STUDY FOR THE ADVANCEMENT OF UNMANNED AIRCRAFT SYSTEMS IN SOUTHERN NEW JERSEY

Prepared for the
South Jersey Economic Development District by:
King Aeronautics & Astronautics Consulting

Page left intentionall blank

EXECUTIVE SUMMARY

Unmanned Aircraft Systems (UAS) represent an escalating technological growth vehicle in the aerospace industry. These systems also reflect the fastest growing aerospace technology in the world today. The United States military was premier in fostering the usefulness of these systems through international conflicts and security concerns. Now this technology is available for multiple federal public and private enterprises worldwide.

This feasibility study supplies the South Jersey Economic Development District with key information on the “state of the nation” in UAS technology and specifically focuses on industrial and research and development (R&D) opportunities for the southern New Jersey region. The information in this report favorably addresses key factors as they relate to the industry and potential market expansion of UAS in the National Airspace System (NAS). We illustrate South Jersey’s potential growth and industry climate by underscoring how the area is already poised for this emerging business due to its unique and expansive aviation infrastructure, facilities and capabilities already in existence. We highlight the region’s advantageous and highly suitable quality of life standards, and we explore potential expansion areas as a basis for attracting this specific industry.

Also discussed are industry/FAA relationships, airspace related matters, and federal departments currently working UAS issues as they pertain to NAS access, robust operations, and R&D. Inclusive are current federal policies, procedures and standards as they relate to the southern New Jersey airspace infrastructure.

Overall, the assessment presents a favorable perspective for UAS future industrial growth within the south New Jersey area. This investment is not hindered by any physical or legal measure of suitability and is competitively predicated on the differential economic advantages in tax and operational baselines. There is ample opportunity for multiple companies to invest in research and development, operational planning, and training within the current construct of existing southern New Jersey facilities.

DISCLAIMER

TABLE OF CONTENTS

Page left intentionally blank

LIST OF FIGURES

LIST OF TABLES

Page left intentionally blank

1 INTRODUCTION

Ten years ago, a few Unmanned Aircraft Systems (UAS) quietly fulfilled a niche capability for military operations. Today, those few systems have matured technically, proved their worth, and unleashed an unlimited potential for their use as a new class of aircraft. As such, the population and functions of UAS have dramatically expanded to excite the world's desire for their abilities. For instance, the US Air Force (USAF) alone currently has 37 UAS patrol orbits in operation and needs to increase that number to at least 50 orbits over the next two years. There is general consensus in the global aeronautics and aerospace industry that technologies required for autonomous capabilities for UAS are mature enough to stimulate even more widespread use. Market surveys consistently project a significant increase in UAS usage over the next five to ten years. Despite the expectation that the military market may start to settle as overseas combat operations wind down, the prediction remains strong because the market for civil applications is primed to grow dramatically.

Historical market predictions as far back as 1995 reported that close to 8,000 UAS worth $3.9 billion [US$] were expected to be produced worldwide between 1994 and 2003. At the time, the reconnaissance market was expected to double in size over the ten-year period. With hindsight knowledge, we know today that these predictions have come to fruition and similar forecasts for the future far exceed past expectations of the UAS community. It is estimated that there are about 300 UAS developers and manufactures in existence today that have produced somewhere between 1,500 to 2,000 different *types* of UAS worldwide. As of October 2009, the U.S. Department of Defense (DoD) alone had more than 6,800 unmanned aircraft in its inventory, compared to fewer than 50 in 2000.[1]

Current predictions claim UAS to be the most dynamic growth sector for the aerospace industry of this decade. Study estimates now show that the marketplace will again, more than double over the next decade from current worldwide UAS research, development, test and evaluation (RDT&E) and procurement expenditures of about $4.9 billion in 2010 to over $11.5 billion in 2019. If operations and maintenance expenditures are added, the total growth is even more significant.

The most influential catalyst to the UAS market has been the enormous growth of interest exhibited by the US military. The profound military interest directly correlates to the general trend toward information warfare and net-centric systems, as well as peacekeeping operations in Iraq and Afghanistan. UAS are a key element in the intelligence, surveillance, and reconnaissance (ISR) portion of the revolution, and they are expanding into other missions as well with the advent of armed hunter-killer UAS platforms. These trends support the notion that the US market alone will account for 76% of worldwide RDT&E expenditures on UAS technology over the next decade and about

1 Unmanned Aircraft Systems: Comprehensive Planning and a Results-Oriented Training Strategy Are Needed to Support Growing Inventories GAO-10-331, March 26, 2010. Available at http://www.gao.gov/new.items/d10331.pdf.

58% of the procurement.

These UAS projections represent higher shares of the marketplace than for defense spending in general, with the US accounting for about 64% of total worldwide defense RDT&E spending and 38% of procurement spending. These noteworthy shifts are due to heavier US investment in cutting-edge technologies, and the marked lag-time in such research and procurement elsewhere, especially major aerospace centers in Europe. This follows similar trends in other cutting-edge technologies observed over the past decade by market analysts. Those areas of growth include precision guided weapons and information and sensor technology integrated with military application of space systems.

Market expectations show sales of UAS will follow recent patterns of high-tech arms procurement world-wide with the US leading the industry and Europe representing the second largest market followed closely by Asia-Pacific rim countries which remain less than transparent about future expansion plans. The rest of developing countries are expected to reflect modest markets for UAS development.

Despite the lack of routine access to the National Airspace System (NAS) and slow federal formulation of suitable UAS standards and practices, a civil market for UAS is beginning to materialize. Market analysis for the public government (non-defense) UAS industry reflect a slow but steady emergence over the next decade starting first with government organizations requiring surveillance systems similar to military UAS to meet coast guard requirements, border protection organizations, and similar national security organizations. Today's approved commercial UAS operations are very limited and mostly involve the smallest category UAS; but, as government application and access expands, it will pave the way for a broader and more lucrative non-government UAS marketplace.

1.1 Purpose

This study was commissioned to explore the feasibility of hosting and sustaining elements of the UAS industry in Southern New Jersey. The relative newness of the industry poses questions as to business requirements and economic viability. Does South Jersey have the physical infrastructure, airspace requirements, manpower base, and local support to sustain such an emerging industry? Are there barriers to attracting the UAS industry to South Jersey? These are a few of the questions that are addressed in this report.

