

STRESS, ANXIETY, AND DEPRESSION LEVELS IN COLLEGIATE AEROSPACE  
STUDENTS: A STUDY COMPARING TRADITIONAL AND AEROSPACE STUDENTS AT  
MIDDLE TENNESSEE STATE UNIVERSITY

By

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A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree Master of Science  
in Aerospace Education

Middle Tennessee State University

December 2022

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## **Dedication**

This thesis is dedicated to the memory of my mother, Brenda K. Waters, your love made me who I am today.

## **Acknowledgments**

There are so many people who, without their support, this thesis would have never happened. I am so lucky to have such a strong network of people in my life who have helped me to succeed.

I would like to express my deepest gratitude to my advisor and committee chair, Dr. Craig for providing me with guidance, wisdom, and words of encouragement throughout this process. His sage wisdom carried me throughout each step of the process for this project. I would also like to thank my committee member, Dr. Beckman, for her exemplary editing skills and thoughtful feedback. This endeavor would not have been possible without their support and expertise.

I would also like to thank my family members and friends who supported me throughout my graduate school journey. I would like to thank my dad, Donnie Waters, who has been my rock throughout my entire life, especially during my graduate school experience. Last, but certainly not least, I would like to thank Dr. Georgiou for supporting me professionally and personally throughout my time at Middle Tennessee State University.

## **Abstract**

This paper investigates and compares the levels of stress, anxiety, and depression among a sample of 574 undergraduate students in the Aerospace Professional Pilot concentration, Aerospace majors in concentrations other than Professional Pilot, and Non-Aerospace students at Middle Tennessee State University. This study sought to determine if Aerospace students exhibited higher levels of depression, anxiety, and stress. The participants of this study completed the DASS-21, a survey instrument that measures three separate constructs, depression, anxiety, and stress. The scores from this survey were used to compare depression, anxiety, and stress levels between the three groups of students using ANOVA and a Tukey HSD posthoc. The results of this study found that Aerospace students did not exhibit higher levels of depression, anxiety, or stress and that non-Aerospace students scored higher in all three categories.

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## Chapter I: Introduction

Mental health conditions such as depression and anxiety seem to be slowly losing their stigma, and individuals have become more comfortable discussing these issues and seeking help for them. Within the aviation industry, however, the grip of stigma has not yet loosened. Aviation is a high stakes industry, and pilots are held to specific health standards set by the Federal Aviation Administration (FAA) to keep their jobs and their pilot certificates. Every pilot looking to gain or maintain their flight certificate must meet with an Aviation Medical Examiner (AME), a medical professional who serves the FAA by medically certifying airmen, who will conduct a physical evaluation (Federal Aviation Administration [FAA], 2022a). The AME will evaluate the pilot physically as well as mentally. AMEs are provided standards with which to conduct their health evaluations by the FAA. These standards provide the examiner with guidance to ensure a successful and conclusive pilot health evaluation. The *Guide for Aviation Medical Examiners*, provided by the FAA, provides AMEs with health requirements that pilots must meet to be issued a medical certificate. This guide also provides a roadmap for AMEs and pilots who have experienced or are currently experiencing abnormal psychiatric symptoms. AMEs are often considered the first line of defense when it comes to ensuring safety. While the FAA does not expect AMEs to conduct a formal psychiatric evaluation, they are expected to draw conclusions about the applicant based on their medical history and observations (Federal Aviation Administration [FAA], 2022b). The medical history portion of the exam depends upon the applicants' responses to questions about their health. The applicant is expected to answer these questions honestly. The observations made by the AME include specific areas such as appearance, behavior, mood, communication, memory, and cognition (FAA, 2022b). Using both self-reported medical history from the pilot, and



observations made by the AME during the appointment, the AME will assess the applicant's psychological state.

If a pilot were to self-report having experienced symptoms of depression, anxiety, or suicidal thoughts or behaviors then the AME will not issue a certificate (FAA, 2022b). In that instance, the pilot would no longer be able to exercise their pilot privileges until they were able to prove the extent or severity of those symptoms through a lengthy process with the FAA, and even then, their pilot status could still be revoked permanently. The prospect of having a medical certificate taken away and losing the ability to fly either temporarily or permanently could lead to pilots not self-reporting these symptoms. Instead of facing the financial and career hardships that come from admitting these symptoms or issues, pilots may continue with their careers rather than seeking help.

Perhaps the most prominent event to take place regarding the mental health of aviators was the Germanwings flight 9525 accident that took place in 2015. The co-pilot of the flight had been with the company since 2014 but had possessed a medical certificate with a waiver due to a "severe depressive episode" since 2009 (Bureau d'Enquêtes et d'Analyses [BEA], 2016). If the pilot had reported a regression in his mental health status, then the waiver would be invalidated, and the pilot would have lost the medical certification and pilot privileges (BEA, 2016). In the winter of 2014, the co-pilot began experiencing psychotic depressive symptoms (BEA, 2016). The symptoms elevated to a point where the co-pilot had seen a psychiatrist who had prescribed him anti-depressant medication (BEA, 2016). In 2015 the co-pilot was formally diagnosed with a psychosomatic disorder, an anxiety disorder, and was hospitalized for treatment (BEA, 2016). The co-pilot did not self-report these symptoms, the formal diagnosis he was given, the medication usage, or the hospitalization to the AME or to Germanwings. On March 24, 2015,

while flying from Barcelona Spain to Düsseldorf Germany, the captain left the cockpit and was locked out by the co-pilot (BEA, 2016). Once alone in the cockpit, the co-pilot descended and eventually crashed into the French Alps, killing himself, 6 crewmembers, and all 144 passengers (BEA, 2016). In the investigation of the accident, the probable causes included the co-pilots fear of losing his medical and flight privileges (BEA, 2016). The investigators also noted that the financial concerns that would accompany a loss of medical certification likely also contributed to this accident (BEA, 2016).

