

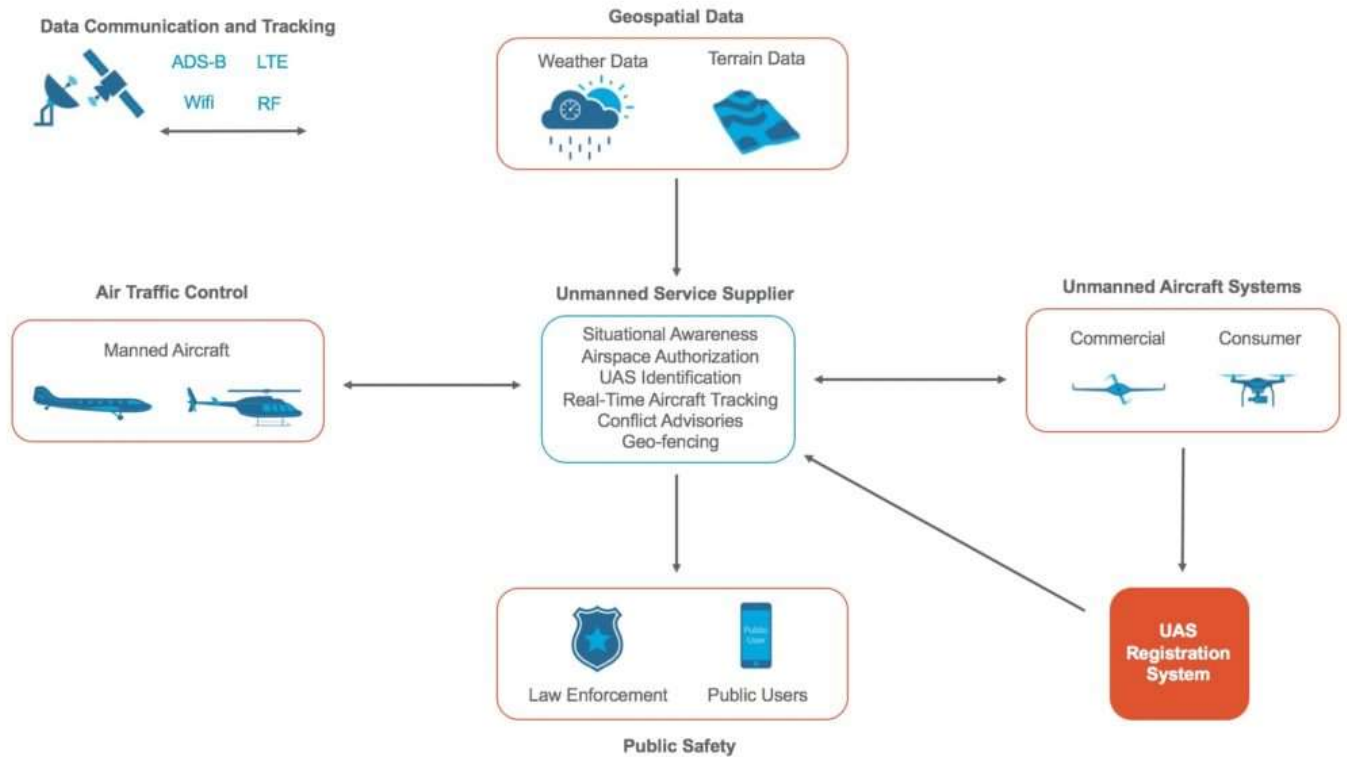
UTM Deep Dive: A Multi-Billion Dollar Market You Can't Ignore

[October 9, 2017](#) By Austin Bohlig

Legislation and infrastructure are two of the biggest hurdles facing the unmanned aircraft industry. An Unmanned Traffic Management (UTM) system is an important solution. We recently had Jim Williams, who has deep expertise on the subject, guest author a piece about the importance of UTM ([here](#)). This post is a deep dive on the UTM opportunity that will identify the core UTM technologies, quantify the market opportunity, and discuss how UTM will facilitate the emergence of autonomous technologies.