1.2 Scope

The goal of this report is to identify the nature of the UAS industry, its potential growth, and the suitability of South Jersey to accommodate and sustain the needs of this industry. While the scope of this report spans the UAS marketing perspective in southern New Jersey and highlights some existing economic incentives, it does not fully investigate the full range of incentives that could be available to prospective aerospace industry if considered by New Jersey state, county, and local governments. Ultimately, there are a multitude of economic incentives that will need to be explored and considered in depth.

2 DESCRIPTION OF THE INDUSTRY

2.1 History

UAS, also commonly referred to as Unmanned Aerial Vehicles (UAVs) or Remotely-piloted Aircraft (RPA), are air vehicles equipped with sensors and software that enable the craft to fly without a human pilot on board. UAS in use today are typically piloted by a human remotely, but the technology is headed toward allowing greater autonomy such that the aircraft takes off, flies, and lands itself. UAS are considered in the context of a system which includes the air vehicle, the control and communications systems, and the remote human operator(s). In addition, the payload of the UAS is the core element of the aircraft's mission. UAS payloads vary significantly and can include: sensors for reconnaissance, surveillance, targeting, or detection of biological or chemical weapons; cargo for transport to troops in remote areas, and; weapons for combat mission deployment.

UAS have come to the forefront of the American psyche in terms of how America fights its enemies and its wars. "During the last week of the Gulf War, thousands of Iraqis surrendered…One of the most unusual surrenders took place when a remotely-piloted vehicle droned above the battlefield, surveying potential targets. Five Iraqi soldiers waved white flags at its tiny television camera. It was the first time in history that men surrendered to a robot."[2] That particular UAS has long since retired and now hangs in the Smithsonian National Air and Space Museum for all to revere in our nation's Capital. More recently in April 2009, UAS again captured the imagination and respect of the general public when it became known that a US freighter captain captured by Somali pirates was rescued by Navy SEALS who were aided in the mission by the surveillance images from a UAS flying above. The news media, who refer to them as "drones," are not the only ones spreading their fame. UAS are infiltrating all facets of pop culture being featured in blockbuster movies and trendy video games watched and played by main stream society all over the world.

What many fail to realize is that UAS are not nearly as novel as they might think. The beginnings of unmanned aircraft can be traced back to World War II. In fact, UAS were developed alongside manned aircraft and many times were used to prove manned flight concepts when the risks were deemed too high for human testing. It wasn't until the 1960s that UAS took on the role of reconnaissance and combat during the Vietnam War. Until recently, however, the technology to expand and realize the vast potential for unmanned aircraft did not exist or was cost prohibitive. The advent of the microchip and the Global Position Satellite (GPS) system has enabled the UAS industry to achieve

2 "Air Power in the Gulf War", James P. Coyne, October 1997.

exponential growth that will continue for the foreseeable future. The UAS industry is global in nature with virtually all industrial nations participating.

Today, the UAS market is predominantly a military applications market, with UAS recently seeing action in theaters of war including Kosovo, Afghanistan, and Iraq. The incipient civil market for unmanned vehicles includes an array of potential applications relating to emergency services, public security, and commercial sectors such as communications, media, and inspection services. Despite the undeniable potential and benefits that can be gained with expanded roles for UAS, the market for significant commercial applications awaits resolution of practical and regulatory barriers. Currently there is lack of standards, regulations, and procedures to govern *routine* integration of UAS in the NAS.

Regardless, it is estimated that there are about 300 UAS manufacturers in 43 countries, including Iran and North Korea. In addition, approximately 100 U.S. companies and organizations are involved in UAS research, development, or manufacturing. U.S. manufacturers have greater than 78% share of the projected UAS market and could gain control of an additional 5 to 10 % over the next decade. Figure 1 shows that Northrop Grumman and General Atomics-Aeronautical System Inc. (General Atomics-ASI) are the top U.S. players, dominating the market at 64% collectively. No other individual company has more than 3% of the projected market share.

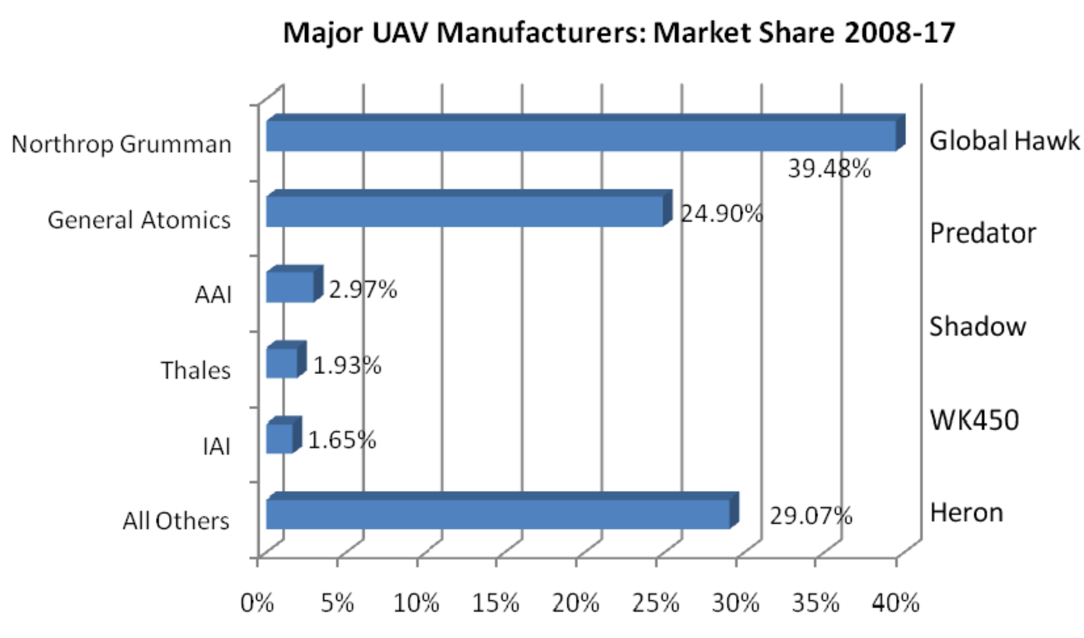


Figure 1. UAS Market Share Projections for 2008-2017

2.2 UAS Types

UAS vary to such a large degree that there is currently no agreement on a classification system. The inventory is made up of an extensive range of craft, from very small hand-launched vehicles to strategic UAS the size of passenger aircraft. UAS can weigh less than one pound and over 26,000 pounds, operate from the surface to above 65,000 feet, operate from zero airspeed (hover) to in excess of 400 nautical miles per hour, or fly missions enduring minutes to days. For example, the smallest DoD operational UAS is the four-pound Raven that flies for about one hour at 50 knots and normally below 1000 feet. The largest is the Global Hawk, which weighs 25,600 pounds, and flies at 400 knots for over 30 hours at 65,000 feet. It is for reasons like this that traditional methodology used to classify manned aircraft does not apply to the UAS industry. For the purposes of this report, a broad generic grouping methodology is presented in Table 1.

