Chapter 4 – Unmanned Aircraft Systems Evaluation

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Introduction - UAS Airside and Landside Activities

The Unmanned Aircraft Systems (UAS) industry is currently an evolving market. The domestic regulatory environment is still in initial developmental stages as the FAA continues to work through the challenges of integration between manned and unmanned aviation in the National Airspace System. UAS technology is also evolving rapidly and the Pendleton UAS Range (PUR) is working to integrate infrastructure and airspace plans into future development and accommodate the wide range of needs across both UAS and manned platforms.

The range of UAS needs vary greatly between the many different types, sizes and functions of platforms, and associated support equipment. Although not totally inclusive, **Figure 4-1** generally describes the different types and categories of UAS platforms, organized into basic groups. Commercial industry generally falls into these categories as well. Currently, Group 2 & 3 are dominating the commercial market, mostly driven by current FAA restrictions and cost; while the Department of Defense (DoD) and other government agencies are operating UAS platforms across the full spectrum of size and capability. The general infrastructure and support requirements for each of group are laid out in this section.

FIGURE 4-1: UAS GROUPS

DoD Unmanned Aircraft Systems (As of 1 JULY 2011)

General Groupings	Depiction	Name	(Vehicles/GCS)	Capability/Mission	Command Level
Group 5 • > 1320 lbs • > FL180		•USAF/USN RQ-4A **Global Hawk/BAMS-D** Block 10 •USAF RQ-4B **Global Hawk** Block 20/30 •USAF RQ-4B **Global Hawk** Block 40	•9/3 •20/6 •5/2	•ISR/MDA (USN) •ISR •ISR/BMC	•JFACC/AOC-Theater •JFACC/AOC-Theater •JFACC/AOC-Theater
		•USAF MQ-9 **Reaper**	•73/85* *MQ-1/MQ-9 same GCS	•ISR/RSTA/EW/ STRIKE/FP	•JFACC/AOC- Support Corps, Div, Brig, SOF
Group 4 • > 1320 lbs • < FL180		•USAF MQ-1B **Predator**	•165/85*	•ISR/RSTA/STRIKE/FP	•JFACC/AOC-Support Corps, Div, Brig
		•USA MQ-1 **Warrior**/MQ-1C **Gray Eagle**	•31/11	•(MQ-1C Only-C3/LG)	•NA
		•USN **UCAS**- CVN Demo	•2/0	•Demonstration Only	•NA
		•USN MQ-8B **Fire Scout** VTUAV	•14/8	•ISR/RSTA/ASW/ ASUW/MIW/OMCM/ EOD/FP	•Fleet/Ship
		•SOCOM/DARPA/USA/USMC A160T **Hummingbird**	•8/3	•Demonstration Only	•NA
Group 3 • < 1320 lbs • < FL180 • < 250 knots		•USA MQ-5 **Hunter**	•45/21	•ISR/RSTA/BDA	•Corps, Div, Brig
		•USA/USMC/SOCOM RQ-7 **Shadow**	•368/265	•ISR/RSTA/BDA	•Brigade Combat Team
		•USN/USMC **STUAS**	•0/0	•Demonstration	•Small Unit
Group 2 • 21-55 lbs • < 3500 AGL • < 250 knots		•USN/SOCOM/USMC RQ-21A **ScanEagle**	•122/13	•ISR/RSTA/FORCE PROT	•Small Unit/Ship
Group 1 • 0-20 lbs • < 1200 AGL • < 100 knots		•USA / USN / USMC / SOCOM RQ-11 **Raven**	•5628/3752	•ISR/RSTA	•Small Unit
		•USMC/ SOCOM **Wasp**	•540/270	•ISR/RSTA	•Small Unit
		•SOCOM SUAS AECV **Puma**	•372/124	•ISR/RSTA	•Small Unit
		•USA **gMAV** / USN **T-Hawk**	•270/135	•ISR/RSTA/EOD	•Small Unit

UAS Airside Facility Requirements

Group 1 Infrastructure Requirements:

Runway requirements

None. Hand launched / recovered.

Airfield support services

General Services

Group 1 vehicles are small, mobile and likely will not require operations into, or out of the airport. Support requirements may include a Mobile Operations Center (MOC), radio communications equipment, crew shelter, data-processing space, training room and secure storage locations.

Facilities

None.

Office / Administrative Space

Customers utilizing Group 1 platforms will likely utilize office space for data-processing, training and secure equipment storage. Current space at Eastern Oregon Regional Airport (EORA) include:

- Office: Single office available in terminal
- Training / Storage Room: Single training / storage area available in terminal, adjacent to office space (old baggage claim area).

