SQUAWK FOREFLIGHT

Safety at Your Fingertips

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1. Project Conception & Background Research

Executive Summary:

Project Squawk ForeFlight is the newest innovation in Aviation Safety. As pilots, stress, and over-saturation can become a major issue when dealing with a crisis. We are trained to Aviate, Navigate, and Communicate. What if we were able to focus more on Aviate and Navigate while relieving weight from the Communication portion? Project Squawk ForeFlight is a new concept that pairs your ForeFlight device with modern avionics to provide a swift and responsive emergency system. You simply press the emergency button on your ForeFlight app and then let Project Squawk ForeFlight do the rest. It will automatically adjust the transponder to squawk your needed code, notify local Air Traffic Control, 911, and ground services, and even ping other ForeFlight users in the area, notifying them of your emergency and location. No more stress of having to relay your location and emergency, from now on, safety is only as far away as one click.

The way that we have gone about solving the problem of pilots becoming confused and distracted during an emergency is by using the ForeFlight software to bring about a functional, user-friendly, and easy-to-access emergency broadcasting system. In order to solve this problem, we plan to test and use this in our own flight training. As commercially rated pilots, and soon-to-be Certified Flight Instructors, we are the perfect candidates for testing our own software.

As pilots, we all know of or have heard of somebody that reacted poorly to an in-flight emergency. For example, a team member's CFI was killed in a fatal crash in 2019. The first responders were able to arrive before this CFI was killed; however, they stated that they weren't there soon enough. If the Squawk ForeFlight feature had already been streamlined, it is possible that the emergency responders could have arrived in time to save this Flight Instructor's life. The potential Innovative Impact of this new technology is that pilots around the globe could have their lives saved in the event of an emergency.

Along with the potential for saving lives, this feature also plans on providing an economic benefit for ForeFlight. We believe that this feature will set ForeFlight apart as the leading Integrated Flight App. We hope to expand General Aviation and continue to make it safer for all through the means of ForeFlight.

Below we have attached a link to our team lead Garrison Grimaud and Lead designer Will O'Hare explaining the basics of squawk foreflight.

https://www.youtube.com/watch?v=L3MtpwoZOQI

1.1 Defining the Problem

As the pilot's workload increases, human error increases. The goal of Squawk Foreflight is to reduce the pilot's workload by streamlining the communicative process within an emergency. During the event of an in-air emergence, a pilot already has a responsibility to react to the situation leaving communication as the last step. The goal of Squawk ForeFlight is to reduce the pilot's workload by making it possible for a more efficient emergency response system built into a device pilots are already familiar with.

1.2 Research

Our approach to identifying how this was a problem was through the FAA and other supporting materials. As stated above, the FAA identified sections of risk and how they are defined. According to the Aviation Instructor's Handbook, the way to mitigate risk is through these three steps:

- Identify the Hazard: Time spent wasted relaying emergency communication and location
- Assess the Risk: Increased pilot errors and potential for disaster
- Mitigate the Risk: Remove an entire portion of the emergency flows and replace it with a simple one-button solution.

Using the ForeFlight platform makes sense from a useability perspective due to the overwhelming majority of pilots that now use Foreflight as a primary chart method. The pilots will not have to relearn an entire UI in order to adopt Squawk ForeFlight but instead will have this option added to the systems that they already use. The Pilot's Handbook of Aeronautical Knowledge and the Airplane Flying Handbook discusses avionics systems that the pilot has available and discusses the importance of using an Electronic Flight Book to the highest degree (PHAK, Airplane Flying Handbook). The FAA has also published an Advisory Circular on runway incursions and one of the things that cause them is misuse of the tools available (AC 91-73B). Being familiar with all aspects of your flight including handling emergencies will assist in all areas of flying.

1.3 Stakeholders

Stakeholders will include any person or company that would show interest or concern with our product. After researching general aviation and the problems this area of study can have, our team decided to focus on the safety and protection of pilots and their equipment. The team was able to identify what parties that would take interest in this field. Some companies are ForeFlight, Garmin, FlightSafety, flight schools, and many other aviation companies. Arguably the most important stakeholder would be Private and Commercial Pilots, the team believes that any product that takes the pilot's

life and safety into account should have a vested interest in this product. With these companies and professions taken into account, the team then began to target our solution for in-air emergencies. Approximately 450 people are killed in general aviation each year due to loss of control. Squawk Foreflight strives to eliminate this issue to some degree. This is discussed more in the next segment, Defining Previous Solutions (Fly Safe, FAA).

1.4 Defining Previous Solutions

All pilots have heard Aviate, Navigate, Communicate. We are taught from the beginning that as long as we follow this chain of command, the risk associated with everyday flights and emergencies should be minimized. What this doesn't take into account is the extreme situation clouding a pilot's judgment. The way that we are employing the new procedure to reduce the pilot workload is through our simple and easy-to-use design. As pilots, we are trained in the ABCDs of emergencies. This is a quick guide used to help us remember what is most important.

A: Airspeed. There is a famous statement, Altitude, Airspeed, or Brains, a pilot needs two of these to survive. Airspeed is king in aviation. An incredible video by flight chops (video linked below) stated that the number one cause of death in GA from 2008 to 2014 was a loss of control. The number one factor contributing to this was the lack of airspeed due to pilot workload. The pilots were too busy contemplating declaring the emergency. Even though we train Aviate, Navigate, and Communicate, the stress of the situation can cloud an individual's judgment.

