

A Small High-Tech Firm Entering China's Market: A Case Study of ADS-B Technologies Inc

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Abstract:

ADS-B Technologies is engineering and consulting firm located an Anchorage, Alaska. Since 2004, the Company has specialized in the design and deployment of Automatic Dependent Surveillance - Broadcast (ADS-B) systems and their related Communication, Navigation, and Surveillance (CNS) technologies throughout the world. For more than a decade, ADS-B Technologies' Principal Intellectual Contributors have been intimately involved in the creation of ADS-B standards and procedures for the FAA, ICAO, Australia, China, Canada, Japan and several other nations.

This case study shows how ADS-B Technologies Inc develops and expands its market in China, a booming but one of the most challenging market in the world. The market development includes the design, construction, operation, training, regulation and deployment of certified ADS-B ground and avionics systems in a highly regulated market. The findings of this case study will help business professionals to understand how to compete in such a niche market.

Key Words: *Ads-B Technology; Aviation Industry; China's Market; International Business*

1. INTRODUCTION

ADS-B Technologies is an engineering and consulting firm located an Anchorage, Alaska. Since 2004, the Company has specialized in the design and deployment of Automatic Dependent Surveillance - Broadcast (ADS-B) systems and their related Communication, Navigation, and Surveillance (CNS) technologies throughout the world. For more than a decade, ADS-B Technologies' Principal Intellectual Contributors have been intimately involved in the creation of ADS-B standards and procedures for the FAA, ICAO, Australia, China, Canada, Japan and several other nations.

Today, ADS-B Technologies represents a more hands-on experience in the design, construction, operation, training, regulation and deployment of certified ADS-B ground and avionics systems than any other commercial consulting and integration group in the world today. One of ADS-B Technologies' greatest strengths is that the staff is composed of highly professional specialists who actually work with the technology every day. ADS-B Technologies is currently "on the ground and in the air" in five continents, building new systems and developing cutting edge new ADS-B related devices. Because of this real-time, real-world experience, the company can quickly adapt to its clients' emerging requirements and offer the most current information and most accurate consulting on all aspects of the technology.

The company's administrative office, research center and hangar are located on an active taxiway at Merrill Field Airport in Anchorage. Merrill Field is one of the oldest and most historic airports in the United States, with 80- year history of pioneering efforts in commercial and private aviation.

2. LEADERSHIP OF ADS-B TECHNOLOGIES INC

Mr. Nelson is the founder of ADS-B Technologies, LLC and is an internationally-recognized expert in the field of ADS-B deployment and integration. He was one of the original members of the FAA's Capstone ADS-B

Program in Alaska and on January 1, 2001 became the first pilot in the world to use ADS-B in a certified air traffic control environment. His opinion has been featured in numerous publications and media presentations, and he has lectured and taught ADS-B technology in more than a dozen countries. He has personally designed several ADS-B networks, including one for the Civil Aviation Flight University of China, which is recognized as the largest 978 MHz ADS-B network outside the U.S. He was also the first to perform a live demonstration of ADS-B (UAT) on both the Asian and African continents specifically in Guanghan, China (2005) and Dar es Salaam, Tanzania (2006). Mr. Nelson spent the first 25 years of his aviation career as a U.S. Navy fighter pilot and has managed and owned several air carriers during the past 15 years. He holds an FAA Air Transport Pilot rating and currently flies ADS-B test & evaluation aircraft in Alaska on a regular basis.

Mr. Nelson has Bachelor of Science degree from Mechanical and Electrical Engineering department of the University of Miami, a Master of Science degree in Aviation Science from St. Louis College. He also graduated from the U.S. Navy Safety School and the U.S. Navy Fighter Weapons School. He has over 40 years of experience in aviation and associated disciplines (26 years U.S. Military), 23 years as a U.S. Navy Officer, 21 years as a fighter pilot, decorated combat veteran. In 1994, Mr. Nelson founded the first Internet Service Provider Company in Southern Spain. From 2004-2006 he was a chairman of the Alaska Aviation Coordination Council. In 2007 he was co-recipient of the prestigious National Aeronautics Association Collier Trophy for the development of ADS-B.