The current office and training / storage area may be sufficient to support one customer at a time. However, additional MOC storage areas will be required (approx. 20' x 40'). Customer demand will generate the need for additional office and storage locations at the EORA.

Group 2 & 3 Infrastructure Requirements:

Runway requirements

There are a wide range of requirements for Unmanned Aircraft platforms and associated launch, recovery and control mechanisms ranging from pneumatic launchers, skyhook recovery, to runway and net system recovery. The infrastructure plans for PUR at the EORA include accommodations for these varying requirements. Typical equipment support and footprints for Group 2 & 3 platforms are described below. **Figure 4-2** shows an example of a UAS launch. **Figure 4-3** shows an example of a portable UAS capture system.

Launch / Recovery

- Pneumatic Launch and Skyhook recovery
- Bungee or hand launch, hard packed surface recovery
- Pneumatic launch and runway recovery

Typical Footprint:

Launch:

- Stowed
  - Length: 17.83 ft
  - Width: 7.25 ft
  - Height: 6.42 ft
- Deployed
  - Length: 22 ft
  - Width: 7.25 ft
  - Height: 8 ft

FIGURE 4-2: INSITU SCAN EAGLE LAUNCH

Transport:

- Typically hitch-mounted, or trailer transport
- Weight: Ranging between 200 - 4,200 lb

Recovery:

Runway:

- Condition:
  - Hard-packed, paved, gravel or dirt
  - Less than 1000 ft

Net Capture:

- Typically off airport

Sky Hook:

- Stowed:
  - Length: 19 ft
  - Width: 7.2 ft
  - Height: 6.25 ft
- Deployed:
  - Length: 28.75 ft
  - Width: 17.5 ft
  - Height: 58 ft

FIGURE 4-3: ARCTURUS T-20 PORTABLE CAPTURE SYSTEM

Fuel Storage, Handling & Limitations

Typical Fuel Requirements:

- JP-5 or JP-8 fuel
- Hybrid Power System Propane/Rechargeable Battery
- Fuel cell
- Battery operated

Airfield support services

General Services

Group 2 & 3 systems will require airfield services such as fuel, UAS pad maintenance, utility support (internet, power, trash, sewer, etc.), transportation, security and labor associated with safety, compliance, and administration support. Memorandums of Agreement (MOA) will be required with the Air Traffic Control Tower (ATCT) for airfield movement and airspace coordination / approval.

Facilities

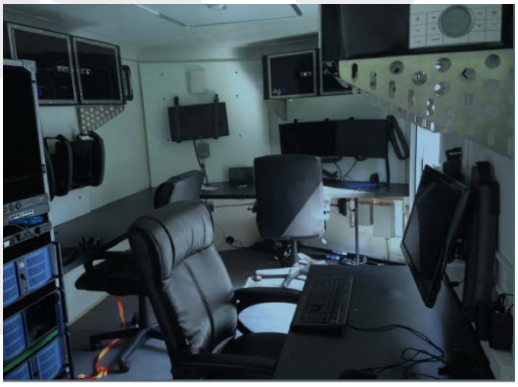
UAS Pads:

Mobile Operations Center (MOC) as shown in **Figure 4-4 and Figure 4-5**: Many Group 2 systems utilize an MOC to support operations in the field. The UAS pads located on the airport are able to accommodate a wide range of trailers to meet the needs of current and future UAS customers.

- Length: 24 ft
- Width: 8ft
- Computer Workstations: 4
- Other Workstations: 2
- 30 foot pneumatic telescoping antenna
- Satellite Internet, WiFi, Plotter, Printer
- Back-up power (24VDCbattery)
- Honda generator for normal power/Able to connect to shore power
- Heat/AC
- External lighting
- F-350 Diesel tow vehicle

FIGURE 4-4: MOC TRAILER

FIGURE 4-5: MOC TRAILER INTERIOR



Office / Administrative Space

Similar to Group 1, Group 2 & 3, UAS customers will require office space for data-processing, administration support, training, and secure storage.

The current office / storage space located in the EORA terminal would likely meet the needs for one customer at a time (accommodating approximately 3-5 personnel per operation), but additional customer demand will generate the need for increased office and storage space at the EORA.