B: Best Place to Land. As one can see, the ABCDE's of aviation is the Aviate, Navigate, Communicate checklist but expanded upon. B is incredibly important. Where will the plane end up? Will the aircraft be landing in a field, an airport, a highway, or a neighborhood? These are questions that need to be answered in a matter of seconds.

C: Checklist. A checklist is a luxury only given to those who have the time to read them. If not, then the checklist is a mental tool that is to be memorized by all pilots. This is another area where Squawk ForeFlight really shines. Aviate, Navigate, Squawk Foreflight. Manage your airspeed, get on the target glide speed, find the best place to land, and click the emergency button. From this point on, focus on flying the plane and forget about the communication section. Focus on safety.

D: Declare Emergency. Similar to C, this is a portion of Communicate. No more thought into declaring an emergency. The pilot will not have to waste any energy thinking but instead can click emergency, quickly find the corresponding name/photo, and then forget about it.

E: Execute Emergency Landing. Make no mistake, E might be last in the group, but it is the only one guaranteed to happen. When a loss of power event occurs, the plane will be meeting the ground whether under pilot control or not. With Squawk ForeFlight, our hope is that the pilot will have more time than he/she would without the quick emergency button. This will give excess time to flying the plane, and executing an emergency landing.

Flight Chops (Testing 4 CFIs): https://www.youtube.com/watch?v=iigjodCiK0g

The FAA states that approximately 450 General Aviation people are killed each year. The primary cause of loss of life is identified as "loss of control." "A Loss of Control (LOC) accident involves an unintended departure of an aircraft from controlled flight. LOC can happen because the aircraft enters a flight regime that is outside its normal flight envelope and may quickly develop into a stall or spin" (Fly Safe, FAA). This loss of control is something that is incredibly important to recognize in both normal flight and also emergencies. Often, a LOC event is what turns a normal emergency into a fatal one. As pilots we are trained to Aviate, Navigate, and Communicate as stated above and if we aren't careful, we can often forget to fly the plane first and enter into a Loss of Control event. This is what we strive to eliminate with squawk foreflight. Removing the stress of declaring an emergency will allow the pilot to focus on flying the aircraft and avoiding this potentially fatal LOC accident.

1.5 The Team's Solution

The concept is an integrated emergency broadcast button using the ForeFlight platform. The pilot will pair their device to their avionics system via BlueTooth capabilities. In the case of an emergency scenario, whether it be a loss of power plant, Visual Flight Rules in IMC (Low visibility), microburst, etc. The pilot only needs to click the emergency button on ForeFlight, followed by a confirmation, and it will automatically switch your aircraft's squawk code to 7700, broadcast "mayday mayday, (tail number)" and will transmit your location to the local Air Traffic Control, and 911 services. The location is broadcasted from ForeFlight through the aircraft's avionics system in order to maintain a more precise location in the case of a crash.

Our approach to the design was to contact ForeFlight and partner with them on the design and integration of our idea into their app. Due to the time constraint of the project, we do not have all the details and inner workings of the device put together; however, we have contacted ForeFlight and they have expressed an interest in partnering with us. Our team found out about this competition on 1/18/2022 at 1:30 PM and went from nothing to having an idea, connected with a ForeFlight team member, and sponsored by the university within a matter of hours. We appreciate all of the support that

our community has given us and the incredible swift feedback and responses from our university and surrounding partners.

Our lead designer and lead engineer have come up with a model for how it should look and operate. The idea is that ForeFlight will connect to modern avionics systems via BlueTooth and be able to transmit location through the aircraft's systems directly. The reason for this is reliability. Squawk ForeFlight is determined to not only be efficient, fast, cleanly designed, and a better alternative to the traditional method of emergency procedures, but also we will be able to transmit without the need for cellular data. One of the things that we strive to accomplish is to have an interdependent system that doesn't rely on the hand-held device's communication abilities but instead pairs with the aircraft's system.

1.6 Implementation of the Solution

The method for how Squawk ForeFlight will operate is through pairing Bluetooth hand-held devices with avionics systems in the flyer's aircraft. As technology has continued to advance, so has the reliability and efficiency of Bluetooth. As of July 2021, a new iteration of BlueTooth has been released. This new version, BlueTooth 5.3, boasts an impressive stat of much faster relay speeds and increased reliability. "BlueTooth 5 is twice as fast, has four times the range, and can transfer eight times as much data" (Svetlik, Scarrott). This is incredibly important for the purpose of Squawk ForeFlight as we prepare to release a feature that will save lives. Reliability is one of the top concerns for aviation, and rightfully so, and therefore by implementing the newest in tech, we will be reducing the odds of an emergency not being transmitted.

As stated above, the system will pair using a Bluetooth connection, but more than just the ability to relay a signal from the plane, Squawk ForeFlight will benefit the pilot by also changing your squawk code to the corresponding emergency for you. As will be seen in Project Description Section II, the application is clean, easy to use, and comes with more than one emergency option. As pilots, we understand that not every emergency situation is one that is a result of the loss of an engine. Squawk ForeFlight is clean and simple to use. The method we will use is to integrate the ForeFlight UI into an easy-to-use button layout. When you click emergency, it will pop up a list of options ranging from an engine out, loss of comms, VFR into IMC, Hijacking, and more. Each corresponding option will squawk and transmit the correct corresponding answer. For example, if a pilot loses comms, he can quickly select the loss of comms button, type in the comments box (example provided below), and send a message to the local ATC. This message can be anything from a basic, "lost comms, diverting to local airport." Or can be

catered for each pilot's specific scenario. This idea is based on the driving app, Waze, where the driver has the selection for each hazard and can comment on the hazard. When it comes to more serious options such as Engine Failure or Highjacking, the system will have a basic outline response that will immediately switch your code to the correct option, and transmit on guard and to local authorities the correct information. For example, a pilot is flying at 1,500 feet AGL when all of a sudden the engine cuts out. The pilot will quickly click the emergency button, then the corresponding engine out option, from that point on, Squawk ForeFlight handles the rest and the pilot can focus on flying. As stated, the way this is done is through Bluetooth connectivity through the aircraft's avionics system. The limiting factor of Squawk ForeFlight is that the aircraft must have Bluetooth-capable avionics.