SPECIFIC EXPERIENCE

- Became the first pilot to fly with a certified ADS-B system and receive “radar-like” critical services (Jan 1, 2001);
- Flown more than 2,000 hours in ADS-B equipped aircraft (1999 – present);
- Keynote Speaker for the RTCA Annual Convention (2002);
- Introduced the Chinese CAA (CAAC) to ADS-B in July 2005, then designed and personally installed a network of 8 ADS-B ground stations (GBTs) across 1,200 km of Central China in 2006 – 2007, thereby creating the largest 978 MHz ADS-B network outside the U.S.;
- Introduced the Tanzanian CAA (TCAA) to ADS-B in Dar es Salaam, Tanzania on behalf of the World Bank and ICAO (June 2006);
- Presented ADS-B to the African Union in Addis Ababa, Ethiopia (Feb 2007);
- Teamed with the Japanese Aerospace Exploration Agency (JAXA) to develop Next Generation ADS-B Collision Avoidance display technology (2006 – 2008);
- Engineer and Owner of 9 Supplemental Type Certificates (STC) for ADS-B installation;
- Taught graduate level courses in Aviation Safety, Aviation Management, Structures and Crash Investigation for Embry Riddle Aviation University (1993 – 1999);
- Vice Commander largest U.S. Navy base Overseas (Rota, Spain).

Mr. Nelson’s experience helps him do business in China for several reasons:

- He had broad experience in aviation and he knew this industry based on his own experience rather than theoretical knowledge.
- Being an aviation veteran for Chinese businesses he could seem like a respected leader and head of ADS-B Technologies Company.
- He was in his late 40s when he went to China for the first time to do business, and was respected for his age in this country.

3. CHINA'S MARKET IN AVIATION TECHNOLOGY: PRODUCT LINES AND PRODUCT EVOLUTION

There are several key products developed by the ADS-B company and successfully used by a lot of aircraft and airports:

- ADS-B Turnkey Flight Following and Air Traffic Management Systems (the original ADS-B).
- Space-Based ADS-B the ADS-B Link Augmentation System, or "ALAS" (developed version).
- ADS-B Multi-Link Airport Surface Surveillance System, or "AMLSS".
- Mobile and Tactical ADS-B Systems.

ADS-B Turnkey Flight Following and Air Traffic Management Systems. One of the products sold by the company to China is the air traffic management system ADS-B, which is the first Space-Based ADS-B system. It is radically new technology that is redefining the paradigm of communications-navigation-surveillance in air traffic management. ADS-B means the following:

- Automatic - No operator attention is required
- Dependent- It relies on very accurate GNSS position data
- Surveillance - Provides aircraft position, altitude, speed, heading, identification and other data
- Broadcast - It does not require interrogation, or triggering by other stations – data is broadcast to any aircraft or ground station equipped to receive the data link signal

As indicated in figure 1, ADS-B is an aircraft and satellite-based transmission system which can be broken into two primary functions, ADS-B Out and ADS-B In. An aircraft equipped with ADS-B Out works by sending GPS-derived position and velocity data from the aircraft systems, through an ADS-B-modified Mode S Transponder or a Universal Access Transceiver (UAT) to other aircraft, ground vehicles and ground stations for the purpose of air traffic control and coordination (Ref 1).

ADS-B allows an aircraft to transmit information to ATC ground stations and to properly-equipped aircraft. Position data is automatically broadcast from all ADS-B Out-equipped aircraft. ATC ground stations and ADS-B In-equipped aircraft will receive this data. ADS-B In is the ability of an aircraft to receive information from other transmitting aircraft and the ATC ground infrastructure. In addition to location data, it will provide traffic and weather information to pilots (Ref II).

In 2004 the company started selling to China, and the first client was the Civil Aviation Flight University of China (CAFUC), which believes ADS-B to dramatically improve the quality of their large-scale flight training operations. Our ground-breaking six campus network at CAFUC spans more than 1,000 miles across Central China and is capable of putting all of the school's more than 400 aircraft on a single screen where supervisors, maintenance personnel, instructors and students can see all of them at one time.

Space-Based ADS-B the ADS-B Link Augmentation System. ALAS is a true over-the-horizon air traffic management system capable of delivering an uncorrupted 1090ES or UAT payload every second from any ADS-B avionics system to a Surveillance System Delivery Point in near real-time from oceanic, remote or mountainous areas where a conventional line-of-sight connection to a terrestrial ADS-B ground station is either impossible, or impractical to maintain (Ref II).