Two large, multipurpose hangars with open floorplans are currently being planned / constructed to meet immediate and future needs of both manned and unmanned aviation (north of TWY D). Depending on budgets, hangars will be outfitted with restrooms, HVAC, and office space. By designing the hangars to

be dual-purpose (large enough to fit a King Air type aircraft), it will allow the highest level of flexibility while the UAS industry evolves. This new construction will also accommodate multiple MOC trailers and UAS platforms when needed.

Group 4 & 5 General Infrastructure Requirements:

Runway requirements

As a general rule, Group 4 & 5 UAS operate very similarly to manned aviation and require very similar infrastructure and equipment support.

Airfield support services

General Services Large UAS will require airfield services such as towing, refueling / de-fueling, deicing, power, security, hangar space, etc. MOA's will be required with the ATCT for airfield movement and airspace coordination / approval.

Fuel Storage, Handling & Limitations

Typical Fuel Requirements:

– Primary - MIL-T-83133, JP-8, or JP-8+100.

– Alternate - MIL-T-5624, JP-5, or additized TS-1

Facilities

Hangars

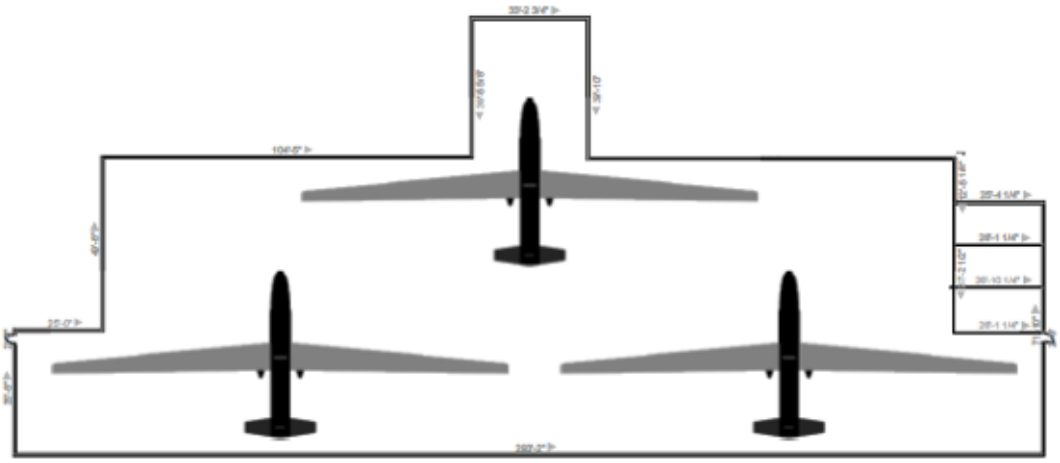
For scaling purposes, we utilized a Global Hawk platform as an example of infrastructure requirements for a large, Group 5 UAS platform.[1] **Figure 4-6** shows typical Large UAS dimensions. **Figure 4-7** shows an example of a UAS hangar layout.

FIGURE 4-6: GLOBAL HAWK DIMENSIONS

	RQ-4A	RQ-4B
Wing Span (ft)	116.2	130.9
Length (ft)	44.4	47.6
Height (ft)	15.2	15.4
Verticle Clearance (in)	19.5	20.65
Tread (ft)	10.6	21.1

[1] Technical Manual 1Q-4(R) A-2-DB-1, 22 April 2008, Version 07.12.001

FIGURE 4-7: EXAMPLE HANGAR PLAN



Office / Administrative Space

The administrative footprints for large platforms are significant with personnel office space ranging from 10-20 offices with a conference room, break-room, and bathrooms. Space located above a large hangar or a small-detached building would meet the needs of required administrative personnel.

Building-based Operations Center

Depending on the owner / operator, Group 4 & 5 UAS platforms utilize command and control stations that may be building-based, or housed within mobile ground stations. The DoD developed mobile ground stations to support overseas locations and separated the Mission Control Element (MCE) and Launch and Recovery Element (LRE) functions. These stations are typically housed in commercially available trailers outfitted with UHF and VHF radio links, a C-band line of sight data link, and KU-band satellite data links. Other users, such as National Aeronautics and Space Administration (NASA), utilize a building-based operations center where ground, support, and communications equipment are permanently installed. **Figure 4-8** shows a typical UAS operations center.[2]

[2] Northrop Grumman Corporation, Pake Chin, Sep 2013

FIGURE 4-8: OPERATIONS CENTER

Summary:
As identified in this section, there is a wide variation of infrastructure, equipment and support service requirements across the various types and sizes of Unmanned Aircraft Systems. Current infrastructure at the EORA will support the immediate needs of customers flying at the PUR. Based on current and forecasted UAS operations tempo (OpsTempo), we believe the Phase I infrastructure and new hangars will support a number of potential flight operations for the next two to five years. The additional hangar construction and office / storage space would be highly attractive to both the UAS and manned aviation industries; both as an immediate and future need at the airport. Phase I & II of the PUR infrastructure execution will likely be driven by customer demand. The evolving FAA regulatory environment has a direct impact on customer demand at the PUR, and thus OpsTempo.