Quick Overview of UTM

Unmanned Aircraft Systems (UAS) Traffic Management (UTM) is a concept created by NASA to safely integrate manned and unmanned aircraft into low altitude airspace. In more basic terms, UTM is a system that allows drone operators to connect to a central coordinating service that manages unmanned operations at low altitudes (under 400 feet). This type of service is important for the future of unmanned aircraft because the FAA does not manage airspace below 400', except near large airports, leaving the majority of the country's low altitude airspace as uncontrolled. UTM is a global initiative to offer an interoperable solution that will ultimately allow for routine beyond-visual-line-of-sight (BVLOS) flights and highly automated operations. The exhibit below highlights how information might flow between a UTM system and other airspace constituents:



Source: Loup Ventures

Key Technologies Enabling UTM

There are many technologies that are required to support the UTM concept. Each function will provide massive market opportunities for large individual companies as well as emerging startups. The 4 key technologies that will enable UTM include UAS Service Suppliers (USS), drone tracking and remote identification, vehicle-2-vehicle (V2V) communication, and detect and avoid (DAA) sensors.

UAS Service Suppliers (USS) – The core functionality of a UTM system will be managed by a UAS Service Supplier (USS). The role of the USS is still evolving, but we know that USS will be commercial entities with approval and oversight by a government agency, such as the FAA. The USS would be the central hub, where all other stakeholders (drone operators, hobbyists, air traffic control, law enforcement, and the public) come for situational awareness regarding unmanned aircrafts. USS will also provide crucial information for commercial drone operators, which include airspace authorization, UAS identification, real-time aircraft tracking, conflict advisors, and geo-fencing.

The ideal USS will provide an independent, highly automated and scalable system that will manage and monitor drone flights, as well as factor in inputs from external sources such as terrain, weather, air traffic control, making this data available to all commercial drone operators or service providers. In addition, the USS will send notifications to external stakeholders like public safety and state agencies.

Drone Tracking & Remote Identification – For a USS to provide real-time situational airiness, it will need to be capable of tracking and identifying drones in-flight, which is attainable through familiar commercial wireless broadband solutions. These communication channels include LTE, radio frequency, Automatic Dependent Surveillance – Broadcast (ADS-B), and wifi. While the industry is still exploring which of these technologies is the best solution, we anticipate UTM will lean on a combination of radio frequency transmission and cellular networks. ADS-B is currently used to track manned aircraft and this technology will be mandated in all manned aircraft by 2020. ADS-B modules have historically been too large to fit on commercial grade drones, but recently a few companies have brought drone-tailored ADS-B to market. Given ADS-B is already standard aviation equipment, we see this as a practical solution for tracking. However, when the manned ADS-B system was built, it was not meant to incorporate millions of drones on the same network. Due to spectrum bandwidth saturation, we do not believe ADS-B will be mandatory in every drone, but only for more advanced autonomous applications. Telecom providers such as Verizon and AT&T have built their LTE networks to handle this type of density, and while LTE is not standard aviation approved equipment, we see LTE as a viable complementary solution. In areas where LTE coverage is poor, some combination of ADS-B, RF and wifi can fill the gap.

Currently, there are no established requirements or voluntary standards for electrically broadcasting information to identify an unmanned aircraft while it's in the air. To help protect the public and the National Airspace System from “rogue” drones, government agencies, such as the FAA, have set up a new Aviation Rulemaking Committee (ARC) that will help create standards for remotely identifying and tracking unmanned aircraft during operations. The ARC will identify, categorize, and recommend available and emerging technologies for the remote identification and tracking of UAS. Based on conversations with industry contacts, we believe the technologies previously discussed are all applicable solutions for remote ID.

V2V Communication – Not only will unmanned aircrafts need to be able to communicate with the USS, but drones will also need to be able to communicate with other drones, which is better known as vehicle-2-vehicle (V2V) communication. While the same technologies that enable drone tracking, such as LTE and ADS-B, will likely be used to communicate with other drones, we believe there will be additional solutions available for shorter reach communication like DSRC (dedicated short range communication). DSRC based on radio frequency that will likely be used by self-driving cars to communicate with other vehicles on the road. We believe it makes sense for UAS Service Suppliers to communicate with all drones as well as other autonomous technologies such as self-driving cars, marine vehicles, and other mobile robots. While enabling information transmission between vehicles is important, we view the crucial aspect of V2V as cyber-security — making sure drones, self-driving cars and other autonomous systems can communicate with each other on a secure network.