Discussed more in section two is the change in how we are implementing the application. Previously the thought was to have our application run through ForeFlight's already-established software; however, due to a lack of partnership and input from our advisor/outside input, we have switched to a standalone application. Our software will work by running its own application. The user will download the application, and purchase a subscription for $12 a year ($1 a month). The application works similarly to the GIF application on iPhone. The user will download the application, and select the feature to be turned on and this will create an emergency overlay that can be placed anywhere on the screen by the user. This allows the emergency notification to be on at all times and not just while running ForeFlight.

1.7 Risk Assessment

With technological developments comes risk. One of the major risks that our team at Project Squawk ForeFlight has considered is the event of the emergency button failing. There are times in which the iPad may run slowly, overheat, not respond, or even the BlueTooth connection will fail. The way we go about mitigating the risk is by allowing the user to override any input from the iPad with their own inputs to the aircraft. If for some reason, a pilot selects that they have an engine failure, then the iPad freezes in the middle of updating the avionics, the pilot can manually place the Squawk code and transmit it on guard as any other normal operation. So what are the inherent risks?

- Poor response time from the Ipad
- Failure to connect via BlueTooth
- Incorrect emergency selected
- Emergency selected accidentally
- Avionics and radio system unresponsive to Squak ForeFlight

Aviation is all about redundancy. The pilot is always in control. With Squawk ForeFlight, there will never be a time that the PIC cannot override any input made from the iPad/hand-held device. In the case of a life or death scenario, the pilot should not be declaring an emergency, and so the idea is that once the button is pressed, no matter if it transmits or not, the pilot will respond as if it had. The best option is to maintain the lowest level of pilot workload and distraction in the cockpit. However, in the event that a pilot is in an emergency that they have time to react, then if the application is not responding, they may revert back to the original methods of emergency checklists.

In the case of an accidental emergency selected, the pilot will have ten seconds to cancel the emergency using ForeFlight before it transmits. If the pilot has not selected cancel or had not realized that he/she accidentally selected the emergency, the best course of action is to call a local Flight Service Station, or ATC and make them aware of the situation.

2. Outreach & Professional Opinion

Any product is only as good as the feedback it receives. After compiling our research and coming up with an idea to solve a problem within the field of general aviation. Our team was able to conduct our own research and collect feedback from identified stakeholders. Taking what they have to say and making sure this gets implemented into the final design. Our main source of feedback came from the Oklahoma State University flight school, advisors, and local pilots. We used polls at OSU and Facebook groups as well as general mouth-to-mouth discussion about our product and idea. Dr. Matt Vance also added his opinion and professional advice.

2.1 Advisor's Input

Dr. Matt Vance is both an Airline Transport rated pilot, and also a professor of Aviation at Oklahoma State University. When we first approached him about the idea of project ForeFlight, he was thrilled. Dr. Vance teaches the human factors in the aviation course as well as the Crew Resource Management course. Both of these are directly related to the product that had been put forward. Dr. Vance brought up a story that involved the squawk ForeFlight product directly.

Imagine you are flying over the Canadian Rockies in a piper arrow when all of a sudden, your plane begins shifting in every direction. The PIC sways and manipulates flight inputs in order to calm the airplane down but no matter what he does, the plane continues to jar out of control. You yell frantically at the pilot to release the controls and

let the plane subside to a rest. Fearing that the aircraft wing is fixing to rip off, you are stressed and confused at what is going on in this seemingly endless scenario. The only thing your mind can think of is what your training told you… Aviate, Navigate, Communicate. As the plane continues to spiral out of control, you ask yourself, "will anybody find the plane?" The plane comes to a rest and you look outside the plane at peace knowing that by the grace of God, you have survived and the plane is intact.

We brought this story up during our original draft but believe it to be incredibly important to the reason why we are so passionate about our product. This story is one of Dr. Vance when he was in his twenties. Dr. Vance stated that this was a defining moment in his aviation career and that it to this day remains one of the drives and motives of his teaching. Using this story, he added the input that we should streamline the application. Our original product was a simple one-button click that had no other option except to squawk 7700; however, Dr. Vance is the one that suggested that we implement all of the other codes along with 7700. By making this product simple to use and also opening up pathways to other emergencies, he has created more value.

The next input that Dr. Vance had was the fact that we have ForeFlight in the name. He stated that by doing this we are limiting ourselves to just ForeFlight when there is potential for other products such as Garmin, Avidyne, and other avionics companies. Having heard this, we also brainstormed the idea of having our idea be a separate app that overlays onto any service. In this aspect, it would work by having the same emergency button but would be in the corner of any application you have (including messages, the home page, lock screen, etc).