Current and Future UAS Airspace Requirements

Airspace requirements currently include Shadow (RQ-7) operations from the Oregon Army National Guard. A copy of the Army Letter of Agreement (LOA) and Certificate of Authorizations (COA), and approved PUR COA for UAS within KPDT Class Delta airspace is included in **Appendix C**. Current UAS operations are restricted to day operations only, while maintaining line-of-sight with the UAS vehicle. If the UAS vehicle exceeds goes beyond the line-of-sight of the air traffic control tower and or UAS operator, then a chase plane/helicopter must follow the UAS and maintain director radio contact with the UAS operator.

Current OpsTempo should not have an impact on arriving and/or departing VFR and/or IFR traffic. Segregation is the current risk mitigation approach used for traffic confliction between manned and unmanned platforms. The Shadow (RQ-7) is currently the most commonly flown platform in the area. The Shadow was created in several renditions, but general specifications include an aircraft length of 11 feet, wingspan of 14 feet, and gross weight of 375 pounds. A platform large enough to carry a transponder,

and ATCT controllers also utilize a visual display in the ATCT (provided by the Army to track the Shadow UAS while in flight). The Shadow launches from the UAS Launch Pads located on the Eastern end of the runway, off Taxiway Golf and Foxtrot (see airport diagram in **Figure 4-12**).

If the air traffic control tower were to close, UAS operations are permitted in Class E airspace with proper approval from the FAA, either through a certificate of authorization or a Section 333 Exemption. *Section 333 Exemption of the FAA Modernization and Reform Act of 2012 (FMRA), grants the Secretary of Transportation the authority to determine whether an airworthiness certificate is required for UAS to operate safely in the National Airspace System (NAS). The Section 333 Exemption process provides operators who wish to pursue safe and legal entry into the NAS a competitive advantage in the UAS marketplace, thus discouraging illegal operations and improving safety.*[3] An air traffic controller's primary responsibility is to separate air traffic near an airport. The smaller the aircraft is, the harder it is for pilots to see-and-avoid other aircraft. The importance of having and maintaining an active air traffic control tower is critical for the safety of both manned and unmanned aircraft.

Figure 4-9 shows the UAS training area surrounding Pendleton.

FIGURE 4-9: UAS TRAINING AREA

UAS operations are divided into three approved zones:

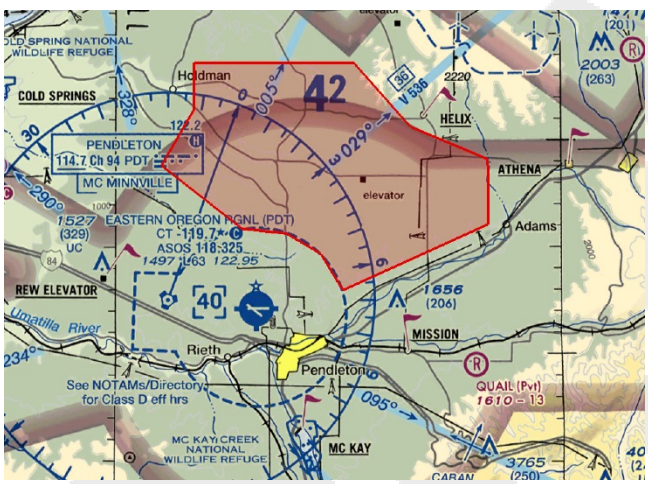
1. Inside KPDT Class Delta airspace:
    a. Altitude: at or below 4,000ft MLS (as assigned by KPDT ATCT)
    b. UAS operations allowed with clearance from PDT ATCT)

