MAGIC Sky

MINOT
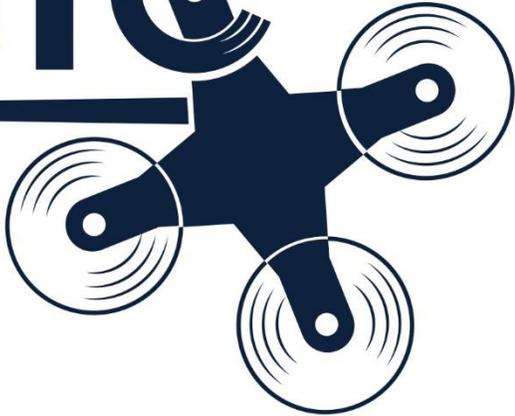AREA DEVELOPMENT CORPORATION

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MAGIC Sky Initiative
White Paper

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Introduction

The Unmanned Aerial Systems (UAS) industry is an emerging industry that has experienced exciting growth and demand over the last few years, which has led North Dakota to be known as the drone state. With a rural setting and wide open skies, Minot is a prime location for UAS operations. Between military and commercial uses, the opportunities are unlimited for UAS businesses in the Minot area.

In late December 2016, the Minot Area Development Corporation (MADC) announced the MAGIC Sky initiative, representing the tremendous potential for the UAS industry in Minot. This initiative combines strategic partners across the state to promote Minot as a top-destination for UAS companies. MAGIC Sky also represents MADC's efforts and commitment to help foster and support the maturing of the UAS industry.

Advantages of MAGIC Sky

Proximity to the Bakken: Minot is located within Ward County, one of the sixteen oil and gas producing counties in North Dakota. Being located directly in the Bakken enables Minot to have access to key players in the Bakken, some of these include: Hess Corporation, Enbridge, Aggreko, Creedence Energy Services, NewKota Services and Rentals, and many more. More than 30,000 miles of pipeline exist in the state of North Dakota, which by law must be inspected every 2 weeks. North Dakota is the 20th largest oil producer in the world and the 2nd largest producer in the nation. 55% of North Dakota's oil is transported via pipe, 29% rail, 8% refined, and 8% by truck. Minot is strategically positioned to serve as the go-to city for Bakken inspections.

Open Skies: Minot's uncongested and diverse airspace, makes Minot's open skies a desirable location for UAS operations. Uncongested airspace is best for UAS, as most UAS operate outside controlled or restricted airspace, which minimizes interference from other airspace users. Low populated regions help reduce risk for UAS operations as well, in the event of system failures. Minot's diverse weather climate makes UAS more economical and safer compared to human or manned helicopters. Minot's open skies are the perfect test bed for Beyond Visual Line of Site operations (BVLOS). SkySkopes, a leading drone service provider, received approval from the FAA to operate UAS at the Minot International Airport; this is one example of the advantage of Minot's open skies as this most likely wouldn't be allowed in a larger city.

Top Industries: Agriculture and energy are the key markets for UAS operations, these industries also happen to be Minot's targeted industries due to numerous advantages Minot has to offer.

- **Agriculture:** Agriculture is the #1 industry in North Dakota, with Minot serving as the hub of production. North Dakota ranks #1 and #2 in 15 different ag commodities: Barley,

Beans (all), Beans (pinto), Canola, Flaxseed, Honey, Peas, Wheat (all), Wheat (Durum), Wheat (Spring), Beans (black), Beans (navy), Lentils, Principal Crops Harvested, Sunflower (oil), Sunflower (all), Sunflower (non-oil). North Dakota exports Ag products to over 83 countries across the globe, which solidifies the crucial role of Minot's distribution and logistical services have globally. Minot area farms are unsurpassed in the amount of on-farm storage for diverse crops they raise, a distinct advantage for end-use processors. Minot area farms also use high-tech farm machinery and field application techniques to ensure quality commodities. Studies show that rising populations and shifts in diets will lead to a 138% economic growth in Ag imports for developing countries, which means the demand for Ag product exports will increase for North Dakota (USDA).

- **Energy:** North Dakota energy projects have the capacity to produce 325 million gallons of ethanol, 85 million gallons of biodiesel, and 2,500 megawatts of wind power. As the second largest oil producing state in the nation, North Dakota's two refineries have a total refining capacity of 88,000 barrels per day. With over 30,000 miles of pipeline in our state (excluding the 1,172 mile stretch of the Dakota Access Pipeline), many servicing companies and high-profile professionals have made Minot their home due to Minot's close proximity to the Bakken. In addition to oil and gas, North Dakota's wind energy potential ranked in the top 10 states for greatest wind capacity (North Dakota Dept. of Commerce). Minot is home to ideal UAS end-users like Xcel Energy, MDU, Central Power, and Verendrye. Coal is also an exciting industry for UAS in North Dakota. There are currently 5 active lignite mines in North Dakota, with a coal production of 27.7 million tons. The lignite industry generates approximately $3 billion in gross business volume within the state, a great industry for UAS to tap into.