2.2 ForeFlight's Input

Contacting ForeFlight proved to be a major struggle. They responded initially with interest; however, contacting further became near impossible. However, this turned out to be an answer to some questions in some aspects. We decided that Dr. Vance's suggestion of using our own application interface made more sense. With this, we switched our product to be independent of ForeFlight or Garmin, and instead it works the same as a widget on your device. Imagine the GIF application or the assistive touch on iPhone. You download the app, then select the feature to be on and it will create the overlay to be on at all times instead of purely during ForeFlight. This is beneficial because when you are not in the application, the emergency feature will still be on the screen. Imagine that you have been cruising in your flight for some time and that your iPad has switched off, previously the pilot would need to turn on the device, then open

ForeFlight. Now, the emergency overlay will be on the lock screen as well so all the pilot has to do is simply turn on the device.

2.3 Implementation of Opinion & Solution

Having heard Dr. Vance's suggestions as well as the lack of partnering with ForeFlight, we decided to implement the change from using a ForeFlight-specific software to now using our own third-party application. Implementing this new strategy, however, has opened up new avenues for issues. Although providing a solution, in some aspects this has also caused additional problems. The first and most obvious problem is that we no longer have access to the ForeFlight application features. Previously, we were going to be joining the ForeFlight features and implementing our own idea into their software. The ForeFlight software already had capabilities to connect to avionics whereas now we would need to code that into our software. The thought process is that we could use Bluetooth to pair to avionics. Further, we will plan to code our product in such a way that it will connect to the GPS antenna of cellular-equipped iPads in order to promote a better connection to the device.

Implementing the solution aforementioned solved the issue of paying for the application. Previously the thought was that we would sell the idea to ForeFlight, but now we can charge a subscription for use of our application. The cost comes out to ninety-nine cents a month or twelve dollars a year. Whereas previously we were concerned about how we would be able to turn a profit, now we have a plan on how to pay for the application and features while also keeping it cheap enough for pilots to use it that it is a benefit for them.

3. Project Construction & Development

No matter the industry, safety is always the number one priority when solving issues, especially in the general aviation industry. When creating a solution for emergency response in general aviation, safety for pilots and their equipment take precedence. With many products and procedures already buying the pilot's attention, our team wanted to create something from within, something the pilot is used to using day-in and day-out.

We wanted to design a product that was both easy to use and also applicable. Taking the design ideals of Waze the maps application, we used their UI as a base for our product. The thought process is to have an easy-to-see and use product that is designed

with usability first and simplicity second. The development and construction of the application are going to require funding to hire a programmer as well as certification of use.

3.1 Constructing a Prototype

In the first step when creating an application our team started with a coding flowchart. This flowchart explains how the team expects the app to function, using any pilot actions as inputs and the results follow the action/input made. Following the flowchart, we developed a rough layout design, focusing on how we want the software to operate under each available selection. After constructing the design and target commands, we mocked up what the entire process should look like and how it should operate on a photo layout.

This flowchart is color-coded to visually explain how little the pilot has to do with our new addition to an App they are already familiar with. Blue inputs have not changed since the pilot's earliest training, opening the App, and starting a flight is how most flights begin as of right now. Then sometime during the flight, an emergency occurs then the pilot hits an emergency button, this action is classified as Green. The App's functionality is coded in Purple, meaning after a Green action from the pilot the App will automatically conduct the action it was told to do. The App's first function is to start Squawking the code 7700 using the transponder. The pilot is then asked to input another action specifying what the emergency is, between engine failure, comm loss, and weather-related issues. After the two inputs from the pilot, the App takes over and starts communicating with Air Traffic Control regarding the specified emergency. Then the app uses the location of the smart device's location and communication abilities to locate and contact local law enforcement and safety.
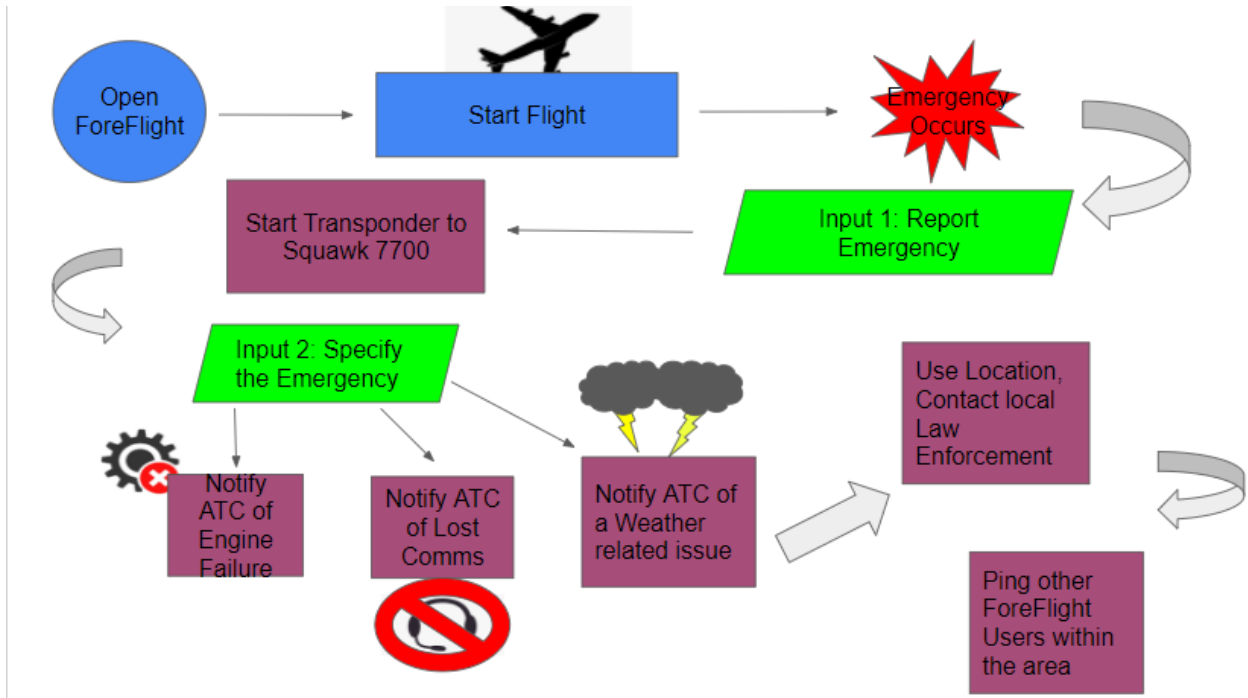
3.2 Testing a Prototype