[3] Federal Aviation Administration; Section 333 ‹https://www.faa.gov/uas/legislative_programs/section_333/›

   c. NW, NE, and SW Holding Points (as depicted in the LOA) and used as directed by KPDT ATCT. Holding altitude: 3,500 MSL or assigned.
2. Operations in North OPAREA outside Class D airspace.
   a. Altitude: at or below 4,000 ft. MSL (as assigned by Pasco TRACON)
   b. Communications will be with PDT ATCT
3. Operations between KPDT Class D and R-5701 (Army National Guard):
   a. Altitude: at or below 4,000 ft. MSL (as assigned by Pasco TRACON)
   b. Communications will be with KPDT ATCT.
4. Operations between KPDT and PUR airspace:
   a. The PUR includes 14,000 square miles of airspace ranging from surface to 18,000.
5. The mixing of manned and unmanned traffic within Class D airspace during launch and recovery operations is currently prohibited.
   a. Exception: Chase aircraft in formation with a UAS to provide see-and-avoid requirements.

Figure 4-10 shows the North Operations Area

FIGURE 4-10: NORTH OPERATIONS AREA (OPAREA)



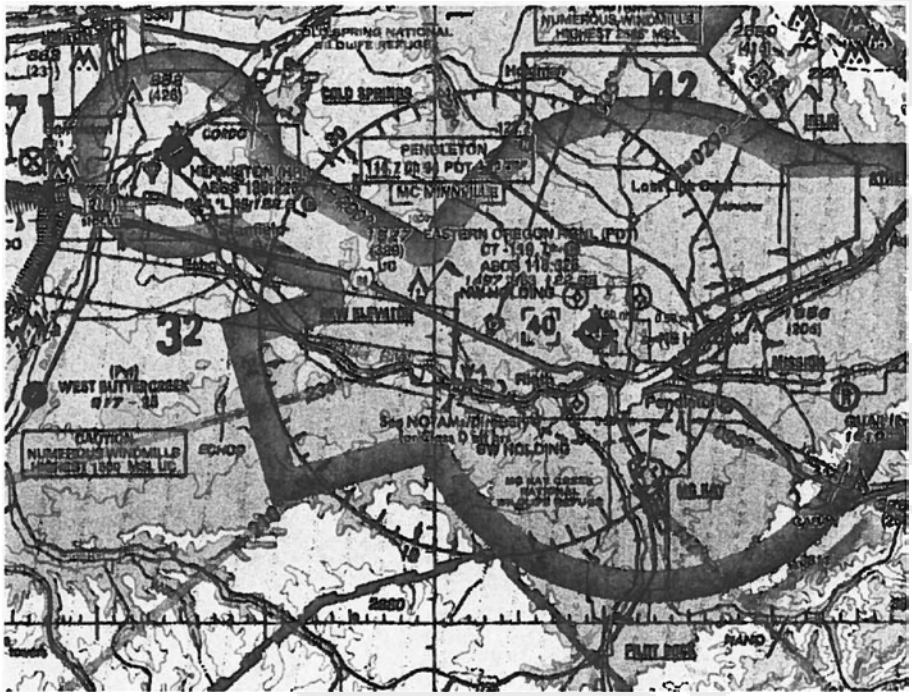
Emergency / Contingency Procedures:

1. Lost Link Procedures: In the event of a lost link, the UAS pilot will immediately notify PDT ATCT via radio or phone (541) 278-1993 if operating in North OPAREA, state pilot intentions, and comply with the following provisions:
   a. Within class D: Proceed to the Lost Link holding point inside the North OPAREA at an altitude of 3,500 ft. MSL. The UA will orbit at this location until link is re- established or until UAS Flight Termination System activates. Or, if able, the pilot will take over with Manual Mode and fly to landing point.
   b. In North OPAREA: Proceed to designated Lost Link holding point and orbit at 3,500 ft. MSL until link is re- established or until UAS Flight Termination System activates. Or, if able, the pilot will take over with Manual Mode and fly to landing point.

c. The UA lost link mission will not transit, or orbit, over populated areas.
d. Lost link programmed procedures will avoid unexpected turn-around and/or altitude changes and will provide sufficient time to communicate and coordinate with ATCT.
e. Lost link orbit points shall not coincide with the centerline of Victor airways.

Figure 4-11 shows the UAS operating area.