Detect and Avoid (DAA) – UAVs' ability to talk with each other via LTE, ADS-B, and other communication technologies will allow for autonomous drones to avoid obstacles known to the USS – but what does a drone do if it loses all connectivity? Many drones are now coming equipped with sensors such as LIDAR, radar, and 3D imaging. These sensors, coupled with advanced machine learning capabilities, allow drones to sense and avoid other UAS and manned aircraft without the need to be connected to a network. Though the sense and avoid technologies

brought to market thus far are impressive, there is still a large opportunity for startups to bring better DAA solutions to market.

Regulation (Not Tech) Remains Biggest Hurdle For UTM

While innovation is still needed on the technology side to support the UTM concept, we believe the largest hurdle to full drone deployment in most countries remains regulation. In the US, commercial drone operations are limited to applications that are within visual line of sight, not over people that are not directly related with the drone operation (i.e. over crowds), and flights during the day. While the FAA allows for drone operators to file for waivers to perform these more advanced drone applications, this process is not efficient. Allowing for beyond-visual-line-of-sight (BVLOS) flights is the most important potential regulatory change. The US and other countries are working on bringing more favorable drone regulation to market; however, due to the time it takes to enact a policy, we don't expect any meaningful regulatory changes to occur in the US until 2018 at the earliest.

UTM Key to Enabling BVLOS Applications

Implementation of UTM will positively impact the aircraft community in many ways; most importantly, UTM will enable new and larger market opportunities. Specifically, it will allow for routine aforementioned beyond-visual-line-of-sight (BVLOS) flights. Flying BVLOS, for example, is required for companies like Amazon to deliver packages via drones. That said, once a UTM system and favorable regulations are in place, it does not mean all drones will be able to fly BVLOS. Drones will likely need to be Type Certified with the FAA or other regulating bodies to perform BVLOS applications. While the current Type Certification (TC) process is costly (~\$2M) and takes 2+ years to finish, we believe there is a new process currently being reviewed internally by legislative leaders that will significantly lower the cost and speed up the process. While this could be an important change, we do not believe the new process will be in place for at least two years, which gives current companies progressing through the traditional Type Certification process a near-term competitive advantage.

Industry Coming Together to Create a Global UTM

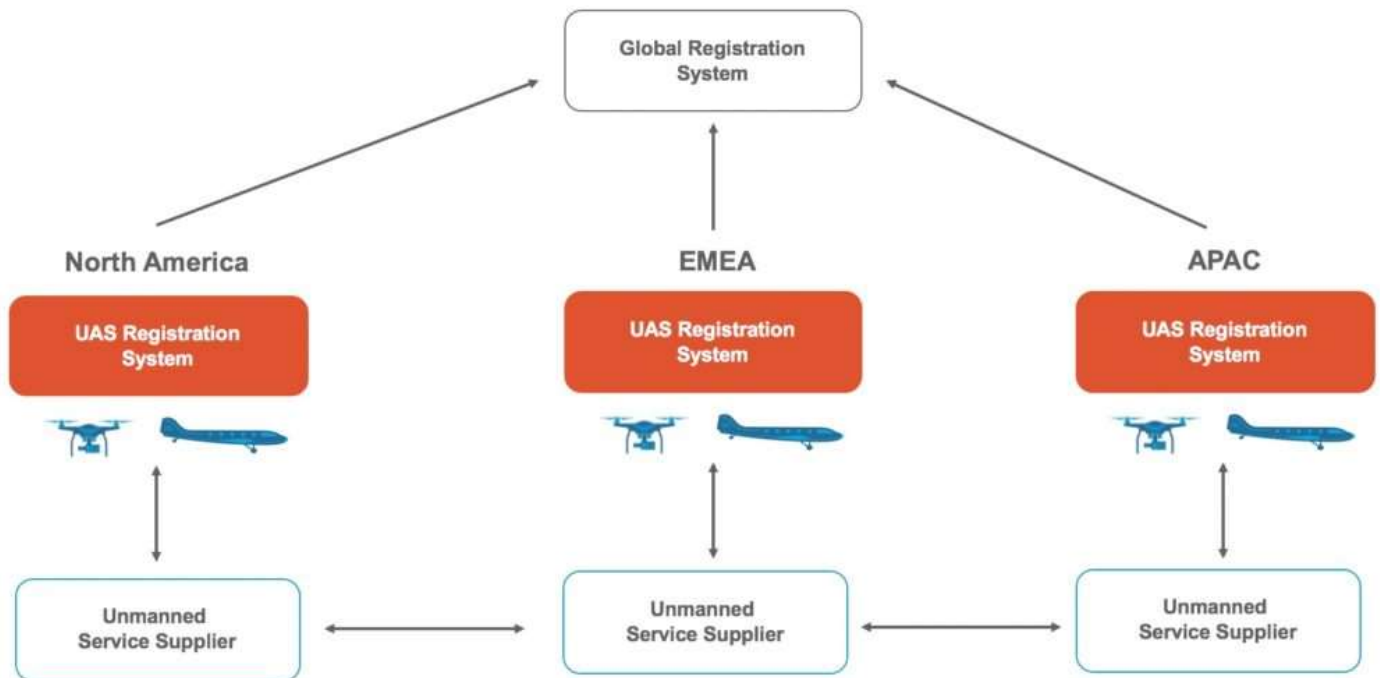
Due to the number of drones that will be operating in any given locale, the industry is going to need several UAS Service Suppliers for a single country, as well as hundreds across the globe to support the situational awareness needed for manned and unmanned aircrafts to operate together. While each nation will regulate drone use as it chooses, the industry needs to collaborate to set standards and protocols for drones to communicate with USS in different countries. The Convention on International Civil Aviation, also known as the Chicago Convention, established the International Civil Aviation Organization (ICAO), which is a specialized agency of the UN charged with coordinating and regulating international air travel. All countries that comply with the Chicago Convention have access to routinely fly into and out of other countries that comply. While this convention currently centers around manned aircraft, we anticipate certified drones will be treated the same way. The Global UTM Association (GUTMA) is a non-profit consortium of worldwide Unmanned Aircraft Systems Traffic Management (UTM) stakeholders,