Instead of communicating directly with the ground station, ALAS takes the ADS-B payload and sends it to the Globalstar, or Inmarsat constellations via an L-Band link. The satellite then turns the signal and transmits it to the constellation's gateway on a feeder link. At the gateway, the process is reversed, and the payload is converted by a local GBT into an ASTERIX Cat 21 or Cat 33 message, and then sent via secure circuit to an ATC automation system. Alternatively, the payload could be sent downstream in a raw format to be processed

by an existing ADS-B network. For ADS-B In, the process is simply reversed, and either L-Band, or S-Band are used (Ref III).

Each second, the aircraft's ADS-B transceiver sends a burst of critical data. ALAS couples off a sample, or a snapshot, of that transmission without degrading the data in any fashion. That sample is then reformatted for transmission over the satcom link. On earth it is transformed exactly back to its original form, as if it were received directly via the existing terrestrial system for insertion into air traffic control automation (Ref III).

ADS-B Multi-Link Surface Surveillance System. This Surface Movement Guidance and Control System includes vehicle transceivers and airfield sensors used for airport tracking and management of the airport surface vehicles. As indicated in figure 2, it is a medium and small airport's alternative to systems like ASDE-X, which helps to manage the whole airport surface vehicle tracking. The system is low-cost and is supposed to meet all the requirements of the small airports. One of the benefits of the system is that it could be easily installed in the airport within 2-3 days.

Basically ADS-B LLC is selling its original product to China, which is ADS-B Turnkey Flight Following and Air Traffic Management Systems, which has impressive success in the local market.

4. COMPETITION OF ADS-B RELATED PRODUCTS IN THE US AND CHINA MARKETS

Originally the market for these products was extremely limited. When ADS-B Technologies Company invented this system, there was no market for this product in the U.S. or anywhere else. But as the U.S. contains territories where the only transportation option is via small airplanes, the companies and airports with a high volume of small aircraft traffic were extremely interested in the new product.

The FAA has been developing the Next-Generation Air Transportation System (NextGen) for the purpose of changing the way the National Airspace System operates. NextGen will allow the NAS to expand to meet future demand and support the economic viability of the system. In addition, NextGen will improve safety and support environmental initiatives such as reducing congestion, noise, emissions, and fuel consumption through increased energy efficiency (Ref IV)).

The ADS-B is an important part of the planned NextGen airspace upgrade and will help to create better aircraft visibility at a lower overall cost than before. ADS-B equipment is built to meet two sets of U.S. government standards: DO-260B and DO-282B. By 2020, all aircraft operating in U.S. airspace A, B, C, and partially E will be required to carry equipment that produces an ADS-B out broadcast.

The FAA has published a rule requiring ADS-B transmitters to take effect on January 1, 2020, but there is no mandate for ADS-B In, which receives data (Ref V). FAA supposes that ADS-B will offer increased safety, efficiency and environmental awareness for pilots and air traffic controllers at a lower overall cost than the current radar system.

Along with ADS-B Technologies Company the following businesses are selling and developing aircraft hardware systems:

In China ADS-B technologies are at the first stage of development. There is just one local vendor – TEDC – which is producing ADS-B surveillance systems. There is not much information available in English concerning this company, but it is necessary to say that TEDC worked together with Civil Aviation Administration of China on Chengdu Jiuzhaigou ADS-B project to compare the ADS-B and radar data. The performance of TEDC ADS-B ground receiver provides better sensitivity.

Also TEDC was working on Chengdu - Lhasa project, LiJiang Airport trial project, and H15 air route project which were aimed at increase of the safety of the air transportation and solving the problem of ground

station data processing (Ref VI). Moreover TEDC was the first company in China which product has received CAAC license for the ADS-B 2000A ground station (2012).

Besides TEDC all the other competitors are foreign companies, particularly companies from the U.S. That is why ADS-B Technologies Company began its operations in China in 2005 they did not have any competitors in the local market.

While the FAA mandate to install ADS-B out equipment for aircraft flying in U.S. airspace by Jan. 1, 2020 is more than six years away, aircraft operating in some countries' airspace must be compliant starting this December. Avionics manufacturers are ready with equipment to meet the mandates and avionics shops and aircraft manufacturers are working on supplemental type certificates (STCs) to smooth the path for upgrades in many business jet types.