FIGURE 4-11: OPERATING AREA



Northern OPAREA -Altitude: at or below 4,000 ft. MSL (as assigned by Chinook Approach)

Point 1	N 45°45'52.00"	w 118°51'27.98"
Point 2	N 45°45'38.49"	w 118°48'28.71"
Point 3	N 45°44'40.79"	w 118°46'09.86"
Point 4	N 45°42'58.90"	w 118°44'41.98"
Point 5	N 45°46'03.05"	w 118°34'54.95"
Point 6	N 45°49'05.96"	w 118°34'54.95"
Point 7	N 45°50'38.04"	w 118°40'07.80"
Point 8	N 45°53'38.50"	w 118°43'56.29"
Point 9	N 45°53'38.50"	w 118°54'41.32"
Point 10	N 45°51'07.SO"	w 118°54'41.32"
Point 11	N 45°48'50.00"	w 118°56'53.14"

Lost Link Orbit

•	N45°46'46.00"	W 118°48'11.00"

Lost Link Altitude: 3,500ft. MSL

NW Holding:	N45°43'32.00"	w 118°51'33.00"
NE Holding	N45°43 '30.00"	w 118°47'49.00"
SW Holding:	N45°39'05.00"	w 118°51'33.00"

Future airspace management between manned and unmanned aircraft is part of the FAA's NextGen program, including Automatic Dependent Surveillance-Broadcast (ADS-B) technology.

Automatic Dependent Surveillance–Broadcast (ADS-B) is a precise satellite-based surveillance system. ADS-B Out uses GPS technology to determine an aircraft's location, airspeed and other data, and broadcasts that information to a network of ground stations, which relays the data to air traffic control displays and to nearby aircraft equipped to receive the data via ADS-B In. Operators of aircraft equipped with ADS-B In can receive weather and traffic position information delivered directly to the cockpit. Range operations are governed by current ATCT LOA restrictions (very similar to the Guard LOA).[4]

ADS-B will be mandated for all aircraft starting in 2020 and available in the size of a business card (today), accommodating the minimal payload capacity on small manned and/or unmanned aircraft. This technology will serve as a tool for both manned aviators in the sky and controllers on the ground to all detect-and-avoid each other.

We do not anticipate the UAS operational tempo driving a need for change to airport air traffic flow for the foreseeable future (next 5-10 years). The procedures described above will accommodate current and future UAS testing at the PUR, and Army ANG training operations. Assumptions include no significant increase to Army training requirements and no large (Group 4 & 5) UAS vehicles as a tenant to KPDT. Large UAS vehicles include airframes such as the GlobalHawk and Predator; require a large runway (5,000-7,500 feet in length) for takeoff and landing and associated support infrastructure / equipment. While the airport welcomes the opportunity, there is no current indication that either of these platforms will be relocating to KPDT.

Group 2 & 3 UAS platforms can utilize unused portions of KPDT runways and taxiways; taking advantage of current air traffic separation / segregation techniques currently employed by the ATCT.