Suicide by plane is not only a concern for commercial aviators, but it also affects collegiate aviators as well. On September 6, 1998, a Piper Seminole crashed at Daytona International Airport while landing (National Transportation Safety Board [NTSB], 1998). Upon further investigation, it was found that this crash was intentional rather than an accident. Before the crash, the pilot, a flight instructor, and a student at Embry-Riddle Aeronautical University attempted to gain access to the Embry-Riddle flight line at the airport (NTSB, 1998). Due to the late hour, the gate would not allow the pilot to enter with their access card, so instead the pilot scaled an eight-foot-tall, barbed wire perimeter fence to gain access to the aircraft (NTSB, 1998). Once the pilot entered the aircraft, they were able to start it and proceeded to take off. Once airborne, the pilot flew towards the beach and followed the Daytona coastline for several miles before returning to the airport (NTSB, 1998). When the pilot returned to Daytona International Airports' airspace, the pilot requested vectors for the runway in use (NTSB, 1998). The air traffic controller conveyed the vectors to the pilot and made note of the altitude the pilot was at, concerned that the pilot would not be able to descend in time to safely make the landing (NTSB, 1998). The pilot responded that they would make the descent and that this would be their “final landing” before nosediving and crashing into the end of the runway (NTSB, 1998). Witnesses to

the accident reported hearing the engines being put at full throttle during the steep descent (NTSB, 1998). In the aftermath of the crash, it was discovered that the pilot had left a note in his home explaining his suicidal ideations and stating, “I do not want to live,” (NTSB, 1998). It is likely that this pilot had experienced suicidal thoughts before this point but had not reported them or sought help.

A more recent event is the 2021 crash of John Hauser, a 19-year-old sophomore from the University of North Dakota. Hauser was flying from Grand Forks, North Dakota to Fargo North Dakota on a solo-cross country flight to fulfill a requirement for his Commercial Aviation degree program (Russell, 2022). The aircraft was found about an hour after it had taken off in a field near Buxton North Dakota (ABC 7 Chicago, 2022). Due to the recency of the accident, the crash itself is still being investigated. Before the flight, Hauser sent his parents a text and left letters for his friends and family. These letters detailed the depressive symptoms and feelings of hopelessness Hauser had been experiencing for an extended period and explained that he felt trapped (ABC 7 Chicago, 2022). In an interview with Hauser’s father, he stated, “he wanted to get help, but he felt that he would have to give up flying if he got help,” (Russell, 2022). The letters left behind by Hauser give an insight into the symptoms and mental health struggles that he experienced and how he felt that he had to choose between his mental health and his dream of flying. A portion of the letter that has been released by the Hauser family states, “if you can do anything for me, try to change the FAA rules so that other young pilots don’t have to go through what I went through,” (Russell, 2022).

Collegiate aviators not only have the challenges of college to contest with, but also have the fear that if they report any depressive symptoms then they will not be able to achieve their career goals. Further research must be conducted on the mental well-being of students in

professional pilot programs. With the current regulations in place by the FAA could cause students to hide their symptoms instead of seeking professional help, which could lead to tragic consequences. By better understanding the levels of stress that exist in the Aerospace student body, faculty and staff can better understand and provide resources and support to students.

## **Literature Review**

### **College Students**

College can be an exciting experience for students. For most it marks the first time leaving home and being somewhat independent. Students may move to a new and unfamiliar location where they are separated from their families and will meet new responsibilities and experiences. For many, college brings with it a plethora of new stressors and anxiety both inside and outside of the classroom. Anxiety in the classroom has been the subject of several studies throughout the years. While several different theories relate the effect that anxiety has on learning, past research proves that test anxiety specifically proves to be a significant educational problem (Everson et al., 1993). Anxiety in college students can come in many forms, one of which is test anxiety. In a study conducted by Everson et al. 196 first-year college students were asked to complete a self-report survey regarding their test anxiety in four traditional subject areas: English, Mathematics, Physical Science, and Social Science (Everson et al., 1993). The researchers found that students reported feeling more anxiety in math and physical science subjects. This study also concluded that students' perceptions of a subject's difficulty are directly related to their self-reported levels of test anxiety.