During the testing phase, we practiced simulated emergencies in the air, allowing ample time to safely recover the aircraft while putting our product to the test. After the assessment, our safety system proved incredibly efficient. Focussing on Aviate, Navigate, and Communicate, our prototype allowed us, after following the ABCs, to quickly respond with communication through two easy clicks.

As Flight Instructor applicants, we have to learn how to teach students the basics of flight. Included in this are simulated emergencies. Our team lead, Garrison Grimaud, is one flight away from being a Certified Flight Instructor. During training for becoming a CFI, he used the product idea in his training. He states, "during the scenario-based problems in a flight of simulated engine failure, I was able to aviate first (fly the aircraft), then navigate second (find where I was going to land), and lastly, I pretended to use my emergency system for communication. Obviously, since the system doesn't exist yet, during my flows I ran through the normal communication flows; however, I explained how using our product would streamline the process while doing the flows. What I found was that if I had this system available, it would remove the need to run through the communication process and would allow me to focus on the more serious sections of

flight." What we can learn from this experience is that our system should help pilots maintain situational awareness, a focus on what is most pertinent to the safety of flight, and also the ability to remove possible human error while communicating. It can be hard to relay your exact location during an emergency due to adrenaline, but with squawk ForeFlight, that is no longer an issue.

3.3 Feedback

In order to get a more accurate idea of what pilots would like to see regarding emergency response, we created a poll that compares our quick response emergency button versus the traditional way of declaring an emergency:

When encountering an in-air emergency, the traditional method of declaring an emergency through radio transmission and squawking 7700 on the transponder can be costly on time. What if there was an easily accessible emergency declaration button on ForeFlight, Garmin Pilot, and/or Avidyne that would immediately declare the type of emergency, relay your location to the surrounding controllers, report mayday on guard, and squawk 7700 for you all within two clicks on your screen? The available answers were as follows: "Quick Response Emergency Button" or "Manually Squawking 7700 and RadioTransmission."

Emergency Pilot Response

21.60%

78.40%

● Manually Squawking 7700 and Radio   ● Quick Response Emergency Button
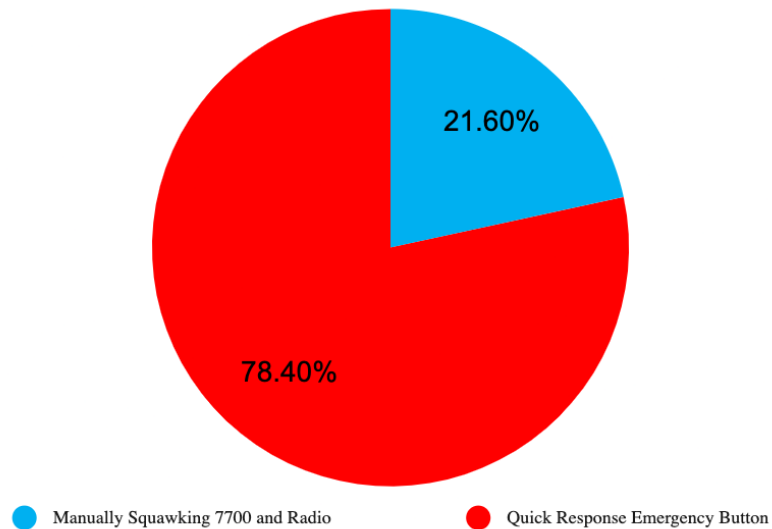
After surveying 176 pilots, our statistics have shown 78.40% in favor of our emergency response idea, with a 21.60% response in favor of the traditional method of declaring an emergency.

3.4 Project Updates

How we adjusted our prototype based on feedback and response:

- Changed from a ForeFlight based program to a standalone
- Updated to a subscription-based program
- Allowed for the emergency button to be movable on the screen. (Users can select where they wish for the icon to be placed on their device)
- No longer required users to own ForeFlight to use the service

Update on the product development:

We were unable to create the physical product due to technological restraints that none of the group was able to overcome. Going forward we will need to hire or find a fifth party member with coding experience. As it currently stands, our product is hypothetical and not actually in place. The way we are planning on representing how the

product would work while in New Jersey is through using an iPad with figures, diagrams, and possibly a website with links to how it would work.

Our lead designer and artist, Will O'Hare has created a new draft of how the product should look. We can and will use this during our presentation in New Jersey and potentially with creating the actual product. As stated before, there are many issues with creating the physical product. Coding is the biggest issue, others include things such as certification for an Aviation related product (safety), ease of use, and making a product that is both affordable but will not lose us money in the process.