and is an example of an important industry collaboration to help bring safe, secure, and efficient integration of drones to national airspace systems across the globe.

Drone Registry Is A Key First Step To UTM

While it will take time until we have a global connected UTM system, we believe the first step will be creating a global registry for unmanned aircraft. At the 2017 Drone Enable ICAO’s UAS Industry Symposium, the ICAO suggested a compelling solution. Given the ICAO currently operates the Aircraft Registration System, which is used to register all manned aircraft across the global, ICAO recommend they also host an international drone registry system. This will allow all drone registry systems to connect with each other, as well as create a plug-and-play solution for countries that don’t have registration system in place. In the exhibit below, we demonstrate how we see an international drone registry connecting into the UTM.

Drone registration has been a significant topic of debate within the U.S. drone community after the U.S. Court of Appeals barred the FAA from requiring hobbyists to register their unmanned aircrafts. Until May 2017, when this decision was made, the FAA required all drone users to register their drone online, which cost \$5 and only took minutes to complete. The registry was designed to help law enforcement identify rogue drones, but looking longer term, a registry establishes an early solution to remote identification. While we believe the U.S. will implement new regulations requiring all drones to be registered, it would be a headwind to UTM development if registration requirements were delayed.



Source: Loup Ventures

USS An Investable UTM Opportunity

Although we believe there are going to be many significant opportunities related to UTM, we view the UAS Service Suppliers as the most investable and sustainable theme. There are currently no companies that have stepped forward to take on the role of a USS, but several drone software companies have partnered with NASA and the FAA to support the development of the concept. These companies that are helping create the UTM solution and contributing to writing drone regulation have a large competitive advantage once UTM goes live. While there are many early stage startups that have the technology to make USS and UTM a reality, we anticipate companies like Amazon and Google will also have proprietary USS systems for their own vehicle networks. It is likely there are multiple USS providers, thus multiple winners in the space longer term.

How Big Can USS Be?

The pieces that will make up the UTM will represent a multi-billion-dollar market opportunity, but we anticipate the UAS Service Supplier market to represent one of the largest components of the system. We believe a USS would charge for their services as a monthly/annual subscription-type fee with providers charging businesses per drone connection. While early, a reasonable fee maybe anywhere from \$100 – 300 per drone connection on an annual basis. We expect over 414k commercial drones will be sold globally in 2020, at which time we expect most UTM systems to go live. Over the following 10 years, we believe commercial units sold will increase on a 12.5% CAGR, and by 2030 we expect the industry to ship over 1.6M units annually. Based on our 14.6% CAGR assumption for commercial units leaving the base, we believe over 10.8M commercial drone units will be in the national airspace by 2030. A USS will also coordinate with manned aircraft, and based on FAA, as well as proprietary forecast we believe there will be ~280K manned aircraft regularly flying.

