ARGH Project Executive Summary

The primary objective of our project is to create a graphical history (video) recorder for large commercial and military drones. The goal for our project is to be able to save the data from a GigE Vision camera and a USB3 thermal camera using the Nvidia Jetson AGX Xavier platform to allow other people to review it later. This is to facilitate an aerial reconnaissance mission where a large drone will be able to record aerial graphical data by taking multiple images every second. Our system needs to record, store, organize, and self monitor data collection to ensure whole hours of images can be taken without any errors. Our system is robust to power failures and has variables saved in ways that allow easy continuation in data from where the system left off when it lost power.

The system consists of multiple hardware components provided by Collins Aerospace: the Single Board Computer Nvidia Jetson AGX Xavier, the GigE Vision camera Imperx C3210, the USB Type C camera Flir Boson320, the power supply module V24C12T150BL with an evaluation board, a PoE switch TP-Link TL-SG1005P, and finally a GigE Vision camera from Flir which is regulated under ITAR regulations. One of the main goals of the project was to integrate all of these pieces into one system. Our power supply module powers the Jetson as well as the PoE switch, the PoE switch is powering the GigE Vision camera and the Jetson is powering the USB-C camera. A user interface is attached to the Jetson for basic operations, including recording time delays, a manual recording mode, a recording length setting, and saved preferred settings. Our system includes a Primary Executable, or APE in short, that will manage the entire software operations and runs upon system startup. The cameras take videos by capturing each video frame as an individual image, this process is done at high speed which allows for the conversion to video after. These images of video frames will be processed by the Storage Block to be organized into an SSD storage medium onboard the Jetson.

This project went through many design phases. The project began with a goal of creating a recording system for the ARINC 818 protocol. The first 12 weeks were focused on developing the team and creating a general plan for the project. After initial research into options was performed, it was decided that the initial project would be too complex and too pricey for a senior capstone project. At this point our project shifted to match the description above. We split the project into 8 blocks at this time which originally included designing a power over ethernet switch and power over ethernet power supply ourselves. Unfortunately our team size was reduced around week 18 so these pieces were cut and the project above was created. We spent weeks 12-20 creating the new design and picking ourselves up at a maximum pace to regain lost ground from essentially starting over. During this time our 6 blocks were designed and built to full functionality. By week 20 we caught back up to pace and got all 6 blocks checked off as completed.

Tasks:											Fall Term											Winter Term											Spring Term
	1	2	3	4	5	6	7	8	9	10	F	1	2	3	4	5	6	7	8	9	10	F	1	2	3	4	5	6	7	8	9	10	F
This time period was spent on the original project which was scrapped. After this the project was restarted with a new goal	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓																				
Update Database and come up with interfaces and properties and system requirements														░	▓																		
Block Descriptions														░	▓																		
Block Validation 1 (Primary Executable, I/O Interface, Storage Manager)															░	▓																	
Block Verification 1 (Primary Executable, I/O Interface, Storage Manager)																░	▓																
Peer review block val 2																																	
Block Validation 2 Draft (GigE Camera, Power Supply, USB Camera)																			▓														
Block Validation 2 (GigE Camera, Power Supply, USB Camera)																			░	▓													
Block Verification 2 (GigE Camera, Power Supply, USB Camera)																				░	▓												
System Verification																					░	▓											
Project Poster Final Draft																								░	░	░	▓						
System Verification																								░	░	░	░	▓					
Final Project Document																								░	░	░	░	▓					

Full Timeline for the ARGH project

Weeks 21-26 would prove to be the hardest of the project as we worked to integrate our system. Combining the four code blocks while writing an extra one in the process was a very challenging process which took over 95 hours in the lab as a group to complete. The project needed to be completed by May 4th 2022 at 8am. On the morning of May 3rd 2022 we had 7.5 of 8 project requirements fully completed and working. We got greedy about making a perfect project though and made a careless mistake that resulted in crashing the entire system and having a completely non functional project. This resulted in us working through the entire night and getting our system back to 7 of 8 working requirements (6 complete, 2 half) at around 6am on May 4th 2022.

Our team learned some major lessons over this turbulent project process. The first major technical lesson we learned was to better plan out code that needs to be combined. We made our code with loose boundaries when discussing with each other and it resulted in code that was difficult to combine and came with weeks of debugging. We will definitely be better planning out collaborative code on future projects. A second lesson we learned was a lesson in thinking more carefully about what code is pushed to a device with root permissions. While we were able to get our system back working fully again, an 18 hour period of work and panic could have been avoided with a little more forethought. We also learned a lot about how to manage a team with meetings and how to communicate effectively with team members and managers above us. We learned about how to handle communication when there are tough issues to talk about and how to pick things back up when a team loses a member.