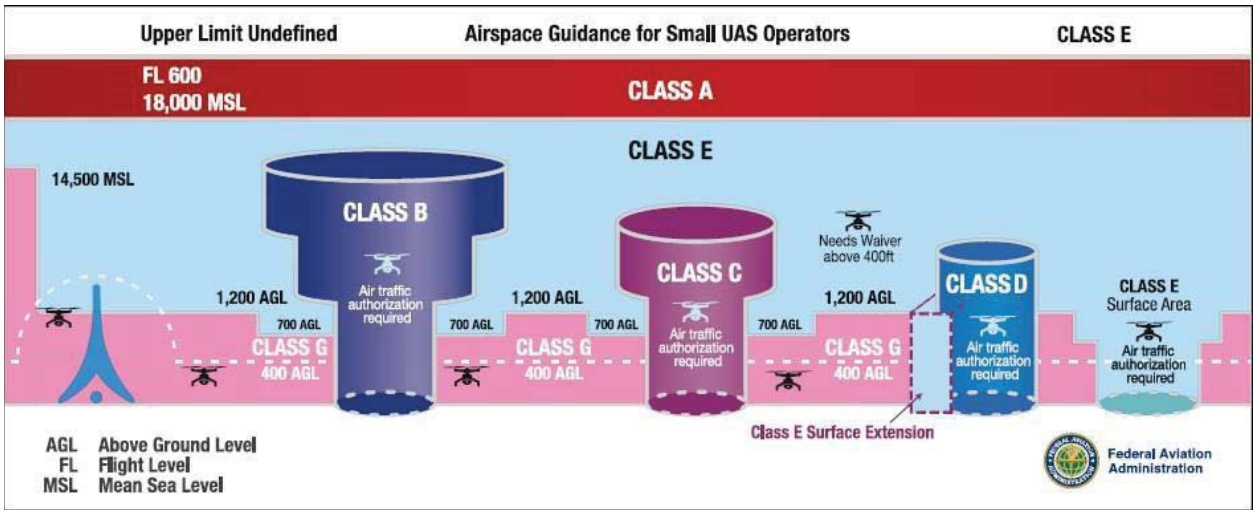
Controlled airspace designations do not affect IFR traffic as IFR traffic is cleared through controlled airspace by ATC.

Class G airspace is uncontrolled and IFR services may or may not be available.

Large sections of controlled and uncontrolled airspace have been designated as special use airspace. Special use airspace is further defined as prohibited, restricted, warning, military operations, and alert areas. Civil operations within special use airspace may be limited or even prohibited, depending on the area, as operations within these areas is considered hazardous to civil aircraft.

ORF is located within Class C airspace, extending from the runway surface up to 4,000 feet mean sea level (MSL) for a 5-nm radius, and from 1,200 feet MSL to 4,000 feet MSL for a 10-nm radius. A graphic of the U.S. Airspace Profile is presented in **Figure 2-16.**

Figure 2-16– U.S. Airspace Profile



Source: Federal Aviation Administration.

The National Aeronautical Charting Office (NACO) of the FAA publishes special aeronautical charts used by pilots to navigate through the National Airspace System. These charts are called sectional charts, or sectionals. A sectional chart provides detailed information on airspace classes, ground-based NAVAIDS, radio frequencies, longitude and latitude, navigational waypoints and navigational routes. It also offers topographical features, such as terrain elevations and ground features that are important to aviators, such as landmarks that will be identifiable from a given altitude. Although these charts are used for VFR and IFR navigation, they are a VFR pilot's primary navigation tool.

Figure 2-17 displays a segment of the Washington Sectional Chart, centered on ORF.

Figure 2-17– Washington Sectional, 103rd Edition [Effective 1 Feb 2018]

Source: aeronav.faa.gov

2.7 METEOROLOGICAL CONDITIONS

Meteorological conditions affect airport operations at an airport in many ways. Winds, precipitation, and temperature influence decisions pertaining to NAVAIDs, runway orientation, and required runway length. ORF is equipped with an Automatic Surface Observation System (ASOS), a highly sophisticated weather data sensing, processing, and dissemination system that is designed to support weather forecast activities and aviation operations. While meteorological readings are taken every minute, 24-hours a day, every day of the year, these systems generally report at hourly intervals, but also report special observations if weather conditions change rapidly and cross aviation operation thresholds. Maintained, controlled, and operated by the FAA and the National Weather Service, the ASOS automatically observes, formats, archives, and transmits observations.