Test anxiety is only one of the forms of anxiety that college students face, and anxiety is only one of the negative emotions that college students might experience. Stress, particularly academic stress, is another concern among higher education researchers. When a student enters

college, they are adapting to new educational environments and procedures that they may not have experienced before. The new academic environment can prove to be very stressful for undergraduate students. A 2018 study conducted at a university in India sought to prove that academic stress exists among students and evaluate the different sources of stress between genders and areas of study (Jayasankara Reddy et al., 2018). Out of the 336 participants in this study, 48.80% indicated having average to high levels of stress (Jayasankara Reddy et al., 2018). Although the researchers found no significant difference in stress levels between genders, they discovered that females indicated that the largest source of stress was 'fear of failure' while males indicated that the largest source of stress was 'interpersonal difficulties' (Jayasankara Reddy et al., 2018). Across areas of study, it was found that students in commerce majors experienced the highest levels of academic stress, followed by management majors, and science majors (Jayasankara Reddy et al., 2018). Although academic stress was reported higher in certain areas of study, academic stress spans across majors and genders in various ways.

Misra and McKean conducted a study at an American university that yielded similar results. This study investigated the relationship between anxiety, time management, and leisure satisfaction. 249 full-time undergraduates were selected to complete a series of self-report surveys detailing their academic stress levels, their time management skills, and their levels of leisure satisfaction (Misra & McKean, 2000). In this study, there was also found to be a positive correlation between anxiety and academic stress. One interesting outcome of this study was that while females proved to have better time management skills, they did not report experiencing lower levels of academic stress and reported experiencing lower leisure satisfaction (Misra & McKean, 2000). This study not only determined the interrelationship between these constructs but was also able to determine specific sources of academic stress. Participants of this study

indicated that the largest source of their academic stress comes from self-imposed stress as well as external pressure (Misra & McKean, 2000). This was further reinforced by a similar study also conducted by Misra in 2004. In the 2004 study, the researcher compared American and International students' academic stress sources and levels. Misra concluded that the largest source of stress in American students came from self-imposed stress and external pressures (Misra & Castillo, 2004). While American students indicated higher academic stress, it does not mean that international students do not experience academic stress (Misra & Castillo, 2004). International students may come from a culture that stigmatizes mental health issues, and reporting feelings of stress may be seen in a negative light (Misra & Castillo, 2004).

Academic stress affects all undergraduate students during their college careers. Institutions must recognize the mental health needs of their students not only for student health but for the overall health of the institution itself.

### ***Mental Health Issues in College Students***

While it is important to understand the academic sources of stress and anxiety, it does not provide the whole picture. Academic anxiety and stress are only a piece of the undergraduate mental health puzzle. New college students will be facing new academic environments, new teaching styles, new subject material, and that is only inside the classroom. College students also experience new social situations and new responsibilities while being away from their families. Because of this other mental health issues may arise during their undergraduate experience.

A study conducted by Beiter et al. aimed to better understand the potential correlates of depression, anxiety, and stress in college students (2015). This research study utilized the Depression, Anxiety, and Stress Scale-21 developed by Lovibond & Lovibond. Depression, anxiety, and stress have been an ongoing problem within the undergraduate student population.

Going to college as an undergraduate often means moving away from home and entering an unfamiliar environment. The transition can include many new responsibilities, routines, and stimuli for the student. This research study utilized a sample of 374 undergraduate students attending college at Franciscan University in Steubenville, Ohio (Beiter et al., 2015).

The authors were able to identify a total of nineteen sources of concern from the responses of their participants. Of the nineteen identified, the ten that caused the most concern included academic performance, pressure to succeed, post-graduation plans, financial concerns, quality of sleep, relationships with friends, relationships with family, overall health, body image, and self-esteem (Beiter et al., 2015, p. 93). When examining the sources of stress indicated by the respondents it becomes clear that the general areas of stress include facets of college student life, finances, and personal and/or interpersonal relationships. The results of the study also indicated that upperclassmen indicated higher levels of depression, anxiety, and stress than underclassmen (Beiter et al., 2015). Academic stress is only one type of stress affecting college students. Beiter et al. highlight other areas of life that can add to the stressors that college students face. The combination of academic and life stress that students face in their college years can lead to mental health issues and disorders such as depression and anxiety. Depression, suicidal ideation, and anxiety are major concerns for educators and institutions, and much research has been done on this population to better understand the issues they face.

In a longitudinal study, researchers initially disseminated the Healthy Minds Study, a web-based survey designed to provide a benchmark of the mental health status of college students across the United States, in 2005 (Zivin et al., 2009). Then, two years later in 2007, researchers disseminated a second survey to students who participated in the 2005 survey (Zivin et al., 2009). The purpose of this study was to assess the persistence of mental health issues in

college students. The results of the study indicated that 60% of participants who indicated that they were experiencing a mental health problem in 2005 were experiencing a mental health problem in 2007 (Zivin et al., 2009). There was also a “high degree of persistence in lack of perceived need for help and a lack of services used” even if the participant was experiencing a mental health issue at the time of both screenings (Zivin et al., 2009, p. 184). The number of students who are positively screened for mental health issues and do not seek treatment is large, it is important for institutions to better understand this population to be able to better provide support.

