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Integrating Unmanned Aircraft Operations into the National Airspace System

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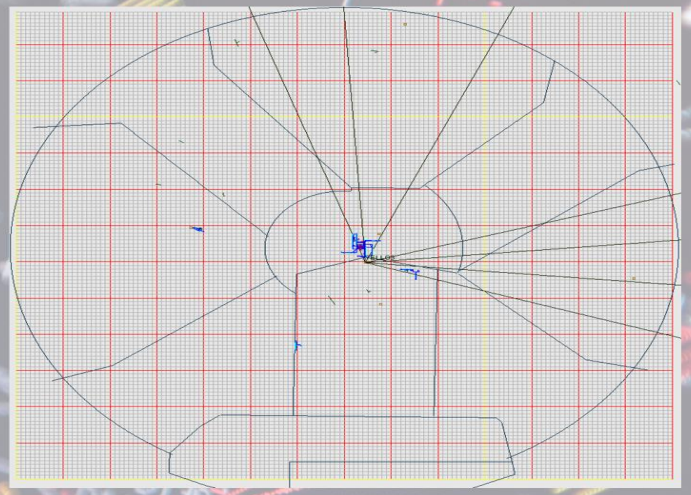
Abstract

- Commercial unmanned aircraft systems (UAS) are expected to dominate the National Airspace System (NAS) in years to come. One particular barrier preventing integration of UAS into the NAS is the lack of standardized procedures for separating aircraft and communicating with ATC. In preparation for adopting unmanned flight operations into a complex control system, it is important to identify solutions to effectively control UAS in the NAS
- The Joint UAS and ATC Team (JUAT) group has designed several simulated ATC scenarios in order to determine effective solutions for integration. Through the use of digitized radar display overlays that replicate the military grid reference system (MGRS) in conjunction with traditional airspace sectors/boundaries the JUAT is able to simulate UAS operations on a basic level.

Obstacles

- When testing and designing the ER:GS the JUAT used a radar simulation program called SimScope, created by Metacraft Systems. In order to display the grid on this program every point had to be converted to decimal latitude and longitude and converted to degrees minutes seconds. This was one of the easier obstacles to overcome and an Excel Spreadsheet was created to convert all of the data as required.
- Because the ER:GS is a proprietary system, a custom flight plan database and server was required to contain the filed flight plans and display them to the pilots and unmanned controllers. The JUAT created custom software that does all of this and additionally plots the currently claimed keypads on SimScope.



Grid Reference System

Also known as ER:GS

- Because it is difficult to understand latitude and longitude quickly without using the system extensively, the JUAT developed a custom version of the MGRS for use in simulations. This system uses a series of numbers to identify boxes of airspace. For example: 1A AA 69 62, KDEN Runway 7 numbers
- 1A – 1 Grid Zone equal to 1000 square km
- AA – 1 Grid Pad equal to 100 square km
- 6# – 1 Keybox equal to 10 square km
- #2 – 1 Keypad equal to 1 square km

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Conclusions

- The FAA expects about 7 million UAS devices to be sold by the 2020. With the vast increase the research done by JUAT has only began to develop what will be an efficient and safe system for UAS. With our basic simulations we found that we were able to effectively separate UAS and communicate with ATC.
- Use of the ER:GS made it easier to use than latitude and longitude. Because each keypad is 1 km it made it easier to grasp distances and locations quicker.
- The use of our own software, designed from the ground up to integrate with our system, helped us fully understand how we could work within our system. Creating the system with pilots, student controllers, a flight service expert and professional UAS operator helped create an effective research and training environment.

Next Steps

- Moving forward the JUAT would like to explore how emergency situations could play a role in the unmanned air traffic system. When a UAS looses communication with their base station, the system will return via a lost link route. Simulation of these scenarios could lead to more discovery of weaknesses and strengths in our system.
- To make the ER:GS system easier to use for pilots and controllers, the JUAT would like to label the grid lines having the labels move dynamically when the controller scrolls or zooms in or out. This would make it easier to identify each box quickly and easily communicate between controller and pilot.