**Introduction**

Outside radar range, planes flying in remote locations must be tracked by alternative means. Organizations focusing on emergency relief, humanitarian development and missionary support need to follow such flights, for safety and security. The Automatic Flight Following System (AFFS) owned by JAARS has been safety tested and used extensively for this purpose but is no longer being used as newer communications modes have emerged. Thus, FTMS at Messiah College is working with avionics consultant Cary Cupka to redesign AFFS to include more advanced technology options. This includes replacing the existing Rabbit Single Board Computer in AFFS 1.0 with a new device capable of the same functions, but allowing expansion with additional programmable input/output pins. The Arduino Mega 2560 has been selected as the best microcontroller option for the ACU. To facilitate visualizing the AFFS system and creating new code, MagicDraw UML (Unified Modeling Language), a software modeling tool will be used to model the overall system, and track design changes. UML will allow details of system architecture to be shared with our clients.

**Direct Serial Communication**

This past year, the FTMS team has been testing direct serial communications between an Arduino UNO and AFFSWin. AFFWin is a computer program that automatically logs and displays tracking information for a flight monitor on the ground. For temporary design and test purposes, this arrangement circumvents the HF transceiver modems on the plane and at the ground station normally in the system. This way, the FTMS team can monitor direct digital communication between the Aircraft Control Unit (ACU) and AFFSWin additional equipment as new code is developed.

![Figure 1](image1.png)

**ACU Microcontroller and AFFS Communication**

Over the past year, the team also conducted research on which microcontroller should be used to update the current one in the ACU. The goal of new microcontroller is to allow more functionalities and support an Android user-interface for pilots. The team formulated a decision matrix comparing potential microcontrollers and decided to move forward with Arduino MEGA 2560. The four basic criteria for choosing microcontrollers were: design specifications, cost, operating systems, and supported programming languages.

![Figure 2](image2.png)

**Conclusions**

FTMS has taken significant steps toward a new, and more versatile version of the AFFS ACU, to enhance the safety of pilots flying small planes in remote locations. The new ACU will be able to communicate messages with the ground station and support a more user-friendly interface. Future work will include integrating the new microcontroller and programming the new ACU.

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**Further Information**

Find out more about our project on the collaborator wiki!