The Healthy Minds Study initially used in Zivin et al.’s study is an annual web-based survey that is disseminated to universities across the United States (The Healthy Minds Network, 2018). The Healthy Minds Survey is an anonymous survey disseminated to college students at participating universities. The survey provides institutions, educators, students, and researchers with a “detailed look at the prevalence of mental health outcomes, knowledge, and attitudes about mental health and service utilization” (The Healthy Minds Network, 2018). Data collected from this survey has been used to help researchers answer questions about student mental health status and how to improve campus services to better meet student needs. One such study was conducted by Lipson et al. using data collected from the Healthy Minds Study from 2007 through 2017 (Lipson et al., 2019). The results of this study indicated that over the ten-year period rates for mental health issues and service utilization increased significantly, while perceptions of stigma decreased (Lipson et al., 2019). The data provided by the Healthy Minds Study indicated that levels of suicidal ideation increased over the ten years from 5.8% to 10.8% (Lipson et al., 2019). This increase in suicidal ideation among college students is alarming, however, with students facing high levels of stress, it is not unprecedented. College students



have indicated in several studies that they are experiencing high levels of stress, and these high levels of stress can and do lead to issues such as depression and suicidal ideation.

Suicidal ideation is when an individual has thoughts about ending their own life. Suicide and suicidal ideation are catastrophic symptom of mental health issues such as depression and anxiety. Suicide is the twelfth leading cause of death for the U.S. population, and the second leading cause of death for individuals in the age groups of 10-14 years and 25-34 years (Centers for Disease Control and Prevention [CDC], 2021). A study conducted by Mortier et al. in 2017 sought to obtain pooled estimates of suicidal thoughts and behaviors among college students on a worldwide scale. The study reviewed literature from 1980 through 2016 that reported a lifetime or twelve-month prevalence of suicidal ideation, plans, or attempts (Mortier et al., 2017, p. 4). The study categorized suicidal thoughts into two categories, broad suicidal ideation, and narrow suicidal ideation. Broad suicidal ideation includes non-specific suicidal statements such as “thoughts of taking your own life” or, “thoughts of being better off dead,” (Mortier et al., 2017). Narrow suicidal ideation is specific statements of suicidal ideation such as “I have the plan to commit suicide,” and “seriously considering committing suicide,” (Mortier et al., 2017). When considering these two categories of suicidal ideation, it was found that one in four college students had reported suicidal ideations that fit into the broad suicidal ideation category, and one in six students in the narrow suicidal ideation category (Mortier et al., 2017).

In 2021 the Healthy Minds Study was disseminated to 103,748 students at universities across the United States (Eisenberg et al., 2022). The results of this survey indicate that 41% of participants screened positively for depression, and 34% of participants screened positively for anxiety (Eisenberg et al., 2021, p. 5). Thirteen percent of participants indicated having suicidal ideation in the past year, 1% indicated at least one suicide attempt in the past year, and 23%

indicated that they had performed self-harm behaviors in the past year (Eisenberg et al., 2021, p. 6). The results from the 2021 Healthy Minds Study indicate that depression, anxiety, and suicidal ideation continue to be a problem for college students.

Mental health issues and psychological conditions affect a large portion of the world's population. Previous research shows that college students may be at an elevated risk for psychological conditions such as depression, anxiety, and stress. College provides individuals with new responsibilities, experiences, and stressors. With all these new and unfamiliar stimuli, college students are at a higher risk than the general population to exhibit and being negatively affected by psychological conditions.

### **Mental Health in Aviation**

Mental health in aviation is a complex subject. The following literature will highlight the regulations set forth by the FAA regarding mental health as well as the role of the Aviation Medical Examiner and the individual pilot when a pilot is screened for mental health issues. There has also been literature published on the elements faced by commercial pilots that can lead to mental health issues. Little literature is available regarding college students majoring in Aerospace and mental health status. Even fewer studies have been done on the effect that the COVID-19 pandemic had on collegiate aviators. Literature on the effect of COVID-19 on both college students and collegiate Aerospace students will be examined below.

### **FAA Regulations Regarding Mental Health Issues**

The Aviation Medical Examiners Guide provided by the FAA provides the roadmap for pilots who have experienced or are currently experiencing abnormal psychiatric symptoms. AMEs are often considered the first line of defense when it comes to ensuring safety. The Aviation Medical Examiners Guide is used by AMEs to assist them in determining the physical

and mental fitness of a pilot to issue a medical certificate. Within the Aviation Medical Examiners Guide is a list of disorders that could pose a potential risk to aviation safety generated by the FAA. These conditions include attention-deficit hyperactivity disorder (ADHD), bipolar disorder, personality disorders, psychosis, substance abuse, substance dependence, suicide attempt, adjustment disorder, bereavement, dysthymic, minor depression, and use of psychotropic medications for smoking cessation. Regarding depression management, an applicant has very limited medication choices when it comes to seeking medication as a form of intervention. The FAA has only approved four selective serotonin reuptake inhibitors (SSRIs). These four SSRIs include Prozac, Zoloft, Celexa, and Lexapro. Any other antidepressant medication or the use of more than one of the approved SSRIs at a time is not acceptable for a special issuance and will result in the denial of a medical certificate. An applicant reporting taking these medications, experiencing these symptoms, or reports having a history of these symptoms is subject to a denial of their medical certificate or a deferral for a special issuance. If an applicant were to report having experienced or having had a history of psychosis, suicidal ideation, electro-convulsive therapy, multiple SSRI usage, or multi-agent drug protocol use then they are immediately denied medical clearance and will not be deferred for a special issuance.