Minot's Education System: Between Minot Public Schools (MPS) and Minot State University (MSU), Minot's education system serves as a great advantage for the UAS industry.

MPS currently offers an Aviation Technology Program that prepares students for their Private Pilot License (PPL). There are two different courses offered within the Aviation Technology Program, once the program is completed students are ready for flight training and the FAA private pilot's verbal exam. MPS targets and prepares children at a young age to enter the aviation workforce. MSU also serves as a valuable resource for the UAS industry, providing a talented pool of graduates each year.

MSU is known for its outstanding academic quality and strong educational standards, a distinct advantage for the Minot region and Minot workforce. As the UAS industry enters the Minot area, there are excellent educational and workforce opportunities for cyber security and data analysis. Security, anti-virus, protection, algorithms, and data storage are all aspects that will need to be addressed with UAS in the Minot area; which in turn leads to a great opportunity for MSU.

"Minot State University looks forward to being an active partner with Minot's MAGIC Sky initiative, and working closely with companies such as SkySkopes to provide new opportunities for our students and graduates. New and emerging industries such as unmanned aerial systems

are exactly the kinds of areas where North Dakota needs to be focused, ensuring we have a diversified economy prepared to lead the nation and the world in the decades ahead," said Dr. Steven Shirley, President of Minot State University.

Distribution/Logistics: Minot's distribution advantages make Minot a standout location for the energy and agriculture industries. Minot is strategically located at the intersection of two Class 1 railroads (BNSF & CP). Only seven Class 1 railroads exist in the U.S., therefore Minot's unique location at the intersection of two is a distinct advantage. With access to 2 Class 1 railroads, Minot provides coast to coast accessibility. BNSF travels to Seattle, Minot, Chicago, and Los Angeles whereas CP travels from Vancouver to Chicago. Minot also provides access to 3 U.S. Highways (HWY 83, HWY 2, HWY 52) and is located at the top of the Central North America Trade Corridor.

SkySkopes: SkySkopes, a leading drone service provider, announced its expansion to Minot in Dec. 2016 and was deemed the first achievement of the MAGIC Sky initiative. SkySkopes was ranked among the top 3 UAS companies in the nation to operate in the oil and gas industry for (DronesX). With a team of highly qualified pilots, SkySkopes conducts aerial inspections, energy audits, mapping and other tasks using cutting-edge drone and sensor technology to provide valuable data to customers. SkySkopes has accepted a partnership with MADC to help MAGIC Sky reach its full potential. As a nation-wide industry leader, SkySkopes's is dedicated to helping MADC make Minot the center location for UAS access to the Bakken.

Collaborators: The MAGIC Sky initiative is facilitated by the Minot Area Development Corporation (MADC), who is highly involved in the Minot community and has earned topnotch partnerships throughout the state. MADC's strategic partners will help leverage the opportunities for UAS companies. Among MADC's Board of Directors are ideal end-users for the UAS industry, including MDU, Enbridge, NewKota Services & Rentals, Ackerman-Estvold engineering, Xcel Energy, Verendrye Electric, SRT Communications, and more. Having connections with top executives and decision makers for potential clients is a huge advantage for UAS companies looking to expand to the Minot area. MADC also has strong partnerships with Minot State University and Minot Public Schools, both of which will serve as great workforce opportunities for the UAS industry. Other potential opportunities for this particular industry, includes servicing the Minot Air Force Base and collaborating with the North Dakota Petroleum Council; which MADC can facilitate these introductions. MADC's membership represents the many end-users who would benefit from UAS. Between customers, workforce, and future opportunities; it's evident that Minot's locations and MADC's connections serve as a great benefit for UAS companies looking to take advantage of Minot's MAGIC Sky.

Legislative Representatives: North Dakota's legislative representatives are extremely responsive to the people of ND and are known for their high involvement with business commerce within the state. It's very common for ND legislative representatives to have a presence during exciting milestones in Minot, but they also leverage their positions to fight for particular projects in the MAGIC City. Matt Dunlevy, President/CEO of SkySkopes, says "North Dakota legislators have been extremely involved within the UAS industry. The pioneering by

our legislators has been provided a tremendous opportunity for North Dakota to take a leadership position in the UAS industry over the last decade. Their leadership brought beyond-visual-line-of-sight permissions to our UAS test site, and they facilitate the possibilities of new UAS companies coming to the state. Only in North Dakota would one find such open minded and accessible legislators."