Table 1. UAS Categories

UAS Category	**Altitude**	**Typical flight duration**	**Typical Uses**
High Altitude	Over 60,000 ft (above class A airspace)	Days/weeks	Surveillance, data gathering, signal relay
Medium Altitude	18,000 – 60,000 ft (class A airspace)	Days/weeks	Surveillance, reconnaissance, hunter-killer
Low Altitude	Up to 18,000 ft (class E airspace)	Up to 2 days	Surveillance, data gathering
Very Low Altitude	Below 1,000 ft	A few hours	Reconnaissance, inspection, surveillance

2.3 Market Size and Growth in UAS

The future is bright for the Unmanned Aircraft Industry. The Teal Group, a Virginia based aerospace and defense market analysis firm, "estimates that the market will more than double over the next decade from current worldwide UAV research, development, test, and evaluation (RDT&E) and procurement expenditures of about $4.9 billion in 2010 to over $11.5 billion in 2019 (as they have reflected in Figure 2). If operations and maintenance expenditures are added, these totals would be even greater.” 3

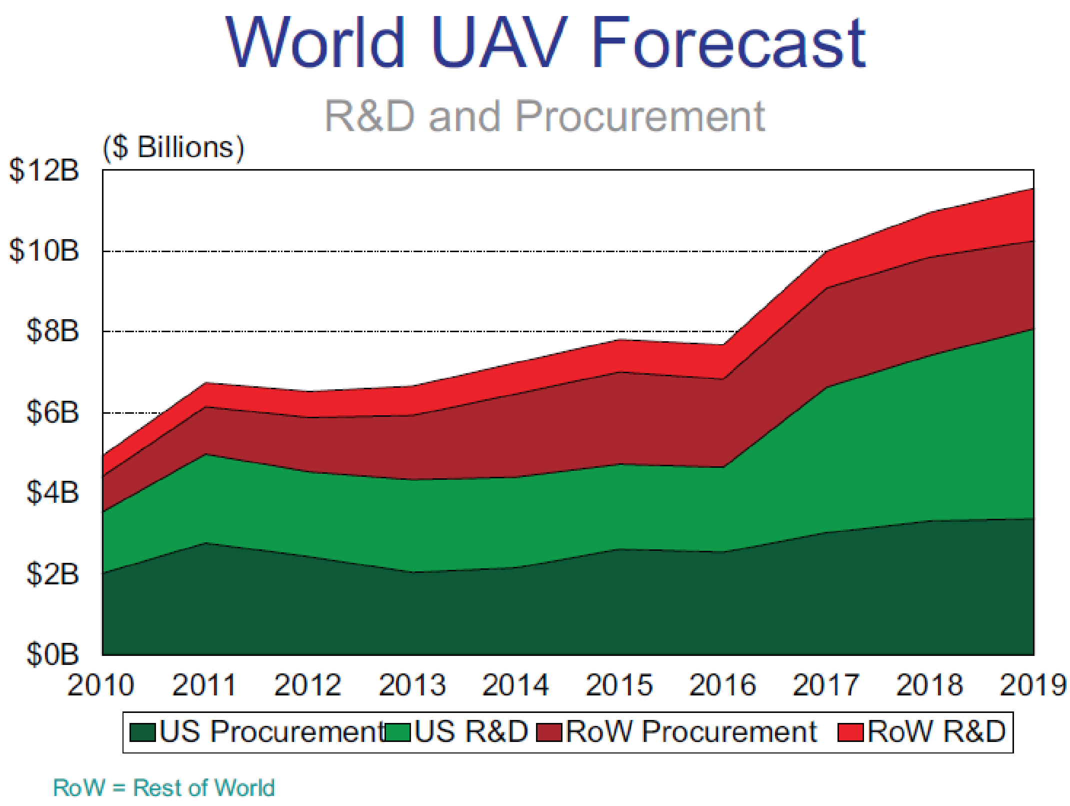


Figure 2. World Unmanned Aircraft Forecast

The US military is the largest customer for UAS followed by Europe and then Asia. Coalition forces are using UAS in every theater the military is currently operating in and many nations are interested in incorporating this capability into their National Defense Strategies. The DoD has already developed its future strategies to fully incorporate UAS into the battle space.

In recognition of the broad use of unmanned ground and maritime systems and the need to facilitate the integration among platforms as well as with manned systems, DoD released the second edition of its integrated “Unmanned Systems Roadmap 2009-2034” (Roadmap) in March 2009.4 The roadmap identifies a DoD-wide vision for all unmanned systems, identifying critical capabilities, obstacles and priorities for the next 25 years. The DoD is

---

3 Teal Group: 2010 World UAV Market Profile and Forecast. Executive Summary available at http://www.tealgroup.com/index.php?page=shop.product_details&category_id=2&flypage =flypage.tpl&product_id=98&option=com_virtuemart&Itemid=5.

4 Department of Defense (DOD) Unmanned Systems Roadmap 2009-2034. Available at http://www.dtic.mil/cgi-bin/GetTRDoc?Location=U2&doc=GetTRDoc.pdf&AD=ADA522247.

implementing the Roadmap despite a November 2008 GAO report that identified problems in the effectiveness of DoD's management and integration efforts.5

In the military sector, the DoD continues to invest aggressively in unmanned systems and related technologies. The President's FY09 budget for unmanned systems is shown below in Table 2. In aerial systems, the estimated budget in FY09 was $3.4 billion, the majority of which was for procurement. Starting in FY09, the trend for RDT&E investment declines, showing the transition to procurement and increase in operations and maintenance funds in the out years.