A special issuance requires several steps and is a very extensive process not only to get the initial issuance but to maintain it as well. According to the AME Guide, once a special issuance is given the applicant must select a Human Intervention Motivation Study Medical Examiner, often called a HIMS AME. HIMS medical examiners have undergone specific training to be able to evaluate pilots for substance abuse issues, and mental health conditions (Federal Aviation Administration [FAA], 2022b). Once a pilot selects a HIMS AME they are required to meet with them in person every six months for an evaluation and must present the

examiner with a report from their psychiatrist. The applicant must also undergo additional evaluation annually with a neuropsychologist and must give the neuropsychologist's report to the HIMS examiner. An additional report to the HIMS AME from the applicant's chief pilot is required every three months. The stringent reports and evaluations that an applicant must undergo to continue flying could lead to pilots deciding to not report their mental health symptoms and instead choosing to continue to fly.

The regulations set forth by the FAA mean that a significant portion of the population would not meet the requirements for a medical certificate. According to the Centers for Disease Control (CDC), between 2015 and 2018 13.2% of adults aged 18 and older reported using antidepressant medication. Additionally, the CDC reported that antidepressant usage was higher for adults with at least some college education, especially when compared to adults who only had a high school diploma (CDC, 2021). The requirements for mental health in aviation medical certifications have played a major role in increasing the stigma surrounding mental health in aerospace. Admitting to a psychological condition and getting help could lead to the end of a pilot's aerospace career and potentially the loss of financial income. The fears surrounding admission to a psychological issue could lead to pilots keeping their mental health a secret. In a study conducted in 2003, before the FAA approved the use of four SSRIs, researchers examined U.S. National Transportation Safety Board reports of 61 pilot fatalities that occurred between 1990-2001 (Sen et al., 2007). The pilots in each of these accidents were reported to have used SSRIs and had levels of these drugs at the time of the fatalities (Sen et al., 2007). Of these 61 pilots, 52 of them never reported the use of SSRIs or the presence of a disqualifying psychological condition (Sen et al., 2007). This study provides statistics on the usage of SSRIs by pilots, and the lack of reporting that comes with them. According to Dr. Todd Hubbard, the

chair of the University Aviation Association's Publication Committee and a senior professor at Oklahoma University, the stigma surrounding mental health in aviation not only leads to pilots refusing to report issues to their AME but also leads to pilots refusing to seek help for their mental health conditions altogether (Hubbard, 2016).

### **Commercial Pilots and Mental Health**

In the past, the available literature on aviators' mental well-being has primarily focused on commercial airline pilots or military aviators. The effects that stress, anxiety, and depression can have on commercial aviators increase the likelihood of occupational errors and accidents. Several factors play into the mental health of commercial aviation pilots and can affect their performance and safety. This study sought to investigate the connection between these factors. A study was conducted on 442 commercial airline pilots from Britain. The participants were given a series of surveys regarding job satisfaction, mental health, and pilot performance, and participated in interviews (Cooper & Sloan, 1985). The results of this study dove deeper into not only the stress that accompanies the job of a pilot but also external stressors that could affect mental health (Cooper & Sloan, 1985). The relationship between performance in the cockpit, job satisfaction, and mental health of pilots was found to be a strong indicator of errors and accidents while fulfilling the role of the pilot (Cooper & Sloan, 1985). The mental well-being of pilots is not only a safety issue for the individual pilot but for society. When a commercial airline pilot is suffering from mental health issues or detrimental levels of stress it creates a dangerous environment for the pilot, the crew, and the passengers. Another study focused on the interactions between occupational stress, fatigue, and mental health in commercial pilots. The researchers used a series of self-report surveys to measure the fatigue levels, mental health, and stress levels of 406 international commercial pilots (Venus & Holtforth, 2022). Commercial

pilots often face irregular work hours which can make it difficult to obtain sufficient rest and can interfere with circadian rhythms (DeHoff & Cusick, 2018). The pilots in this study indicated that they were experiencing high levels of accumulated fatigue and 18.7% had positive depression screenings (Venus & Holtforth, 2022). The pilots who reported higher levels of fatigue also reported higher perceived stress levels and higher scores on depression and mental well-being scales (Venus & Holtforth, 2022). Fatigue, stress, and workload are all common to the aviation environment, and play together to increase the mental health risks for commercial pilots, “lifestyle conditions may contribute to the prevalence of these mental health challenges within the pilot population” (DeHoff & Cusick, 2018, p. 7).

The pilot profession presents a turbulent and at times stressful work environment which can lead to mental health issues and psychological conditions. One study was conducted using an anonymous web-based survey to identify if, and to what extent psychological conditions affect commercial pilots (Wu et al., 2016). This study utilized the online anonymous survey to give an accurate measurement of the mental health status among commercial airline pilots. The study found that 12.6% of the participants met the criteria for depression, and 4.1% of participants reported having had suicidal thoughts or behaviors within the past two weeks (Wu et al., 2016). With the anonymity of the survey, the ability of the researchers to determine the generalizability of their findings to the entire airline pilot population was limited (Wu et al., 2016). Additionally, due to the stigma that exists in the aerospace industry, the authors warn against taking these responses at face value (Wu et al., 2016). Even with the anonymity of the survey, it is likely that participants still did not feel comfortable participating in the study due to the nature of the questions being asked. The results of this study are indicative of an even larger underlying

problem within commercial aviation and show that potentially hundreds of pilots are still flying while experiencing depressive or suicidal symptoms (Wu et al., 2016).