Proximity to Minot Air Force Base: The Minot Air Force Base (MAFB) is located just 15 miles north of Minot with a population of approximately 12,000. The MAFB is the only base housing two components of the nuclear triad for the U.S. Air Force. In 2016, the base had an economic impact of $591 million in Minot. Approximately 1,400+ retired military personnel make up Minot's workforce and about 500 highly-skilled servicemen and women transition out of the military each year to join the civilian workforce. Minot's proximity to MAFB serves a valuable benefit for the UAS industry because of the potential workforce and end-user opportunities. Retired military make superior UAS pilot's or other workforce professions in the UAS industry due to their military training, background, and special skillsets. The military is a market full opportunities for UAS businesses, ranging from security screening on a local level or infield applications. Minot's close proximity to the MAFB is a strategic advantage for UAS businesses looking to tap into the military market or secure a qualified workforce.

Opportunities and Demand
Bakken Applications: There are four key applications for the Bakken; pipeline inspection, oil storage tanks/boilers, site surveys/pre-construction, and volumetrics.
- **Pipeline Inspection:** UAVs can be used for above and below ground pipelines, fuel gas lines, valves, flanges, connections, seals, etc. Typical pipeline inspections are performed visually from an airplane and by foot. Inspections via UAS have more benefits to offer companies. The real value comes from data that UAS sensors capture, then transform into actionable data. For example, different IR (infrared thermal imaging) camera systems can be integrated on UAS to detect a variety of concerns for a pipeline company. With over 30,000 miles of pipeline in ND and the requirement of biweekly inspections; cost savings and efficiency for pipeline inspection is in high demand (this even excludes the 1,172 mile stretch of the Dakota Access Pipeline).
- **Oil Storage Tanks/Boilers:** Inspecting oil storage tanks and boilers are time consuming and expensive. UAS can be used both internally and externally to inspect storage tanks and boilers, which in turn provide applicable data and increase safety. The inspection time and cost can be significantly reduced by using UAS.
- **Site Surveys/Pre-construction:** UAS provide highly accurate Digital Elevation Models, and contour maps for new work sites and expanding work sites. UAS allow for a faster and more accurate collection of land elevation data. The data has a turnaround time of one or two days, which is much more efficient than current methods.
- **Volumetrics:** Many companies use volumetrics to calculate the mass volume of various variables, for example: mining services, landfill volume, stockpile management, reservoir volume, site topography, density calculation, environmental assessments, etc.

Stockpile management and reservoir volumes are two common volumetric uses for the Bakken.

Military Applications: UAS can be utilized for surveillance, disaster response, or search and rescue (SAR) needs.
- **Surveillance:** Whether a situation requires long-term monitoring or rapid deployment to gather time-sensitive information, unmanned aircraft has proven to be most cost-effective and accurate way to collect data. For example, an unmanned aircraft can use a high resolution camera or thermal imaging sensors that is customized to a particular mission's requirements.
- **Disaster Response:** Unmanned aircraft equipped with high resolution cameras or thermal imagers provide a bird's eye view of disaster areas, which can also assist relief crews in determining the most efficient use of their resources. During a disaster, every second counts when it comes to saving lives. Utilizing UAS provides real-time monitoring, reliable, and up-to-date data to help first responders make more informed decisions.
- **Search and Rescue (SAR):** UAS are highly effective for search and rescue operations due to range, flight time, sensor capabilities, and cost. UAVs are relatively inexpensive compared to manned aircraft, making them more affordable and applicable for SAR operations. UAS offer a bird's eye view and can be achieved virtually anywhere within a matter of minutes.

Agriculture Applications: As agriculture remains ND's top industry, the applications and demand for UAS are extremely high. Normalized Difference Vegetation Index (NDVI), hyperspectral, and drainage are key agricultural applications.
- **NDVI:** Collecting data of crop health is extremely valuable for farmers. Drones offer a more efficient way of collecting data due to the high resolution imagery. The data is collected by using a multispectral sensor. Multispectral sensors provide a better insight to the health of crops, compared to a regular Electro Optical (EO) camera. With the multispectral data, UAS inspection creates NDVI, which provides an image that can visually show crop health. For example, green meaning healthy, yellow meaning so-so, and red meaning no vegetation at all.
- **Hyperspectral:** Hyperspectral sensors are similar to multispectral sensors, however hyperspectral looks at thousands of different bands of light versus only a few. This allows for greater spectral detail, meaning you can also determine the species of plant and cause of plant distress, in addition to pant health. Hyperspectral provides important information regarding hydrology, environmental monitoring, and invasive weed mapping. Collecting data for crop insurance is one great example of using hyperspectral sensors.
- **Drainage:** UAS can collect drainage mapping and elevation data with high resolution and previse elevation maps. Farmers can avoid standing water, soil erosion from runoff, nutrient loss, saving farmers time and money.