Table 2. President's Budget for Unmanned Systems: 2009-2013

PORs FY09PB ($M)	Funding Source	FY09	FY10	FY11	FY12	FY13	Total
	RDT&E	1291.2	745.5	136.2	108.7	68.9	2353
UGV	PROC	33.4	42.3	53.5	59.5	21.1	210
	O&M	2.9	3.9	3	12.8	10.1	33
	RDT&E	1347	1305.1	1076.4	894	719.5	5342
UAS	PROC	1875.5	2006.1	1704.7	1734.3	1576.2	78897
	O&M	154.3	251.7	249	274.9	320.2	1250
UMS	RDT&E	57.3	73.8	63.2	70.1	76.9	341
	PROC	56.7	78.4	95.9	91.6	103.7	426
	O&M	5	4.5	11.3	13.5	13.9	48
Total		4823	4513	3393	3260	2911	18900

UGV=unmanned ground vehicles; UAS=unmanned aircraft systems; UMS=unmanned maritime systems; RDT&E = research, development, test & evaluation; PROC = procurement; O&M = operations &maintenance
Source: DOD FY 2009-2034 Unmanned Systems Integrated Roadmap

Although this study focuses on the unmanned aircraft industry specifically, it should be noted that this is a segment of the much larger unmanned industry which includes ground and maritime vehicles and is also growing exponentially.

The capability needs of the unmanned systems have been defined by the DoD to include the following priorities:

- Reconnaissance and surveillance,

5 Unmanned Aircraft Systems: Additional Actions Needed to Improve Management and Integration of DOD Efforts to Support Warfighter Needs - GAO-09-175, November 14, 2008. Available at http://www.gao.gov/new.items/d09175.pdf.

- Target identification and designation,
- Counter-mine and explosive ordinance disposal
- Chemical, biological, radiological, nuclear reconnaissance

There is large potential for civil applications of UAS, ranging from surveillance and reconnaissance to scientific data gathering or delivery of services (e.g., crop dusting, telecom relays). However, the absence of standards, regulations and procedures to govern the safe integration of civil-use UAS into civil airspace are key factors limiting growth in the non-military UAS sector. As a result, most civil operations of UAS in 2009 were related to test or demonstration flights. According to a 2010 study by the Teal Group, world civil UAS production is forecast to make up 5.3 percent ($237 million) of the $2.9 billion in 2010 global production value, rising to 10.5 percent ($3.8 billion) of global production value ($44.9 billion) by 2019.6

The capabilities possessed by UAS have not gone unnoticed by the civilian market. There are many applications for use in today's market but because of lack of sufficient standards and regulations there is extremely limited access to the NAS civil UAS. Civil UAS are those that are not conducted by a public government agency. The applications for utilizing UAS in the civil arena is growing each day and fanning the flames to establish a regulatory guidance along with policy and procedures to allow civil use. Concurrently with the efforts under way to clear the barriers to commercial use, development efforts continuing to refine UAS applications include:

- Security surveillance (borders, ocean patrol)
- Earth observation and environmental science
- Agriculture
- Firefighting
- Power and gas line inspection

3 UAS OPERATIONAL CLIMATE

3.1 FAA Airspace Access

UAS are currently flying in the NAS on very limited basis via a process of special authorization granted by the FAA. The ability, or more precisely the inability, of UAS to operate routinely in the NAS is a topic that has drawn high level attention and focus. Congress has mandated that the FAA research and develop standards to reduce restrictions and grant more widespread access to the UAS community. This is a daunting challenge for the FAA who's obligation is to protect the American citizen both in the air and from things that transit our airspace that could potentially cause damage to people and property on the ground. The pressure to assimilate the UAS community is staggering

6 Teal Group: 2010 World UAV Market Profile and Forecast. Executive Summary

and has resulted in Congress forming the Executive Committee (Ex-Comm) National Airspace System Access Working Group whose members represent the major stakeholders in public UAS access; DoD, Department of Homeland Security (DHS), Department of Transportation (DOT), and National Aeronautics and Space Administration (NASA). The Ex-Comm is chartered to jointly develop solution sets to the current barriers hindering NAS access, and to produce a strategic plan to achieve significantly expanded access within the next five years while also providing a long-term path to the ultimate goal of safe, seamless, routine integration of UAS in the NAS.

3.2 UAS Operations

DoD, DHS, and NASA currently operate various UAS in the continental US and internationally on a daily basis. In areas where DoD has total control of the airspace (i.e., war zones), UAS operations are not limited in scope and operate according to DoD rules. Within the US, UAS are routinely operated in restricted airspace under DoD control. As a highly relevant example, South Jersey accommodates this requirement in Restricted Area 5002 (R5002) known as Warren Grove Range, 17 miles north of the Atlantic City International Airport. R5002 is operated by the NJ Air National Guard, an organization that maintains a good relationship with qualified industry participants and has a long history of utilization for research, test, and evaluation. Operations outside of R5002, or any restricted airspace, requires explicit coordination and approval from the FAA through either the Certificate of Waiver or Authorization (COA) process or the Special Airworthiness Certificate-Experimental Category (SAC-EC) process.

Approval is not guaranteed and even when successful, these processes can be time consuming (lasting up to two years in some cases) before access is granted. The proponent must present extensive information to the FAA to assure them that the aircraft is safe to operate and specific information about the intended route of flight and use. This can be an extremely difficult task to accomplish even with mature and veteran UAS airframes. When granted, waivers are generally airframe and mission specific and they must be regularly renewed on at least an annual basis. However, it should be noted that for critical and time eminent situations, such operations to assist with the recent floods in North Dakota, the wild fires in California, and the oil spill in the Gulf, special disaster and emergency authorizations have been granted in as little as a few hours.

Despite these hurdles, UAS access and operations are rather slowly, but undoubtedly, expanding every day. Figure 3 illustrates where UAS are currently operating in the US today.