There are several elements of the aviation profession that can lead to a pilot exhibiting a symptom of psychological conditions such as depression, anxiety, or stress. Commercial pilot mental health is not only an issue for the individual but should also be treated as a safety issue.

### **College Aviators and Mental Health**

While the literature mentioned above is important for understanding the mental health status of airline pilots, little research has been done on students of collegiate aerospace programs. The most applicable literature that has been published concerning mental health issues in collegiate pilots will be discussed below.

A study conducted in 2018 set out to determine student perceptions of stress, and what stressors are unique to flight training (Robertson & Ruiz, 2018). The study consisted of three sections, the first was a list of stressors that the researchers provided as well as a section for students to list stressors that were not included in the provided list (Robertson & Ruiz, 2018). The second portion of the survey included a Likert scale for each of the stressors so that participants could indicate the extent of stress provided by each stressor (Robertson & Ruiz, 2018). The third portion of the study asked the participants for demographic data (Robertson & Ruiz, 2018). The stressors with the highest stress rankings were check rides and financial factors (Robertson & Ruiz, 2018). As indicated in the study conducted by Bieter et al., financial concerns were also highly ranked for the general undergraduate student population. However, the stress of financial concerns is likely higher for students in the professional pilot major due to the supplemental cost that is associated with flight training. Checkrides also provide extra stress to students in aerospace majors. In addition to a student's exams that are typically a part of every

college student's experience, aerospace students have this additional evaluation to undergo. This study helps to highlight areas of stress that are unique to aerospace students in flight programs but also highlights areas where stress that is normally found in university students may be amplified.

The most prominent mental health study that has been done on students enrolled in collegiate flight training comes from scholars from Arizona State University. The study utilized a mixed method of research to compare students in collegiate flight training programs with students who are pursuing flight training outside of a collegiate environment (Jacobs et al., 2020). This study also compared the depression, stress, and anxiety levels of collegiate flight students across year groups using the Depression Anxiety, Stress Scales developed by Lovibond & Lovibond. At the conclusion of the study, the researchers found that there were no significant differences between the collegiate flight training students, and students who were not in collegiate flight training. The findings also showed no significant difference between the year groups of collegiate flight training students (Jacobs et al., 2020). While this study might not have discovered any differences between year groups, it still shows that mental health issues such as depression, anxiety, and stress run rampant among undergraduate students. All the participants of this study reported normal to mild scores on the depression, anxiety, and stress sub-scales (Jacobs et al., 2020). This study found no significant differences between these groups. However, this study showed that most of the participants experienced some level of depression, anxiety, and stress.

### **Impact of COVID-19**



The novel COVID-19 virus shook the world in 2020. The pandemic not only brought about a contagious and dangerous virus, but also a halt to the normal function of society. During the pandemic stay-at-home orders were issued, schools moved to an online format, workers were forced to work from home, and businesses and institutions closed their doors to the public. When disasters affecting a mass of individuals occur emotional reactions are to be expected (Pfefferbaum, 2020). Disasters such as natural disasters or mass casualty events are disasters that will often elicit emotional responses from individuals, and one of these reactions can present itself in Post-Traumatic Stress Disorder (PTSD) (Pfefferbaum, 2020). However, the COVID-19 pandemic does not meet the criteria for trauma that is required for PTSD, instead, individuals have begun developing depressive and anxiety disorders (Pfefferbaum, 2020). In a sample of people quarantined in 2020, and a sample of healthcare workers it was discovered that the emotional responses they experienced included symptoms of extreme stress, depression, and anxiety (Pfefferbaum, 2020). College students are a subpopulation that has already shown to be at a higher risk for negative psychological conditions and symptoms. During the COVID-19 pandemic, while the general population showed a disintegration in mental well-being, college students indicated an even more rapid decrease in mental well-being. While college students were faced with the same changes due to the pandemic as the general population, they also faced their own unique challenges. Perhaps the biggest change seen in universities across the nation was the switch from in-person classes to online classes. Students were isolated at home, unable to attend their university in person. College students were facing changes to their normal routines and were being isolated by the pandemic, which potentially lead to an increase of psychological conditions and mental health issues. In an interview study with 195 student participants, it was found that 71% indicated that their mental health had decreased significantly due to the COVID-

19 pandemic (Son et al., 2020). Another shocking result of the study found that 44% of students reported having an increase in depressive thoughts, and 8% indicated an increase in suicidal ideations (Son et al., 2020).