Infrastructure Applications: UAS are used for the inspection of powerlines, wind turbines, bridges, railways, highways, and more. Thermal inspections and 3D models are also common infrastructure applications. There are many advantages in using UAS for these types of inspections, as most inspections are best performed visually from a low flying aircraft. The ability to fly, for example powerlines, using UAS lowers the cost and provides customers with higher resolution imagery. The data collected can be processed by software that assists with precise vegetation management, engineering inspections, asset management, and maintenance inspections. Using UAS for infrastructure applications also increases efficiency and worker safety. For example, using UAS to inspect wind turbines can be done at a much faster pace. Time savings can be achieved by inspecting multiple turbines daily with the use of UAS, instead of one or two daily by workers. Being able to detect cracks, erosion, and other damaged areas on the blade via UAS is much safer compared to manned inspections. Thermal inspections with UAS show energy efficiency of buildings or structure. This data is used to identify leaks, structural damage, faulty insulation, and other infiltration/exfiltration of heat around structures. UAS are also used to capture imagery to create accurate 3D Models of structures and building. This is done by taking many images from different angles and heights, using software with photogrammetry to create 3D points of the entire area. This type of data is very accurate and can be used for a wide variety of applications. There is a wide-range of uses for UAS infrastructure applications, all of which provide a more safe, cost efficient, and accurate way to collect data. Minot's strategic location offers great opportunities and demand for the inspection of wind turbines, transmission lines, railways, highways, and more.

Cost Savings, Efficiency, and Safety Improvements for Existing Business in ND: With fluctuations in the oil and gas industry, agriculture industry, and state/local funding… businesses in North Dakota are looking for ways to save money and increase efficiency. Timing is everything, especially for a newer industry to enter a new market. There is no better time than the present for the UAS industry to enter the Minot market.

Business Synergy: Minot has a lot to offer the UAS industry. There is a realistic potential for Minot to serve as a UAV/UAS hub, featuring all parties within the value chain, including end-users, manufacturers, operators, and data analyzers.

Aviation Education: The existing aviation programs offered at Minot Public Schools is a great introduction for young adults to enter the UAS industry. Minot Public Schools has been in conversations with SkySkopes to collaborate together to grow the aviation training in the Minot area with hopes to increase the workforce.

Cyberspace Education: As a new industry enters the Minot area, so does new workforce opportunities. Minot State University (MSU) will grow and develop a cyberspace program to accommodate the new workforce trends and opportunities. Cyberspace will have an immense impact on the UAV/UAS industry, leaving a special niche for MSU to provide a talented workforce of highly trained young professionals. Dr. Steven Shirley, President of Minot State University stated, "MSU is excited to welcome such cutting-edge drone technology to the Minot area. The UAS industry fits directly into a new initiative, called "NexusND," underway by the

North Dakota University System. Led by Chancellor Mark Hagerott, the goal of this initiative is to develop research, education, workforce training, and economic development highly attuned to North Dakota's economy in three sustainable and high-growth sectors: cybersecurity, high performance computing, and unmanned aerial systems. MSU is thrilled to take part in NexusND and to support the growth and development of UAS in Minot and in central & western North Dakota."

New Business: In addition to the agriculture and energy industries, there are many other opportunities for UAS to be used in North Dakota. Whether its cinematography or thermal imaging for commercial uses, there are existing use applications for UAS that are beyond the current target market of MAGIC Sky. Without a doubt, there are also application opportunities that have yet to be discovered as well.

Data Collection & Storage: Minot is an established location for data collection and storage, offering strategic advantages with our capacity, climate, and workforce. Minot is proud to be the home of SRT Communications (SRT), the largest telecommunications cooperative in the state of North Dakota. SRT provides over 50,000 active services to their customers, and has the capacity to serve the Minot Air Force Base. Data analysis is imperative for UAS operations and as these industries expand to Minot, so does the opportunity for data collection and storage.

Conclusion

With a business friendly climate, state incentives, reduced state regulations, and many other statewide benefits, there are many reasons North Dakota has become a top state for drone activity. Minot offers unique advantages for the UAS industry with close proximity to the Bakken, open skies, targeted industries, strong educational systems, strategic distribution/logistics, SkySkopes, strong legislative representatives, and connections to ideal clients and top executives. All of these components make Minot's MAGIC Sky a strong and strategic initiative to attract UAS businesses to the Minot area. With Minot's key industries aligning with the target market of UAS, there is great demand for UAS operations. Minot is not only the perfect location for end-user applications, but also offers many opportunities for the industry as well as local incentives. MADC is committed to leveraging the MAGIC Sky initiative to promote Minot's advantages and develop the opportunity available for the UAS industry.