Potential moving forward:

Our group is working on securing a possible patent for the idea; however, the issue has arisen that Garmin recently published a similar product. What Garmin has created is an emergency assistance program. Unlike Squawk ForeFlight where the application will squawk a code for you and direct link to your avionics, Garmin's system works by sending messages via your device to pre-established emergency contacts. It will broadcast your location and emergency to emergency contacts. Squawk ForeFlight however will broadcast your location and squawk code to emergency personnel, ATC, and other application users in a specified radius.

Garmin's product: https://www.garmin.com/en-US/legal/idtermsofuse/

3.5 Final Solution

Since the team wasn't able to partner with ForeFlight like we had hoped our "Plan B" was to create our own application system for ios devices. The team believed the best course of action was creating a system much like the Assistive Touch feature found in the ios system shown below.

The device would be installed and use access to the device's BlueTooth, Location, and Communicative abilities. Once created the application would have access to the screen, no matter if the screen is on or off. It would provide the pilot the option to report an emergency and clarify what kind of emergency has occurred. Below are renders of what the application would look like in real-world application.
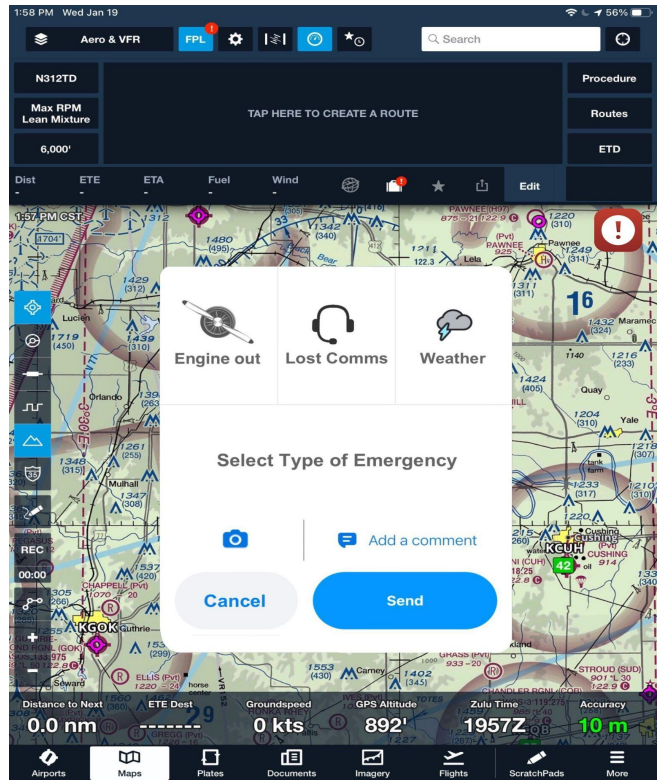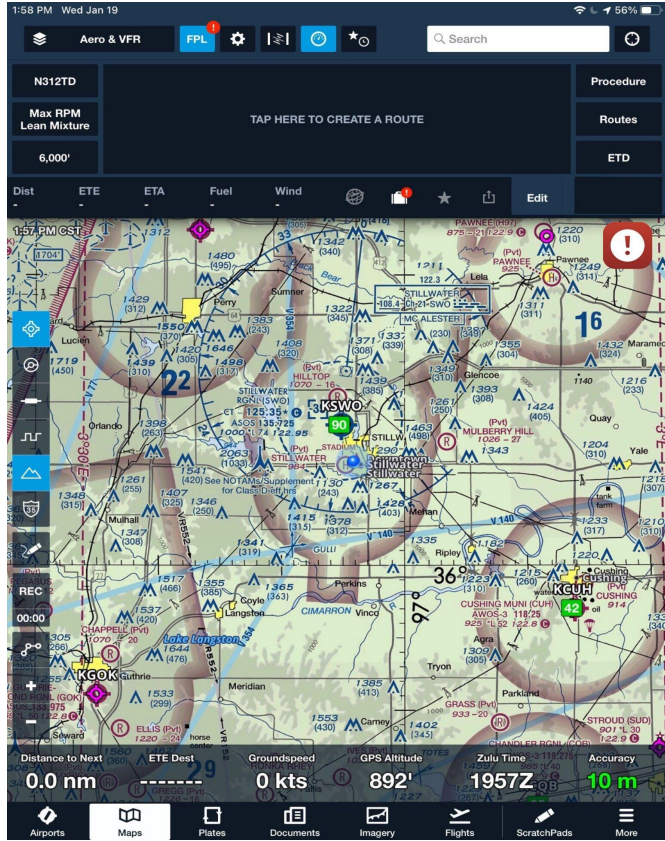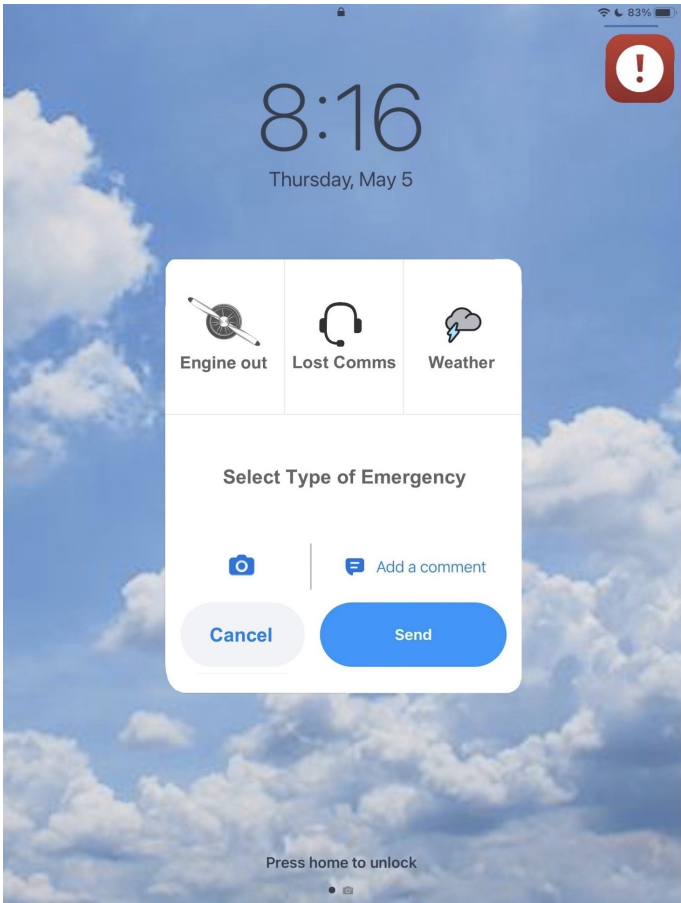
This process can be created by using the coding language called "Swift". Using this language we can specifically code for any ios device such as iPhones or iPads. This process would include creating and designing a user friendly User Interface (UI). The lead engineer has had some experience in coding UIs in other languages. The first action would be to create a command button, once selected the application would open a UI with three additional buttons that can classify which emergency the pilot was experiencing. Two more buttons will be on the UI, a "Confirm" or "Cancel" button that will either perform the action or cancel the action altogether.