As indicated in figure 3, ADS-B related technologies developed rapidly in the last several years. According to Universal Weather & Aviation, beginning December 12 Australia is requiring ADS-B out for all aircraft at and above FL290 within 12 nm of Australia's landmass. Hong Kong begins requiring ADS-B on the same date for airways L642 and M771 at and above FL290 and from Dec. 31, 2014, in all Hong Kong airspace at and above FL290. In Singapore and Vietnam certain airways at and above FL290 require ADS-B beginning December 12. Other Asian airspace subject to ADS-B requirements includes Indonesia (effective December 12 at or above FL290), according to Pat Dunn, NBAA IOC regional lead for Asia, who gave a presentation on this subject at the International Operators Conference in March. Europe will require ADS-B by Jan. 8, 2015, for new aircraft weighing more than 12,500 pounds or with a max cruise speed of more than 250 kts and for older aircraft by Dec. 7, 2017 (Ref VII).

5. ADS-B'S CHINA MARKET STRATEGY

5.1 Initial market research in China

The global economy increases cross-cultural communication and inspire companies to go global and do business in other countries. International trade helps to rise sales and profits, builds a company's prestige, creates jobs, and offers variable ways for businesses to develop. But one thing gets tricky: what factors to consider or develop before going global. That is why it is always important to make an initial market research before doing business internationally.

Before selling products or services to another country it is important to make sure that the company representative knows the country's culture, its traditions and special features. If it is planned to enter the Chinese market, then it would useful to visit China, meet with businesses and potential clients and to be familiar with the language and culture. But overall there are some advices on preparations before going globally from Mr. Nelson and based on online resources summary:

It is important to conduct research in order to find the best market for the product. If the company has already chosen a particular country, it could be useful to check what places and areas in the country need the product. Even more it is important to know if the target market already has what you are selling, or there is a need for the product or service that the company could fill.

It is also useful to explore regulations connected with selling particular product. This research will help to minimize any possible risks and will ultimately save time, money, and energy in the long-run.

One of the useful things would be conducting proper market research. The two main types of research include:

- Secondary market research – gather information from public sources including books, newspapers, market reports and studies and the Internet.
- Primary market research – communicate directly with experts, customers, and other important sources of information in order to fill in any gaps after you have conducted secondary research.

The next step is identifying possible risks on the local market, for example, political situation or the existence of regulations or certifications needed in order to sell special products.

After assessing possible risks, the company could access government agencies and/or companies that offer tools and resources to help in eliminating those risks.

Attending trade shows and visiting online trade sites relevant to the company's industry could be useful. These events and resources provide an opportunity to network, make contacts, and begin to develop relationships with potential overseas partners and clients.

In the case of ADS-B going to China almost all the listed steps or advices were followed. There was a proper market research held by Mr. Nelson's employees. Meanwhile he was reading about Chinese culture and the political situation. It is always useful to know who is in power in the country, about sporting events or about film, music and news popular in the country just in case it is mentioned during conversation. If a company's representative knows such details it helps to build good first impression which could be a bridge to the following negotiations and contracts. Moreover, it was important that for the moment ADS-B Technologies was trying to penetrate Chinese market this company did not have any competitors, so it was the question of offering a new level of technologies which could replace aging technologies (radar). That is why Mr. Nelson was trying to reach progressive companies or agents who would be ready for something new, and he found the first client at the conference in Hong-Kong in 2005.

5.2. ADS-B Technologies Business Development in China

ADS-B activity is increasing around the world. ANSPs are looking to ADS-B as a means of decreasing the cost of providing services and increasing the operational efficiency and capacity of the regional air transportation system.

Boeing is actively engaged with European regulators and operators and the FAA to gain approval for Boeing airplanes to operate current ADS-B equipage in European NRA.

The earliest known mandate for ADS-B equipage is November 2010 in Canada's Hudson Bay, where separation will be reduced from 80nml to 5nml in trial. Transport Canada is allowing use of the 1090eS existing equipage for this NRA application.

The next mandate will be December 2013 in Australia. Because much of Australia's western airspace is not covered by radar systems, the country has selected to aggressively move forward with ADS-B based surveillance to avoid the costs associated with deployment and maintenance of expensive radar systems (Ref IV).

As indicated in figure 4, ADS-B Technologies started selling to China in 2005. At the beginning it was just one client - Civil Aviation Flight University of China. They become client after conference on Aviation in Honk-Kong.