UAS Landside Facility Requirements

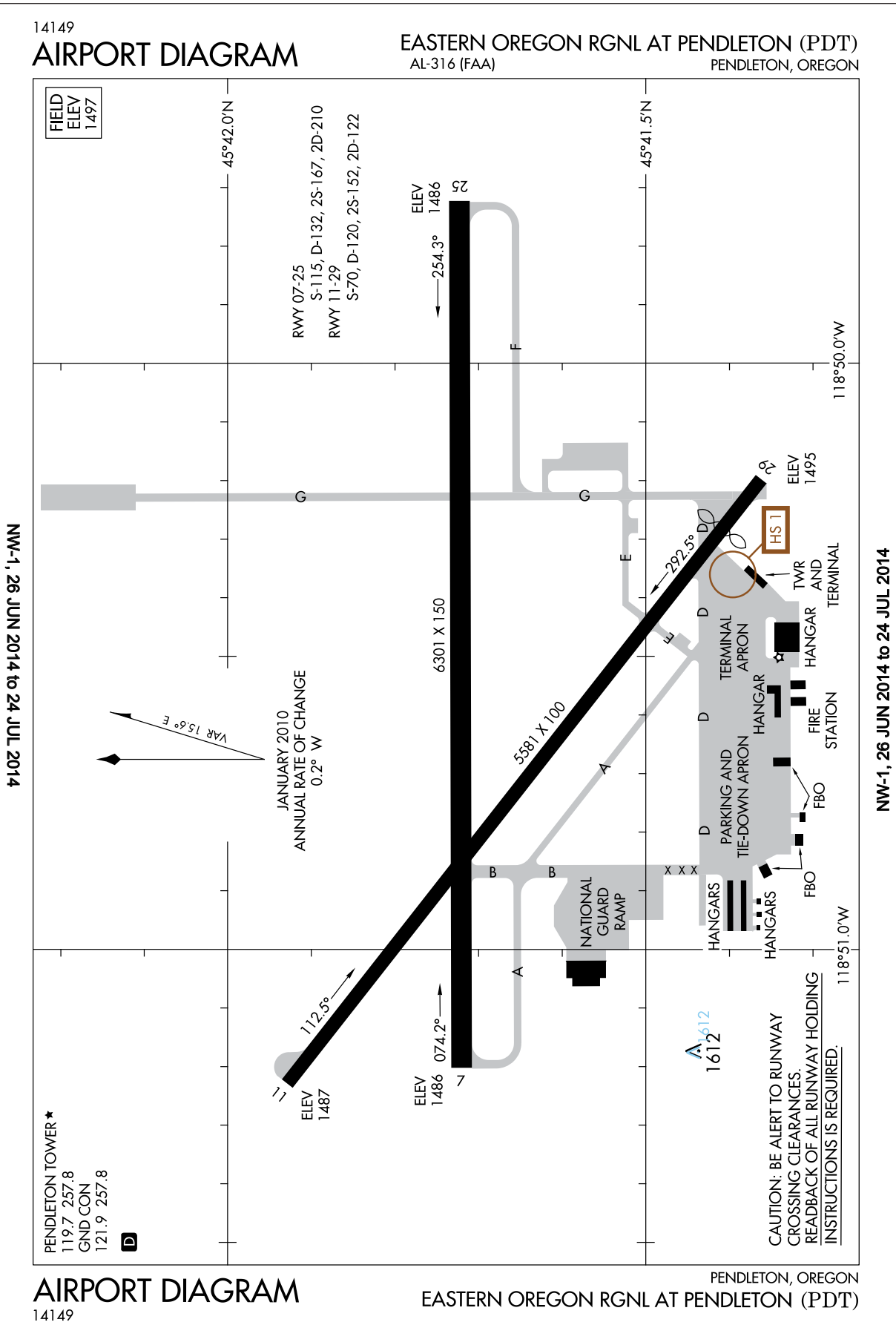
Current and future UAS infrastructure support requirements are captured in the EORA's Phase I, II, and III plans for the Pendleton UAS Range. Phase I is complete, while Phase II and III development will be implemented upon customer demand. The UAS industry is still an evolving market so plans include

[4] https://www.faa.gov/nextgen/programs/adsb/

maximum flexibility, accommodating both manned and unmanned aviation industries until the UAS market becomes more established and self-sustaining.

Infrastructure:

The available EORA paved surfaces include: UAS Strip 16/34 (currently Taxiway Golf): 60' x 4,300', Runway 7/25 (Main): 150' x 6,301', and Runway 11/29: 11' x 5,581'. The Class Delta airspace is managed by a UAS experienced ATCT that coordinates closely with both PUR and the established Army National Guard UAS unit operating the Shadow (RQ-7) safely and routinely. The experienced team onsite at the PUR is led by a team of expert industry professionals across manned, unmanned, and FAA backgrounds that ensure operations are conducted in a safe and cost effective manner. **Figure 4-12** shows the airport diagram at Eastern Oregon Regional Airport.



KPDT AIRPORT DIAGRAM
FIGURE 4.12

EASTERN OREGON REGIONAL AIRPORT
AIRPORT MASTER PLAN

CENTURY WEST ENGINEERING

Phase I:

The airport provides a 2,800-foot UAS dedicated strip and a full-service UAS operating area with available dark fiber connections. The EORA maintains a dedicated UAS Operations Area with 15, 50'x50' work areas (UAS Pads) adjacent to the dedicated, paved UAS strip. These customer work areas were designed to accommodate UAS trailers, MOCs, crew operations, etc. and wired for 240v, 50amp and 120v, 30amp electrical outlets as well a water hookups. Secure Dark Fiber Gigabit hardline access with 100mbps standard speed is also provided. This can be upgraded to full Gigabit speeds that tie into one of the fastest data pipelines in the State of Oregon, allowing for real-time cloud based data uploads and computing.

Phase I build out in support of the Pendleton UAS Range includes some infrastructure and equipment specific to the needs of unmanned aircraft (i.e. UAs launch/recover pads), but the majority of plans accommodate the needs of both manned and unmanned aircraft. This will maximize infrastructure support at the airport while the UAS market continues to evolve (growth dependent heavily on FAA regulation development).