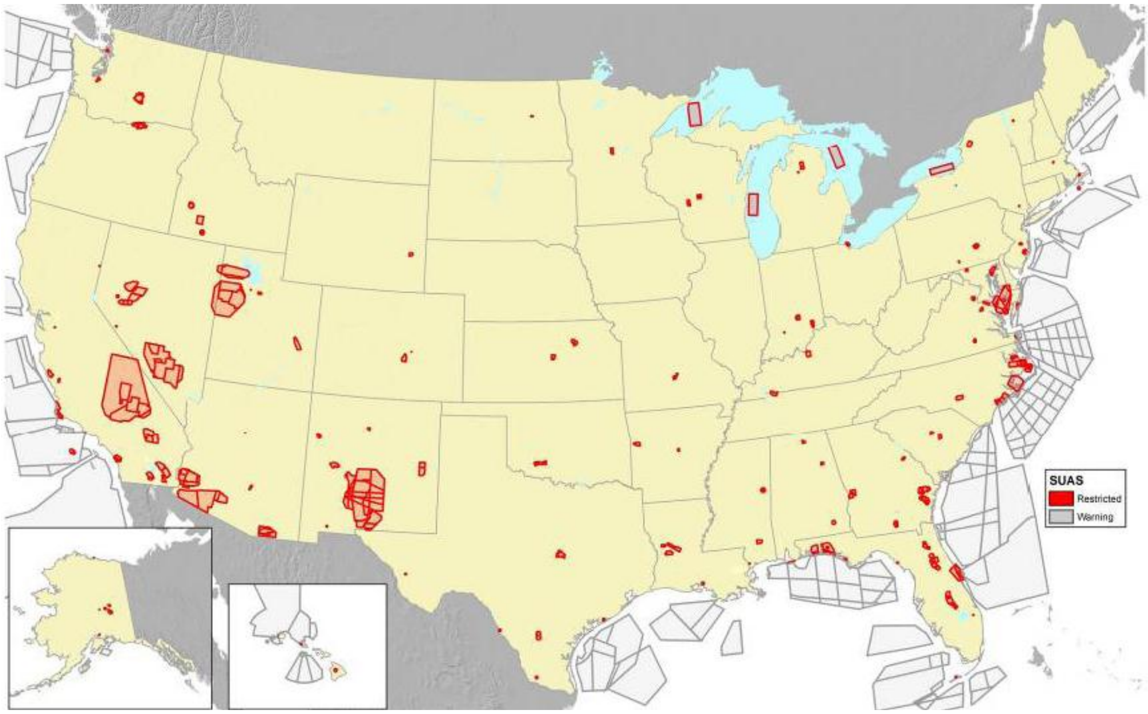


Figure 3. UAS Restricted and Warning Operating Areas

3.3 Airspace

The ultimate goal of the UAS community is the safe and seamless integration of UAS into the NAS. To understand their "file and fly" objective it is imperative to understand the construct of the airspace in the US.

Six classes of airspace are defined in the US, each requiring varying levels of user performance (aircrew/aircraft). Aircraft are controlled to varying degrees by the ATC infrastructure in the different classes of airspace. A brief description of airspace classes follow.

- Class A airspace exists from Flight Level (FL) 180 (18,000 feet MSL) to FL600 (60,000 feet MSL). Flights within Class A airspace must be under IFR and under the control of ATC at all times.
- Class B airspace generally surrounds major airports (generally up to 10,000 feet MSL) to reduce mid-air collision potential by requiring ATC control of IFR and Visual Flight Rules (VFR) flights in that airspace.
- Class C airspace surrounds busy airports (generally up to 4000 feet AGL) that do not need Class B airspace protection and requires flights to establish and maintain two-way communications with ATC while in that airspace. ATC provides radar separation service to flights in Class C airspace.
- Class D airspace surrounds airports (generally up to 2500 feet AGL) that have an

operating control tower. Flights in Class D airspace must establish and maintain communications with ATC, but VFR flights do not receive separation service.

- Class E airspace is all other airspace in which IFR and VFR flights are allowed. Although Class E airspace can extend to the surface, it generally begins at 1200 feet AGL, or 14,500 feet MSL, and extends upward until it meets a higher class of airspace (A–D). It is also above FL600.
- Class G airspace (there is no Class F airspace in the United States) is also called "uncontrolled airspace" because ATC does not control aircraft there. (ATC will provide advisories upon request, workload dependent.) Class G airspace can extend to 14,499 feet MSL, but generally exists below 1200 feet AGL and below Class E airspace.

Accordingly, Classes B, C, and D relate to airspace surrounding airports (terminal airspace) where increased mid-air collision potential exists; Classes A, E, and G primarily relate to altitude and the nature of flight operations that commonly occur at those altitudes (en route airspace).

ATC provides separation services and/or advisories to all flights in Classes A, B, and C. They provide it to some flights in Class E, and do not provide service in Class G. Regardless of the class of airspace, or whether ATC provides separation services, pilots are required to have the capacity to "see and avoid" other aircraft during all conditions. Figure 4 depicts this airspace with representative UAS and their anticipated operating altitude.