4. Project Performance / Monitoring

4.1 Project Objectives

What our product should be able to do:

- Project your location to local ATC, emergency services (911), and to other pilots using the application
- Be cost-effective for the user and also profitable for us as the developers
- Be easy to access and use as well as reliable

4.2 Quality Deliverables

As discussed in Section 3.2, the team was only able to prove that the problem we have defined is actually an issue. Not having a solution in hand isn't entirely a problem. The team has conducted multiple polls, contacted professionals in the general aviation industry, and has an idea ready to implement when we have more time and resources.

Since there isn't a physical prototype, the team has decided that our time can be better spent on compiling as much research and support regarding safety within the general aviation industry. Then using those developed resources and ample time, we would then start constructing a prototype that can pass our objectives from the section stated above.

4.3 Effort & Cost Tracking

Budgeting for this project was difficult since we couldn't work with ForeFlight like we had hoped and the lead engineer was pressed for time. Most of the budget was calculated by research and current real-world situations. The project/prototype was itemized into four different categories: Coding Department, App Testing, Field Testing, and Implementation. The average Computer Scientist makes about $107,000 a year, and a project this size could start at only one person but could eventually become a 5+ person coding process. Implementation is calculated by the hour since any updates should be produced over the air, a Computer Science Intern's hourly wage was inspired for the budget at $25/hour for roughly 300 hours. App and Field Testing was calculated by case studies from other Apps and what they have quoted, App testing was quoted at 10% of the overall total. Where Field Testing was quoted at 20% of the total. The Estimated cost of operation a year came out to be just under $220,000.

The travel budget was calculated for the four-team members to attend the Smart Connected Aviation Student Competition as National Finalists. The team felt it necessary to budget for four main categories: Hotel rooms, Flights, Food, and other Travel Fees. The hotel stay was calculated by the average rate of $500 a night for two nights, the team would prefer two rooms, ensuring each member sleeps in their own bed. Each member is flying to the Philadelphia International Airport from Oklahoma and Arkansas. The average plane ticket was around $500, there are four team members and we will need flights back. Other travel fees include any ride-shares or trains the team chooses to use to get into Atlantic City. Finally, food was priced at $100 a day per person. The grand total came out to $6000, which is all the allotted traveling funds the FAA plans to give the team.

Project Budget			
	Items	Price	
	Coding Department	$107,000	per person a year
	App Testing	$11,450	10% of Coding dept + Implementation
	Field Testing	$91,600	20% of Coding dept + Implementation
	Implementation	$7,500	$25/hr = 300 man hours
	Estimate Total	$217,550	/Year

	June 22-23			
# of Team Members		Items	Prices	
4		Hotel (2 Nights x 2 rooms 1 bed per person)	2000	
		Flights (4 Flights)	1600	
		Food (3 meals x 4 People)	1200	
		Travel Fees (Ride shares, trains, etc)	1200	
		Total	6000	(in Dollars)

5. Conclusions & Recommendations

In conclusion, Squawk Foreflight has gone from being an interesting idea thought up from a few aviation lovers, to now being something that we are all passionate about. This product can not only change our lives, but also save pilot's lives. The product servers as an emergency response system that at one click of a button, you will be squawking the appropriate code, transmitting your location to local ATC, and also to 911/ground services. Squawk foreflight will revolutionize the safety of flying. By removing Communicate from the Aviate, Navigate, and Communicate section of flying, pilots will be able to focus on what matters most. As discussed in an earlier section, we hope that this will prevent loss of control events. The FAA states that approximately 450 general aviation people are killed every year and a large majority is caused by a Loss of Control (LOC) event. By allowing the pilots to focus on flying the aircraft, we know that they will be able to focus on what matters most (flying the aircraft).

Project squawk foreflight will be economically beneficial for us as the owners but also will be delivering a fantastic benefit to the users. We know that our product is one that is going to satisfy and ease any users minds and help them know that they are in good hands. Our product will be able to allow the users to focus on flying the plane, and enjoying their time in the sky. In the end what we all really want is to be able to hop in our aircraft, take our friends and family flying, and know that no matter what happens, we will get our loved ones home safe with them having loved the experience. Project Squawk Foreflight will deliver safety to your fingertips.