The COVID-19 pandemic turned the world upside down, and negatively impacted the aerospace industry to unprecedented levels. The COVID-19 pandemic caused great losses in the industry, and over time hundreds of airline pilots were furloughed or were given early retirement. Researchers from Wright State University conducted a web-based survey to address the impact that COVID-19 had on the aviation system and aviation workers (Cahill et al., 2021). Researchers focused on specific areas that had been impacted such as well-being and morale, performance and safety behavior, and safety oversight (Cahill et al., 2021). Out of the 1,523 aviation workers that responded to the survey 63% indicated that their mental health significantly decreased since the pandemic, and 134 respondents indicated that they were experiencing severe depression and suicidal ideation (Cahill et al., 2021). Of those indicating having experienced suicidal ideation, 68 of them were pilots (Cahill et al., 2021). The COVID-19 pandemic presented new challenges for an industry already facing mental health hurdles.

The pandemic not only negatively impacted the commercial airline industry, but also the perceptions of collegiate aerospace students. Scholars at the University of Southern Queensland investigated the COVID-19 pandemic and its effects on collegiate aerospace students. The study utilized an online survey that included items asking participants about the impact that the pandemic had on their university program, and their future considerations about aerospace careers (Miani et al., 2021). In anecdotal evidence evaluated by the researchers, it was found that applications for undergraduate aerospace programs had decreased significantly over the course of the COVID-19 pandemic (Miani et al., 2021). According to Miani et al. many students in an

undergraduate aviation program reported that they felt concerned for their future careers after COVID-19, and some even considered changing their career paths altogether. This study also found that undergraduate aerospace students feel stress when considering post-graduation career. This is something that appears to affect all college undergraduate students (Beiter et al.), however, in the aftermath of COVID-19 Aerospace students have been left wondering if another pandemic-sized event could leave them without a career. Because of the impact, COVID-19 has had on the industry, students in aerospace-specific degree paths have had concerns regarding their post-graduation and career plans. Perhaps the biggest fear regarding career concerns came from students seeing the aviation industry shut down during the early stages of the pandemic. However, in 2022, two years after the beginning of the pandemic there seems to be an industry-wide pilot shortage. During the pandemic, airlines offered their senior pilots an early retirement and furloughed hundreds of pilots (Josephs, 2022). During this time airlines were unable to train new pilots due to safety concerns surrounding the COVID-19 virus (Josephs, 2022). Now that the pandemic has passed, the airlines are scrambling to fill pilot slots. While the career concerns of student pilots might have initially had students questioning their career choices, the post-pandemic pilot job outlook is exponentially brighter.

In a study by Wu et al., the authors found similar results regarding students in the United States and their perceptions of the aviation industry post-COVID-19. 79% of the 206 participants in this study indicated that they held a negative view of the job market and expected to find it difficult to establish a career in the aerospace industry (Wu & Shila, 2021). This study also indicated that students in the U.S. are also facing higher levels of pandemic-related stress and anxiety (Wu & Shila, 2021). Participants of this study indicated that financial concerns,

moving to online learning, and being unable to progress in training were the main sources of stress (Wu & Shila, 2021).

The COVID-19 pandemic presented several challenges and mental health implications for society. The general population experienced several negative emotional responses to the pandemic and rates of psychological conditions such as anxiety and depression were on the rise. The subpopulation of college students was no exception to this. Because of the unique challenges faced by college students such as the transition to online learning, college students were at a heightened risk of mental health issues during the pandemic. Aerospace students were also fighting another unique set of challenges. Without the ability to continue flight training and watch the impact that COVID-19 had on the airline industry, aerospace students experienced heightened levels of concern, stress, anxiety, and depression.

### **Statement of the Problem**

While it is logical for undergraduate students to be facing high levels of depression, anxiety, and stress, there may be some degree programs that can induce higher levels of stress than others. One of the programs hypothesized to create more stress in its students is the professional pilot program. When a student is enrolled in an aerospace program that includes flight training the pressures described in Beiter et al. are present, however, there are also unique stressors that exist for this type of student. In some universities, to obtain admittance to a flight training course students must meet a certain GPA requirement. Students are not only under pressure to perform well academically in their traditional classes to be able to enroll in the selective flight courses, but also to complete them in the allotted time. Students are given strict deadlines by which they are to complete their flight training. Failure to meet these deadlines can cause a delay in the completion of their major. Students are competing against the clock, and

barriers to their success are often events such as weather delays, maintenance delays, or health issues. Students in collegiate flight schools also face a heightened financial burden than most other traditional college students. The price of these flight-training courses is an additional fee on top of the tuition and fees that all undergraduate students must pay. While there are scholarships available, many aerospace scholarships are highly competitive or have restrictive rules as to what or how the scholarship can be used.

Beiter et al. found that the most prominent sources of stress in a student's life come from academic performance, pressure to succeed, and financial concerns. When a student chooses to enroll in a flight-training collegiate program it appears that they are placing themselves at a heightened risk of stress, anxiety, and depression. In this study, the respondents' DASS-21 subscale scores are compared to each other to determine if students majoring in specific programs experience higher levels of depression, anxiety, and stress than other students.

The overarching research question guiding this study is as follows: Are Aerospace students at Middle Tennessee State University prone to exhibit higher levels of depression, anxiety, and stress than students in majors other than Aerospace? Specific research questions which will be investigated are indicated below.

### **Research Questions**

1. Will Middle Tennessee State University (MTSU) Aerospace students in the Professional Pilot concentration exhibit higher levels of depression, anxiety, and stress as exhibited by responses on the DASS-21, than MTSU Aerospace students who are in concentrations other than Professional Pilot?