“Policy of ADS-B Technology in China” is published by Air Traffic Management Bureau, CAAC in 2007. There is a plan in China to implement ADS-B technologies in small and medium airports all around the country with emphasis on Western part of China. Specifically, the following strategic objectives were announced by Civil Aviation Administration of China:

- Compatible with ICAO surveillance development policies; meet the requirements of future civil aviation transportation and ATS development in China; provide surveillance technical standards, operational procedure as to ensure safety and increase efficiency.
- Evaluation ADS-B system performance and reliability; validation of ADS-B based systems.
- Promote ADS-B application in Western Route to solve the problem of insufficient surveillance and increase flight flow in Western area.
- Keep with international ADS-B technology trends; build ADS-B system nationwide and promote ADS-B system applications; increase national civil aviation surveillance ability and airspace utilization efficiency; meet the requirement on surveillance system from future flow increase.
- Adopting the Technology policies of developing and applying Radar and ADS-B surveillance system simultaneously.
- Implementation of ADS-B air-air application (ADS-B IN) (Ref VI).

6. Lessons Learned from China's Market

One of the advices on making business abroad was about finding a good agent to help the company in building contacts with foreign businesses. There are several parameters which an agent should fit to be helpful. First of all he has to know English and the local language. In our case the knowledge of Chinese languages is important, preferably Mandarin, Wu and other dialects. Secondly, it should be person in his late 40s or older, as in China businessmen of that age are considered more valuable and respected. Moreover, he should have a good face before local businesses. He should be a person you can trust that is why it would be better to find someone based on recommendations.

But even if you are following all those recommendations, sometimes companies still may contact the wrong person and lose money as result.

One unsuccessful attempt for ADS-B Technologies was about finding an agent for being a third party in negotiations with one of the Chinese companies. They have found an agent who was in touch with the company ADS-B Technologies was trying to approach. In fact those agent was postponing the deal on purpose for almost half of the year. He was telling Mr. Nelson that the other party was still thinking on the offer and cannot yet sign the contract. At the same time the agent was telling the other party that ADS-B Technologies is not yet ready to make an official offer. Later, Mr. Nelson contacted directly the other company and found out the agent was lying on purpose just to get paid for a longer period of time. Here, one important lesson from this situation could be that it is extremely important to check the person you are hiring as an agent in another country, especially in China. It should be agent with recommendations and a good reputation or “good face.”

One of the contracts signed by ADS-B Technologies Company was the one with the Civil Aviation Flight University of China (CAFUC) 2006 - 2011. It was also the first contract the company signed in China. CAFUC is the only full-time regular institution of higher education for civil aviation pilots, as well as technicians of other civil aviation specialties and high-quality applied professionals in engineering, management and arts required by national economy, under the direct jurisdiction of Civil Aviation Administration of China. With its headquarters in Guanghan City, Sichuan Province, CAFUC has four flight training sub-colleges in Xinjin, Guanghan, Luoyang and Mianyang and two air terminals in Luoyang and Suining. It has set up seven colleges, including College of Flight Technology, College of Air Traffic Control, College of Aviation Engineering, College of Air Transport Management, College of Computer Science, College of Foreign Languages, and College of Cabin Attendants, Sports Department, Simulator Training Center, Aero Engine Maintenance Training Center, Aircraft Repair Plant, Sanxing General Airline Co., Ltd., and Chinese Civil Aviation Scientific Research Base. Now CAFUC has more than 8,000 full-time students. It has formed an educational pattern of “flight orientation and comprehensive development” and is the largest “university of civil aviation” in Asia with a global reputation (Ref VIII).

By the end of November, together with ADS-B Technologies company CAFUC has set up five ground based transceivers in its five airports and has installed more than 200 GDL90 transceivers in aircrafts. Now it is possible to “see” the aircraft of each airport by ADS-B system.

As indicated in figure 5, ADS-B is a new technology for China that is redefining the paradigm of communications-navigation-surveillance in Air Traffic Management. It helps pilots and air traffic controllers to "see" and control aircraft with more precision, and over a far larger percentage of the earth's surface, than has ever been possible before. This is the first time this technology was used in China. For CAUFUC it is important as it can help the crew know the traffic information around them and avoid collision.

CAFUC is one of the agencies which is taking part in ADS-B testing and implementation. As early as 2005, the CAFUC initiated ADS-B validation project, which was finished in 2009. Six ground stations in a sub-college can share the data with the main ADS-B server via the campus network, all the training airplanes could be used for surveillance in real time. ADS-B Technologies Company was helping to set ground stations and with testing.