Lastly, our team has been so honored to have competed in this event, and no matter what happens, this has brought us all together and united in a common goal. It has been an absolute pleasure working on this assignment and learning more about the aviation industry. Our entire team was brought together without knowing each other and within a small amount of time have been able to come together to create something amazing. None of us have ever been a part of something so large and also so impactful. We plan on pursuing this idea whether we win the competition or not. From the Project Squawk Foreflight team, we all just want to extend a thanks and say that we can't wait to compete in New Jersey! Fly safe and squawk VFR.

6. Appendix A: Project Timeline

GANTT CHART

| PROJECT TITLE | Squawk ForeFlight | | COMPANY NAME | Oklahoma State University |
| PROJECT MANAGERS | Kamron Dildy, Garrison Grimsrud, Will O'Hara, & Zach Pennington | | DATE | 3/1/22 |
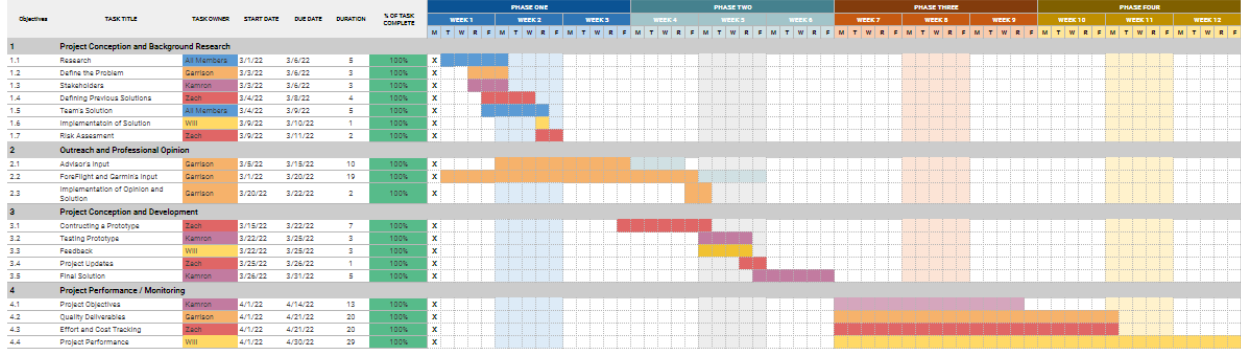
Objectives	TASK TITLE	TASK OWNER	START DATE	DUE DATE	DURATION	% OF TASK COMPLETE
1	**Project Conception and Background Research**					
1.1	Research	All Members	3/1/22	3/6/22	5	100%
1.2	Define the Problem	Garrison	3/3/22	3/6/22	3	100%
1.3	Stakeholders	Kamron	3/3/22	3/6/22	3	100%
1.4	Defining Previous Solutions	Zach	3/4/22	3/8/22	4	100%
1.5	Team's Solution	All Members	3/4/22	3/9/22	5	100%
1.6	Implementatoin of Solution	Will	3/9/22	3/10/22	1	100%
1.7	Risk Assesment	Zach	3/9/22	3/11/22	2	100%
2	**Outreach and Professional Opinion**					
2.1	Advisor's Input	Garrison	3/5/22	3/15/22	10	100%
2.2	ForeFlight and Garmin's Input	Garrison	3/1/22	3/20/22	19	100%
2.3	Implementation of Opinion and Solution	Garrison	3/20/22	3/22/22	2	100%
3	**Project Conception and Development**					
3.1	Contructing a Prototype	Zach	3/15/22	3/22/22	7	100%
3.2	Testing Prototype	Kamron	3/22/22	3/25/22	3	100%
3.3	Feedback	Will	3/22/22	3/25/22	3	100%
3.4	Project Updates	Zach	3/25/22	3/26/22	1	100%
3.5	Final Solution	Kamron	3/26/22	3/31/22	5	100%
4	**Project Performance / Monitoring**					
4.1	Project Objectives	Kamron	4/1/22	4/14/22	13	100%
4.2	Quality Deliverables	Garrison	4/1/22	4/21/22	20	100%
4.3	Effort and Cost Tracking	Zach	4/1/22	4/21/22	20	100%
4.4	Project Performance	Will	4/1/22	4/30/22	29	100%

7. Appendix B: Quad Chart

Squawk ForeFlight

Objective and Description of Effort:
• During the event of air in-air emergence, a pilot already has a responsibility to react to the situation leaving communication as the last step. The goal of Squawk ForeFlight is to reduce the pilot's workload by it possible for a more efficient emergency response system built into a device that pilots are familiar with.

Technical Approach:
• Working with ForeFlight, our team was able to create a future working partnership.

Image:

Team & Management Approach:
• Garrison G. Grimaud: Team Lead
• Will O'Hare: Lead Designer and Artist
• Kamron Dildy: Editor and Creative Liaison
• Zachary Pennington: Lead Engineer

Schedule:
• 1. Project Conception & Background Research: 3/1-3/11
• 2. Outreach & Professional Opinion: 3/1-3/22
• 3. Project Conception & Development: 3/15-3/31
• 4. Project Performance/Monitoring: 4/1-4/30

Cost:
• Coding Department: $107,000/person a year
• App Testing: $11,450-10% of Coding dept + Implementation
• Field Testing: $91,600-20% of Coding dept + Implementation
• Implementation: $7,500- $25/hr = 300-man hours
• Estimate Total: ~$217,550 /year

8. Appendix C: References

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