When weather conditions exceed predetermined weather element thresholds, a special report is transmitted through an automated very-high-frequency (VHF) airband radio frequency (127.15 MHz) to pilots operating at or near ORF. These messages are also available via phone by calling 757-460-9348.

2.7.1 Local Climate

The average annual temperature in Norfolk, Virginia is 60.05 degrees Fahrenheit; The average low is 52.00 degrees Fahrenheit, while the average high is 68.10 degrees Fahrenheit. July was the warmest month, with a mean temperature of 87.00 degrees Fahrenheit. Average monthly precipitation ranges from 3.11 inches to 5.51 inches, with annual precipitation averaging 46.55 inches. Average monthly snowfall during the months of December through February range from one to two inches, with an annual average of five inches of snowfall. The local climate requires the Airport to support snow removal and aircraft deicing services.

This climate data for Norfolk, Virginia was obtained from the National Oceanic and Atmospheric Administration (NOAA) and the NWS.

2.7.2 Wind Coverage

In addition to climate data, the ASOS (Station 13737 – Norfolk International Airport) at ORF collects wind speed and direction data, which can influence airfield development decisions on runway orientation and length. Local wind conditions at an airport are a key factor in determining runway use. Aircraft operational safety and performance is enhanced when aircraft depart and land into the wind, therefore, runways that are not oriented to take full-advantage of the prevailing wind patterns are not utilized as frequently as runways that are appropriately oriented. According to FAA AC 150/5300-13A, *Airport Design*, the desirable wind coverage for an airport is at least 95 percent at all speeds, meaning that the primary runway at an airport has at least 95 percent wind coverage and that the wind at the airport is within certain limits of crosswind conditions. Wind coverage is calculated using the highest crosswind component that is acceptable for the type of aircraft expected to use the runway system. Larger aircraft have a higher tolerance for crosswinds than smaller aircraft due to their size, weight and operational speed.

Table 2-19 provides the standard crosswind component by aircraft size. **Table 2-20** outlines the weather classification criteria and the number of recorded observations at ORF between 2007 and 2016.

Table 2-19 – Crosswind Components

Runway Design Code (RDC)	Maximum Crosswind Component
A-I and B-I aircraft*	10.5 knots
A-II and B-II aircraft	13.0 knots
A-III, B-III, C-I through D-III D-I through D-III	16.0 knots
A-IV, B-IV, C-IV through C-VI, D-IV through D-VI	20.0 knots
E-I through E-VI	20.0 knots

Source: FAA AC/5300-13A *Airport Design*

Table 2-20 – Weather Classification Criteria

Weather Class	Recorded Observations at ORF (2007-2016)
All Weather	131,281
VFR Conditions	15,056
IFR Conditions	92,646

Source: NOAA, National Climate Center; Station 723080 (2007-2016)
VFR – Visual Flight Rule
IFR – Instrument Flight Rule

The combination of the crosswind and the weather classification allows for the calculation of the wind coverage, which is presented in **Table 2-21** for ORF. Wind coverage is the percent of time crosswind components are below an acceptable velocity. The 95 percent wind coverage is computed on the basis of crosswinds not exceeding 10.5 knots for ARC A-I and B-I; 13 knots for ARC A-II and B-II; 16 knots for ARC A-III, B-III, and C-I through D-III, and 20 knots for ARC A-IV through D-VI. The calculated wind coverage for ORF facilities shows that all runways exceed the 95 percent wind coverage threshold when combined in all modeled weather conditions (all weather, VFR-only, and IFR-only), as well as individually for crosswind coverage of 20 knots. Runway 5/23 meets the 95 percent wind coverage threshold for each crosswind speed in all modeled weather conditions. Runway 14/32 does not meet the 95 percent wind coverage threshold in VFR or IFR conditions when the crosswind speed is 10.5 knots, in all weather conditions or in IFR conditions when the crosswind speed is 13 knots, or in IFR conditions when the crosswind speed is 16 knots.