Another ADS-B Technologies Company client is Jinggong (Beijing) General Aviation Company. This company and its subsidiary Shaanxi Jinggong General Aviation Company are two Category A general aviation companies approved by CAAC. Based on these two companies, Jinggong aviation industry exclusively owns Beijing Badaling Airport; and has set up two operation bases, i.e. Shaanxi Pucheng Neifu Airport and Hebei Huanghua Airport (Ref IX). Jinggong Aviation is doing operations, trainings, and maintenance in the field of aviation. It has an experience in remote sensing, aerial prospecting, control of plant diseases and insect pests, aerial photo shooting and air sightseeing.

In 2008, ADS-B Technologies completed its seventh ADS-B (UAT) Ground Broadcast Transceiver (GBT) site in China at the Badaling Great Wall Airport, which is located 45 miles north of Beijing and within sight of the Great Wall. The airport is owned by Jinggong General Aviation Corporation, which is planning to use it as a model for dozens of similar airfields it plans to develop throughout the country (Ref X).

Taking into account all the information about ADS-B Technologies' clients in China, the firm has been successful to develop its business and market strategies. Its management has successfully retained several key clients which included the governmental agencies and therefore had opportunities to be part of the national plan of ADS-B implementation. Company works through the agent which knows the local market, has connections with Chinese businesses and has a good face. Even if the company does not have the website in Chinese language, it has the link to the company subsidiary/agent in China (Dynasty Aviation Technologies, Ltd) and by means of that new Chinese clients may contact the agent directly. In 2008 Dynasty Aviation Technologies became as an official Garmin Aviation Distributor and Service Center in China (Ref XI). Dynasty's President, Scott Jiang, is those agent Mr. Nelson approached in his first trip to China when he was presenting ADS-B technologies at the conference. Dynasty Aviation Technologies specializes in selling only Garmin Aviation products. Its business office is located at Beijing.

From one side it seems to be risky to sell products in China knowing that at any moment they could be copied by local companies. But on the other hand, the process of getting patent in China is so complicated and expensive that it is easier to work immediately and to sell products while the local market needs them.

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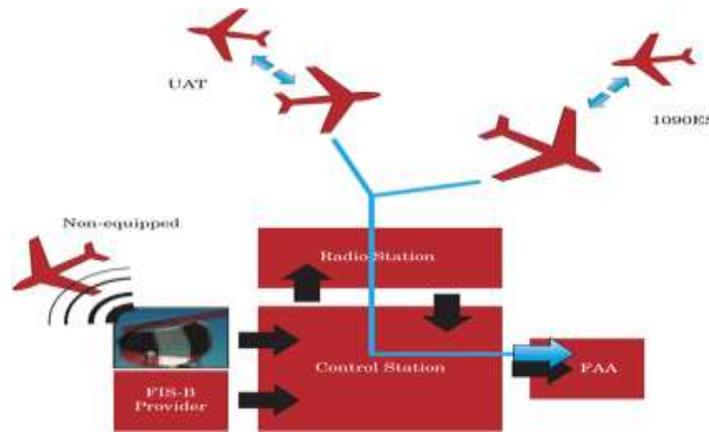


Figure 1. How ADS-B Flight Following and Air Traffic Management Systems work
 Source: http://www.duncanaviation.aero/straighttalk/adsb/how_it_works.php

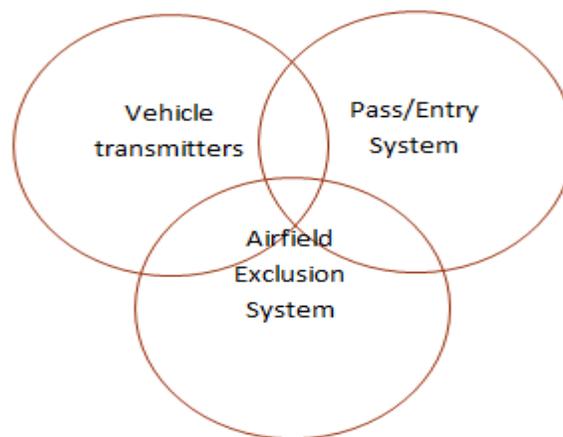


Figure 2. AMLSS Airfield Architecture.
 Source: <http://www.ads-b.com/LISTgallery2.htm>