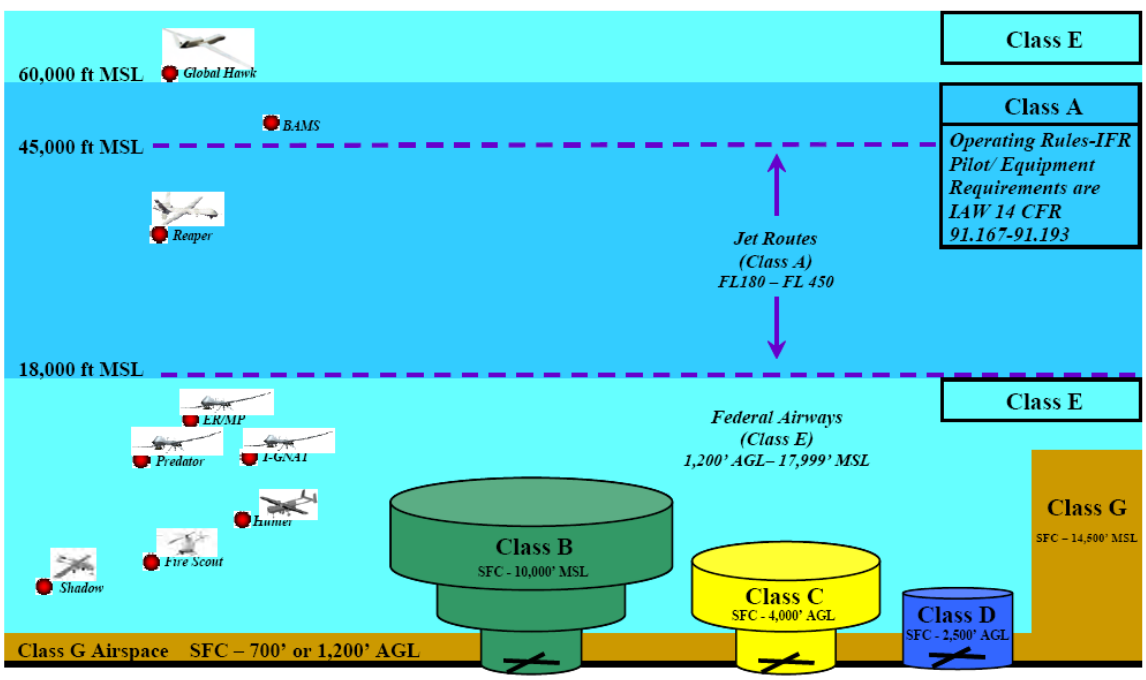


Figure 4. US Classes of Airspace

3.4 Access and Barriers Specific

The UAS community as a whole faces several barriers to routine access to the National Airspace System. There are estimated to be between 1500 and 2000 variants of UAS in the field or in development today with very little commonality in design or operation. Because the FAA has not developed any regulatory standards for development, certification, aircrew qualification, or operations for *routine* access, the FAA is forced to look at each UAS separately. There are a wide variety of UAS. They range in size from under one pound to thirteen thousand pounds. Some are controlled by line of sight communications and others can be flown from any location around the world using satellite communications. Their performance characteristics vary just as greatly in altitude, airspeed, turn rates, and endurance. These systems were not designed to operate in the National Airspace System and therefore data to support the viability, interoperability, and compatibility was not provided to the FAA. This data is now being collected and analyzed to support UAS integration. There are basic concerns about what happens during a loss of communication link between the UAS and the operator. There are questions about the "see and avoid" requirements for aircraft operations in the NAS. There are issues with separation standards. Currently no UAS can accept a visual approach; no UAS can accept an instrument approach. A UAS can not be told to follow traffic or to maintain a visual on traffic. All these questions and more must be satisfactorily answered prior to being granted access.

4 STRENGTHS AND OPPORTUNITIES FROM THE SOUTH JERSEY INDUSTRIAL PERSPECTIVE

According to the national Aerospace Industries Association (AIAA), the industry directly employs approximately 600,000 workers in the U.S. There are currently 119 aerospace companies operating in New Jersey. Workforce issues are critical to the industry, playing out in the expanding range of occupations, and in the education of existing workers as they are kept up to date on new materials, processes and procedures.

4.1 Highlights of State National Workforce Issues in Aerospace

The Bureau of Labor Statistics estimates that between 2006 and 2016 the industry will add approximately 10 percent to the workforce. A recent survey of 30 major companies by AIAA estimated hiring needs of almost 59,000 employees in the next five years. Lockheed Martin alone estimates it will need to hire 140,000 in the next decade.
While the median age of the national workforce is 39.9, the median age of an aerospace engineer is 54, and other occupations range from 45-54. Over 58 percent of the workforce is over age 50, indicating that the majority of employees will be eligible for retirement in the near future. Only 22 percent of the workforce is 35 years or younger—consequently, a large pool of engineers and technicians will need to be in the pipeline to meet the demands of employers. Security clearances are also a common requirement in aerospace industry. Aerospace occupations require a wide array of skill levels and rely heavily on

proficiencies in math, engineering, mechanics, computer and electronic science, and physics. Occupations also require attention to detail, strong problem-solving or troubleshooting skills, and the ability to work under deadline. Almost 70 percent of jobs in aerospace companies relate to research and development, production, and maintenance operations. Examples of these various aerospace jobs include:

- Engineers & Scientists: Aerospace engineers, astronomers, atmospheric scientists, electrical engineers, electronics engineers, materials engineers, mechanical engineers, and physicists
- Technicians & Specialists: Aerospace and operations technicians, avionic technicians, electrical and electronic engineering technicians, mechanical technicians, air traffic controllers, aircraft launch and recovery specialists, air communications and airfield specialists, and radar and sonar technicians.
- Trades: Aircraft mechanic and service technicians, sheet metal workers, engine and other mechanics, first line supervisors of mechanics, and welders.
- Operators & Assemblers: Aircraft and systems assemblers, electromechanical assemblers, CNC operators, inspectors and testers, machinists, and cargo handlers.
- Supply Chain Management. Critical to any successful aerospace industry venture is an efficient supply chain and effective supply chain management.

Other jobs include sales, finance, management, office administration and support functions that are common to any business. South Jersey's strong employment base in commercial and military operations yields a significant number of jobs at the technician, trade, and engineering levels.

Additional strengths include:

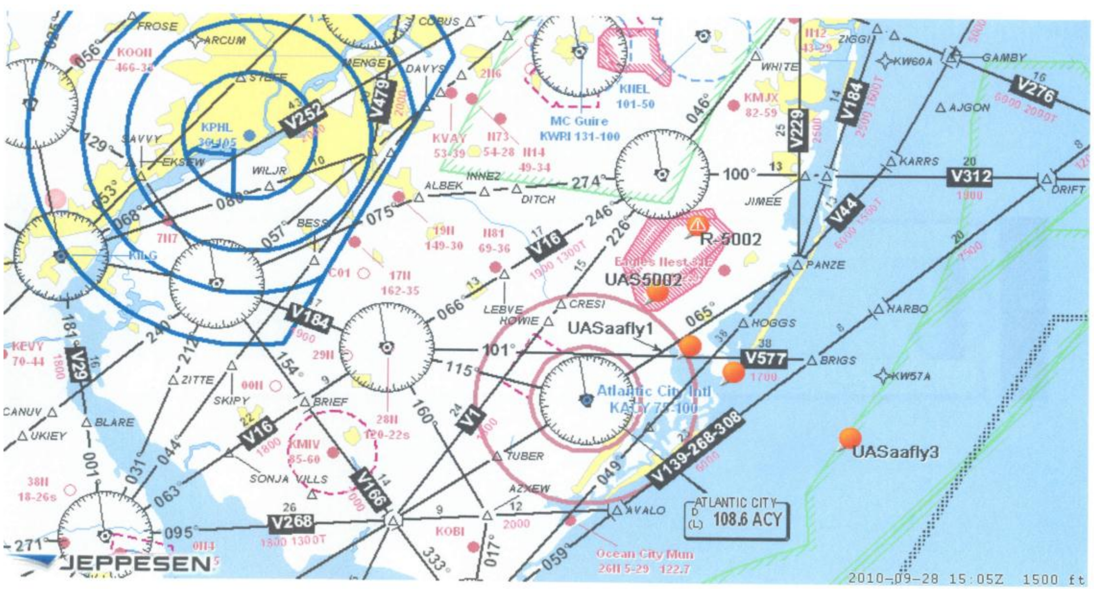
- Overall breadth and scale of existing industry including a mix of large and small companies and markets in both military and civilian aerospace applications.
- Industry expertise and concentrations of employment in: Aircraft maintenance, Precision manufacturing, Composite repair, National security.
- Multi-skilled, highly motivated workforce with an exceptional work ethic, producing high quality output.
- Research base in aerodynamics, controls and intelligent systems, multi-spectral sensors, composites, and weather systems.
- Large military installation with expertise in engines, aircraft maintenance and modification installation, engine repair, and fuel systems.
- Proximity to the FAA's federal laboratory for research, development, operational test and evaluation – the WJH Technical Center.
- Test facilities that include restricted airspace (Warren Grove and W107) and long/wide runways, and that are supported by technicians knowledgeable in aircraft systems.