Based on a \$200 and per connection fee USS will charge drone operators, we believe the commercial market opportunity is ~\$261M in 2020. However, over the next 10 years as the install base grows we believe the USS market will generate \$1.7B in revenue by 2030, representing a 20% CAGR over that time frame. That said, this estimate only factors in commercial drone units. USS providers could charge as much as 2x more for manned aircraft to connect to the USS. When incorporating manned aircraft, the market opportunity expands in excess of \$2B annually. However, we believe the USS will provide many other services but given the infancy of this market it is hard to quantify the exact dollar amount.

USS MARKET FORECAST

	2020	2021	2022	2023	2024	2025	2026
Global Unmanned Systems Market							
Global Unmanned Systems Market	\$1,200,000	\$1,500,000	\$1,800,000	\$2,100,000	\$2,400,000	\$2,700,000	\$3,000,000
YoY Growth	-	25%	20%	17%	14%	12%	10%
Regional Unmanned Systems Market							
North America	\$400,000	\$500,000	\$600,000	\$700,000	\$800,000	\$900,000	\$1,000,000
Europe	\$300,000	\$350,000	\$400,000	\$450,000	\$500,000	\$550,000	\$600,000
Asia Pacific	\$200,000	\$250,000	\$300,000	\$350,000	\$400,000	\$450,000	\$500,000
Latin America	\$100,000	\$120,000	\$140,000	\$160,000	\$180,000	\$200,000	\$220,000
Middle East & Africa	\$50,000	\$60,000	\$70,000	\$80,000	\$90,000	\$100,000	\$110,000
Global Total	\$1,200,000	\$1,500,000	\$1,800,000	\$2,100,000	\$2,400,000	\$2,700,000	\$3,000,000

UTM Will Manage Much More Than Drones

Although UTM’s primary focus will be managing drone traffic, we believe these platforms will eventually manage other autonomous technologies, such as flying-cars and self-driving vehicles. Uber is working closely with NASA and FAA because they plan to operate their urban mobility aircraft without a pilot on board. Their business model is to have their taxi aircraft operate autonomously similar to the way Amazon plans to operate their delivery aircraft. In our [Auto Outlook](#), we estimated that 95% of all new vehicles sold will be fully autonomous by 2040. For the auto industry to move to full autonomy, a similar UTM-like hub will need to be in place that monitors known environmental data, V2V communication, and detect and avoid, just like the UAV solution. It seems to make logical sense that there could be a centralized UTM that communicates with both unmanned aircraft as well as self-driving vehicles and other autonomous systems to maximize traffic efficiency. Factoring in the autonomous vehicle market leads us to believe the UTM and USS opportunity has significant upside optionality.



Where UTM is Today

Over the past two years since NASA launched its UTM project, the organization has conducted two technology demonstrations and plans two more to test the concepts described here. The third demonstration is planned for early 2018 and will focus on testing technologies that maintain safe spacing between cooperative aircraft (equipped with transponders or ADS-B) and non-cooperative aircraft (only detectable by primary radar) over moderately populated areas. The final demonstration has not been scheduled, but should be close to an actual commercial application of the technology. The plan is for the FAA to take over the program in 2019 to establish the policy needed to approve operations.

Many other countries are also testing UTM concepts. Europe seems to be the furthest along. They refer to their UTM project as U-Space, which is a set of new services and specific procedures designed to support safe, efficient, and secure access to airspace for large numbers of drones. While initial U-space services are expected to be operational by 2019, initial test partners suggest that half of the U-space services could be deployed today. For a deeper dive into U-Space see [here](#).

Bottom Line

While the industry has advanced UTM in meaningful ways, there is still a lot that industry and government constituents need to do in order to make this concept a reality. Improvements are needed on the technology front, but the biggest challenge remains regulation. We believe the autonomous vehicle industry and governments across the globe see the benefits of UTM, and we anticipate favorable regulation will eventually be put in place. Based on NASA's progress and the effort those participants are investing in their technical demonstrations, we believe the first implementations of UTM will go live around 2020. The time is now to invest in core technologies that will enable UTM, because it will play a major part in our automated future.