Table 2-21 – ORF Wind Coverage

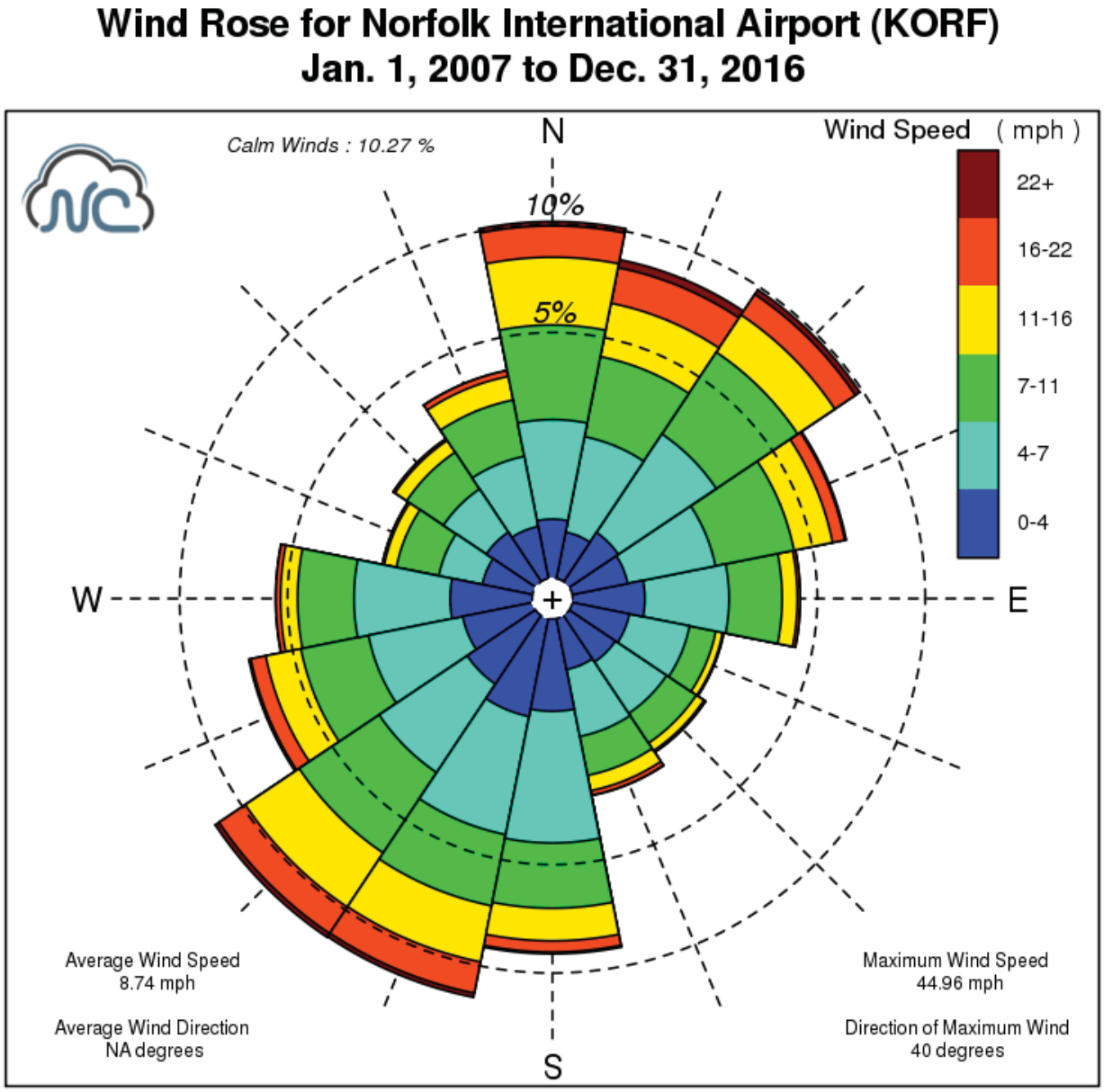
	Runway	10.5 Knots	13 Knots	16 Knots	20 Knots
AW	5/23	95.56%	98.14%	99.62%	99.93%
	14/32	80.00%	87.77%	95.89%	98.81%
	All Combined	98.58%	99.64%	99.93%	99.99%
VFR	5/23	95.75%	98.27%	99.70%	99.96%
	14/32	78.79%	87.17%	96.01%	99.04%
	VFR Combined	98.77%	99.72%	99.96%	100%
IFR	5/23	92.05%	96.34%	98.9%	99.75%
	14/32	76.67%	84.58%	92.52%	96.68%
	IFR Combined	96.51%	98.88%	99.75%	99.98%

Source: NOAA, National Climate Center; Station 725080 (2007-2016)

Weather observations are presented in a format that is specifically designed by the FAA to be useful for evaluating weather conditions at an airport. Wind direction is grouped according to a 16-point compass rose (N, NNE, NE, ENE, E, ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW and NNW).

Wind speed is organized into groups of 0-3, 4-6, 7-10, 11-16, 17-21, 22-27, 28-33, 34-40, and 41 knots per hour or greater. This data is typically displayed on a wind rose for each weather classification. The all-weather windrose is depicted in **Figure 2-18.**

Figure 2-18– All Weather Windrose



Source: State Climate Office of North Carolina