4.2 Southern New Jersey Airspace

Southern New Jersey finds itself with a unique advantage with respect to proximity of special use airspace. Restricted area 5002 is owned and operated by the New Jersey Air National Guard and has a long history of utilization as a facility for development and test of unmanned aircraft. The primary part of the airspace extends from the surface to 14,000 feet and has a full spectrum of target sets optimum for payload work. Warren Grove Range also has a paved runway suitable for launch and recovery of most unmanned aircraft currently in the field and in development. In addition to R5002, Warning Area 107 is conveniently located just off the South Jersey shore and extends from the surface to Flight Level 50. This area is optimum for development and test of unmanned aircraft system maritime operations.

There are several local airports in South Jersey capable of hosting any UAS currently operating or in the developmental phase. In particular Woodbine Airport has a long runway and the capacity for expansion of ground facilities. At a minimum Woodbine Airport would provide a good alternate landing site because of its close proximity to ACY. Its close proximity to the restricted and warning areas also make this a choice location. Atlantic City International Airport would also make a choice location to base a UAS industrial company. The airport offers full air traffic control services, ample ramp space, and extremely close proximity to the restricted and warning airspace. The addition of the NextGen Aviation Research Park at the FAA WJH Technical Center also creates a synergy between other aerospace and government agencies not available at any other location in the nation. A notional routing has been created in Figure 5 below to demonstrate the proximity and potential benefits of operating in the South Jersey area.

Figure 5. South Jersey Airspace Infrastructure



The current airspace adjacent to the Atlantic City International Airport contains a variety of opportunities not readily available in other parts of the country and also affords close proximity to ACY, a major multi-user field and R&D facilities. Twenty five miles to the east are major Warning airspace facilities, W-107 that encompass over 100 square miles, 3000-50000 feet upon request with VACAPES (Virginia Capes) Naval Control Facility. This is the closest, but just one of three major airspace facilities available of this type. In addition, seventeen miles to the north is R-5002 the closest restricted area of three in the vicinity that allows users to perform a variety of operations requiring this specific type of airspace. The orange pin markers illustrate general paths to these two airspace facilities and serve to illustrate current pathways that could notionally be utilized in a request for UAS transit operations for the area.

Figure 6, on the following page, shows a proposed flight pathway for UAS in a working area described by W-107 found in the FAA flight planning supplement. The orange pin points “UASaafly” illustrate a least invasive over flight of ground infrastructure to include the center of the Atlantic City’s Absecon Inlet waterway to the edge of W-107. This avoids maximum over flight of residential and industrial surface structures.

Figure 6. Notional ACY UAS Flight Path to W-107

Finally, Figure 7, on the following page, shows a short 17 miles via a straight line north to the orange pin point labeled UASR5002 which would be the restricted airspace of choice for current UAS operations in the Atlantic City area.

Figure 7. Notional ACY UAS Flight Path to R5002

4.3 Southern New Jersey and the Business of Aviation

The overall education level of the workers in South Jersey is comparably high in relation to the rest of the Nation. According to recent statistics released by the New Jersey Department of Labor and Workforce Development, approximately 83% of the residents of South Jersey are high school graduates and 21.3% of the residents have a bachelors degree or higher. Several local colleges and technical schools are offering degrees associated with the aerospace industry. Atlantic Cape Community College is now offering an Associates degree in air traffic control and the Richard Stockton College recently announced it will be offering a Masters of Science Degree in Aviation Simulation and Modeling.

The UAS marketing potential for Atlantic City is grounded in both a significant history of aviation associated with the Atlantic City International Airport (ACY) and the unique combination of the other government entities co-located on the 5000 acre base. ACY is the largest airport facility in southern New Jersey. This airfield and airspace infrastructure adjacent to the facility continues to be the backbone for future aerospace growth in the region. ACY is a joint civil-military airport located nine nautical miles (17 km) northwest of the central business district of Atlantic City, in Atlantic County, New Jersey. Situated in Pomona, it is the major component of a national aviation area that lies on portions of three municipalities: Egg Harbor Township, Galloway Township, and Hamilton Township. The airport is accessible via Exit 9 on the Atlantic City Expressway.

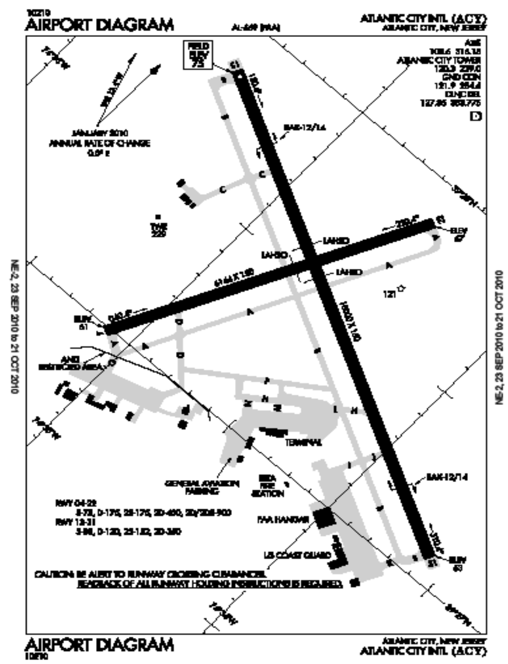


Figure 8. ACY Airport Diagram

The FAA WJH Technical Center also resides on the 5000 acre property and hosts six essential agencies that combine to make this location unique in the world and preeminently postured to support any aerospace industry. The FAA WJH Technical Center is the only federal laboratory which specializes in air traffic management and is the seat of all research, development, test, and evaluation that takes place in the FAA. The relationship with and proximity to this facility and its workforce of approximately 3000 employees is the single most significant draw a UAS industry member will consider when contemplating establishing a UAS-related business in South Jersey. Of direct and significant relevance is the fact that several Cooperative Research and Development Agreements (CRDAs) between the FAA WJH Technical Center and UAS industry partners (namely, The Boeing Company, Boeing-Insitu Inc., Textron/AAI Corporation, General Atomics-ASI, GE Aviation Systems Inc.) are already in place with several more CRDAs currently being considered.