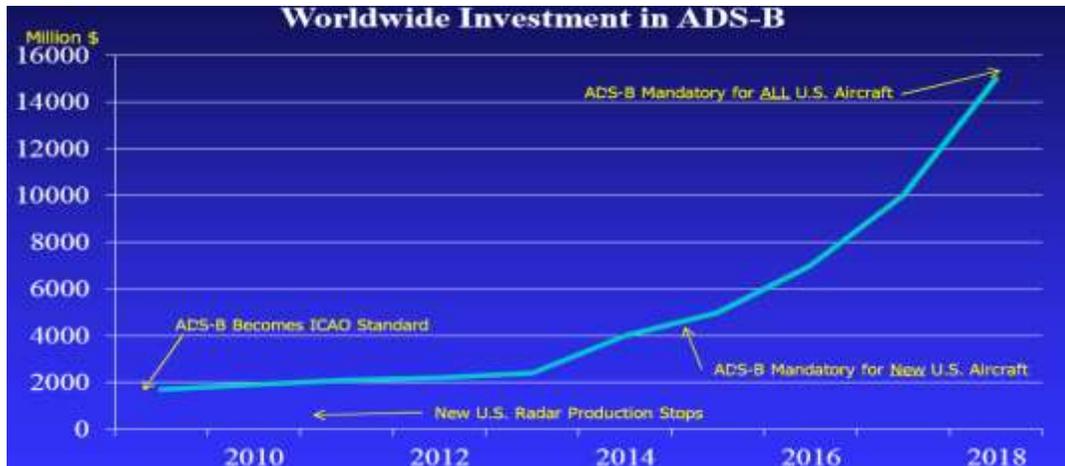


Figure 3 Worldwide Investment in ADS-B provided by Mr. Nelson)

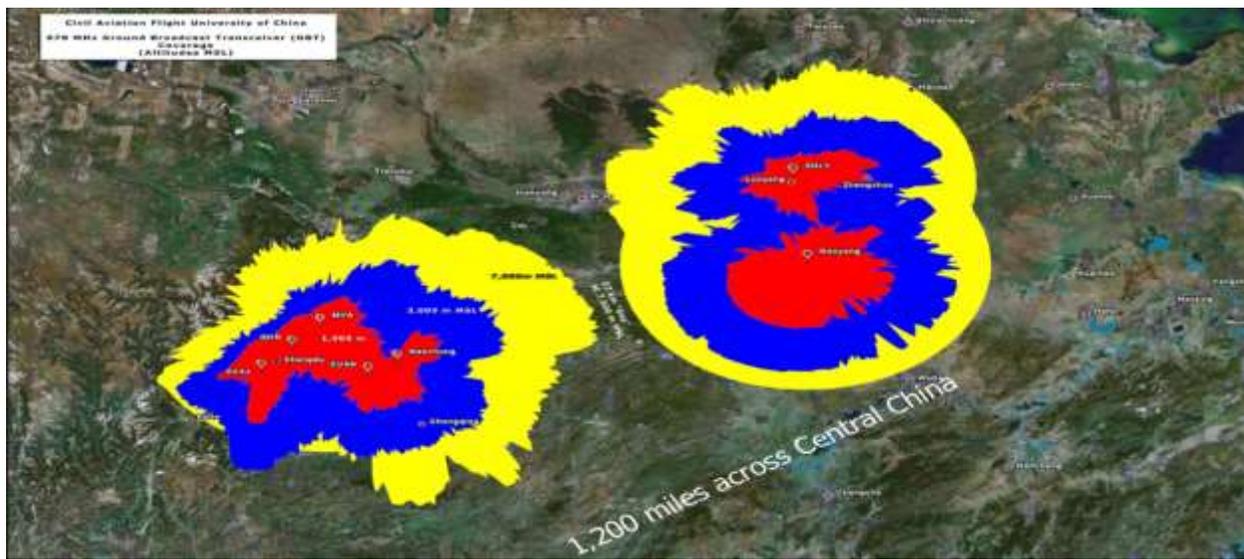


Figure 4: ADS-B Technologies Company surveillance system network in China. (Source: Information provided by Mr. Nelson, ADS-B Technologies President & CEO)



Figure 5. The ADS-B station operated by CAUFUC.
Source: Retrieved from http://218.6.160.247/news_2.htm