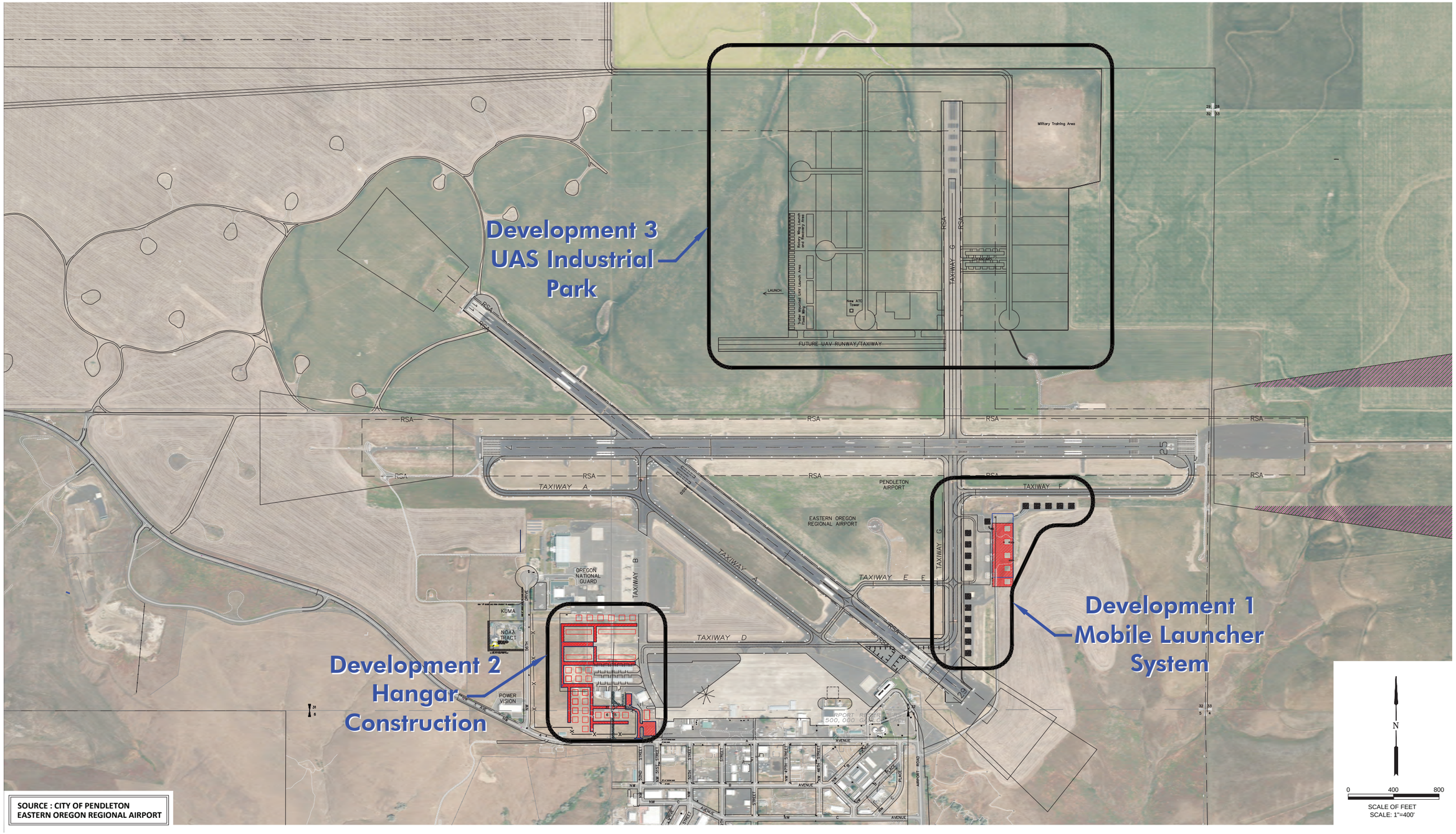
Phase II:

Phase II includes hangar construction on the southwest corner of the airfield, near the existing T-hangars. This will include additional multi-purpose UAS hangars and other immediate facility needs.

Phase III:

Phase III addresses long-term development needs for UAS facilities. This includes an industrial park area with vehicle access from the west; adequate space for construction of a new UAS hangars and buildings; and construction of a new UAS launch and recovery runway.

Figure 4-13 is the Pendleton UAS Range Phase I, II, and III.



SOURCE : CITY OF PENDLETON
EASTERN OREGON REGIONAL AIRPORT

UAS DEVELOPMENT PHASES
FIGURE 4.13

EASTERN OREGON REGIONAL AIRPORT
AIRPORT MASTER PLAN

CENTURY WEST ENGINEERING