The synergy created between the FAA WJH Technical Center and the other on-base tenants allow for wide range creativity and end-to-end research and testing in the aeronautics industry. The other co-located government agencies, which account for an additional workforce of 1,500 people, are highlighted as follows:

- The South Jersey Transportation Authority (SJTA) owns and operates ACY. The airport contains buildings and structures only on about 40% of the total build-able surface area located on the south side of the airfield.

- The New Jersey Air National Guard (NJANG) 177th Fighter Wing operates the F-16C/D Fighting Falcon, maintains a 24 hour alert mission, and owns and operates the Warren Grove Range.

- The Coast Guard Air Station (CGAS) Atlantic City operates HH-65 Dolphin helicopters and maintain a 24 hour alert in the National Capital Region.

- The Transportation Security Administration's Federal Air Marshal Service has elements of their training center located on the base campus.

- The DHS Transportation Security Laboratory is another federal research laboratory located at the base that is responsible for developing and testing technologies they utilize throughout the Nations' airports.

In addition, The South Jersey Economic Development District has been visionary in its focus on the aviation industry by partnering with NJ state and federal agencies in the development of the NextGen Aviation Research Park which will also be located on property adjacent to and owned by the FAA WJH Technical Center. The NextGen Aviation Research Park is currently under construction is anticipated to add another workforce of about 2,000 high paid technical jobs to the region. Tenants of the research park will include academia and private companies directly associated with the commercial aerospace research industry.

Clearly these are several indicators that any company interested in participating in the UAS market will find a qualified pool of South Jersey residents able to meet their work force needs.

In addition to the aviation-related facilities and manpower that exist, another attraction to the South Jersey region is their association with the Urban Enterprise Zone Program which was developed and instituted to encourage business growth and stimulate local economies. The New Jersey Department of Labor and Workforce Development describes the program details to include:

- Sales tax revenues generated by UEZ businesses are dedicated for use within the zones for economic development projects.

- Businesses participating in the UEZ Program can charge half the standard sales tax rate on certain purchases.

- In addition, UEZ businesses may enjoy tax exemptions on certain purchases and manufacturers may qualify for sales tax exemption on their energy and utility consumption when they meet specified employment and other criteria.

- For each new permanent full-time employee hired, businesses may receive a one-time $1,500 tax credit.

- Employers may also benefit from subsidized unemployment insurance costs for certain employees who earn less than $4,500 per quarter.

The UEZ Program allows a tax credit against the Corporate Business Tax up to eight percent of qualified investments within the zone. Also, businesses may be eligible for priority financial assistance.

4.4 Fifteen Things You Should Know About New Jersey

The following information is an excerpt obtained from the State of New Jersey's official website (http://lwd,state.nj.us).

1. Twenty-three FORTUNE 500® companies are located in N.J. [7]
2. N.J. ranks #5 nationwide in transitioning to the "New Economy" with Knowledgeable Workforce, Globalization, Economic Dynamism, Digital Economy, and Technological Innovation. [8]
3. N.J. ranks #5 for college attainment. [9]
4. N.J. ranks 4th in venture capital investments. [10]
5. N.J. came in second to California with the number of communities making it to *Money* magazine's list of America's Best Places to Live. [11]
6. CNBC ranks N.J. among the top 15 states for business. [12]
7. N.J. is the #1 state in broadband penetration in the country. [13]

---

7 Fortune 500 ® 2008

8 The 2008 New State Economy Index Report.

9 Corporation for Enterprise Development

10 American Electronics Association, Cyberstates 2007

11 MONEY® magazine, August 2007

12 CNBC, July 2007

13 Leichtman Research Group, Inc., March 2007.

8. N.J. is ranked 3rd nationally as best for small business ahead of New York and California. [14]

9. The ratio of Ph.D. scientists and engineers per 1,000 workers is one of the highest in the nation. [15]

10. International trade supports more than 900,000 jobs. [16]

11. CNBC ranks N.J. #1 for Quality of Life. [17]

12. N.J. has the nation's highest concentration of scientists and engineers with over 410,000 working statewide. [18]

13. More than 60 million U.S. consumers are within a four-hour drive of the state. [19]

14. N.J. has a high-tech payroll of $18.4 billion, ranked 6th highest nationally. [20]

15. In an annual study on logistics infrastructure, Northern N.J. ranked #3 in the United States and Southern N.J. ranked #4 for best waterborne commerce capability. [21]

*The businesses, persons and other entities mentioned here are not affiliated with and do not endorse the State of New Jersey, or any aspect of the State.

14 Surepayroll's Top Ten States for Business, 2008

15 Corporation for Enterprise Development

16 Business Roundtable, 2007

17 CNBC, July 2007

18 NJ Labor and Workforce Development

19 US Census "Population Estimates"

20 AeA 2008.

21 Expansion Management Magazine, October, 2007

5.0 CONCLUSION

Overall, this assessment has presented a favorable perspective for UAS future industrial growth within the south New Jersey area. In particular, Atlantic County offers a varied and robust technology environment for fostering the advancement of UAS technologies. The current ground and airspace infrastructure available can easily accommodate major R&D with aviation flight test facility potential unequaled in the northeastern US. This is also evident by the advent of the FAA's willingness to share R&D facilities in promulgating new aerospace technologies. The current adjacent airspace structure to Atlantic City offers a wide and varied utilization potential. The current utilization of many of the airspace warning and restricted areas are currently scheduled at the 40% rate or less allowing for much higher use. Additionally, restricted and warning areas are within close proximity of Atlantic City International Airport allowing for less of an impact on the NAS for prescribed COA airspace descriptions. These would only impact the NAS during transits to and from the available restricted and warning areas.

This potential investment is not hindered by any physical or legal measure of suitability and is competitively predicated on the presumption that NJ would offer a differential economic advantage in tax and operational baselines advantageous to sourcing this industry. There is ample opportunity for multiple companies to invest in long-term research and development, operational planning, execution, and training within the current construct of existing southern New Jersey facilities.

6.0 NEXT STEPS

The next logical steps toward achieving the objective of attracting members of the UAS industry to South Jersey are to conduct a detailed study of economic incentive tools at the disposal of SJEED and to initiate an aggressive socialization campaign within the industry. In this report, the current policy of the Urban Enterprise Zone Program was briefly addressed but there are a host of other incentives that could entice industry members to this location. An in depth analysis by qualified financial advisers and analysts can produce the desired mix of incentives and recommendations. Once those options are developed, a framework for action to recruit businesses should be aggressively employed. This report has not identified any significant barriers that would inhibit the success of this endeavor.