2. Will MTSU Aerospace students in the Professional Pilot concentration exhibit higher levels of depression, anxiety, and stress as exhibited by responses on the DASS-21, than MTSU students in majors other than Aerospace?
3. Will MTSU students in concentrations other than Professional Pilot exhibit higher levels of depression, anxiety, and stress as exhibited by responses on the DASS-21, than MTSU students in majors other than Aerospace?

## **Chapter II: Methodology**

Quantitative research methodologies were used in this study to determine the difference in depression, stress, and anxiety levels between students in Aerospace majors in the Professional Pilot concentration, Aerospace majors in concentrations other than Professional Pilot, and students in majors that are not Aerospace. A survey was utilized to gather data from participants. This method of data collection was the most effective and efficient way to perform data collection from participants because the responses came directly from the participants, and the survey allowed for complete anonymity. Due to the nature of this topic, every effort was made by the researcher to ensure the complete anonymity of the participants. The survey used in this study was the DASS-21 developed by S.H. Lovibond and P.F. Lovibond in 1995. This survey provided the researcher with a total score, and three sub-scores for the depression, anxiety, and stress scales. The scores were able to be converted to z-scores and provided the researcher with quantitative data to compare between the three student sample groups. This study was approved by the Institutional Review Board under protocol number 22-2158 7I (Appendix A).

### **Participants**

Participants were selected through convenience sampling procedures. The sample group used in this study were undergraduate students from Middle Tennessee State University enrolled in courses during the summer and fall 2022 semesters. Courses that met throughout the summer and fall semesters were selected, and the students in these classes were recruited by the researcher to participate in the study. The courses selected by the researcher consisted of Aerospace courses and courses outside of Aerospace to ensure that three samples of student

populations were represented in the study. Participants were excluded if they were not over the age of 18, or if they were not undergraduate students.

The first group of students included Aerospace majors in the Professional Pilot concentration. The second group of students included Aerospace majors in concentrations other than the Professional Pilot concentration. The third group of students included students who are in majors outside of the Aerospace Department. A total of 574 students chose to participate in the study. Three hundred and thirty-three of respondents indicated that they were Aerospace majors in the Professional Pilot concentration. 102 of the respondents indicated that they were Aerospace majors in concentrations other than Professional pilots. 139 of the respondents indicated that they were in majors other than Aerospace.

### **Instruments**

This study utilized the Depression, Anxiety, and Stress Scale-21 (DASS) (Appendix C). The DASS is a 42-item survey designed to measure depression, anxiety, and stress. The DASS was developed by S.H. Lovibond and P.F. Lovibond in 1995 to measure the constructs of anxiety and depression while eliminating the overlap between them and providing a better distinction between the two syndromes (Lovibond & Lovibond, 1995, p. 5). Previous self-report scales had difficulty differentiating anxiety and depression, and the DASS was developed to determine the core symptoms of anxiety and depression both in a clinical setting and in non-clinical settings (Lovibond & Lovibond, 1995). Development of the instrument took place from 1979 through 1990, and several samples of clinical and non-clinical subjects were used over this time (Lovibond & Lovibond, 1995). Early in the development of the instrument a new scale called stress emerged, stress proved to be separate from anxiety and depression (Lovibond & Lovibond, 1995). The development of the instrument also led to a 42-item questionnaire, and a shortened



21-item questionnaire also called the Depression Anxiety Stress Scale-21 (DASS-21). The DASS-21 includes three self-report scales which measure negative emotional states of depression, anxiety, and stress (Lovibond & Lovibond, 1994). The DASS-21 was chosen by the researcher for this proposed research study over the DASS due to the scale being shorter and easier to administer, without compromising reliability (Henry & Crawford, 2005).

The DASS-21 was chosen by the researcher due to high levels of internal validity, and because it has been proven to have a better fit than competing models that measure negative affect (Henry & Crawford, 2005). In a study conducted by Henry, and Crawford, the DASS-21 was tested for internal reliability, and validity, and compared the stress scale to a competing model. The researchers found that the three scales measured by the DASS-21 possess adequate reliability. When these scales were combined the study found that the scale generates considerable validity when used to measure general psychological stress (Henry & Crawford, 2005). When compared to another model, the Positive and Negative Affect Scale (PANAS), the DASS-21 proved to have a better measure of fit concerning the measurement of stress (Henry & Crawford, 2005). This is because the DASS-21 provides a measure of stress, while the PANAS provides a measurement of general negative affect or a general feeling of negative emotions. The researchers hypothesized that the DASS-21 stress scale would measure negative affect, and when comparing the two instruments they would correlate accordingly. The terms ‘stress’ and ‘negative affect’ are not interchangeable, and the researchers found that when they were interchanged a significant loss of fit occurred (Henry & Crawford, 2005). The study performed by Henry and Crawford, proves that the DASS-21 is a reliable and valid measurement of anxiety, depression, and stress. The DASS-21 reliably pinpoints symptoms specific to anxiety and

depression with little overlap. This instrument also measures the scale of stress rather than simply measuring negative affect.

A study was conducted on the structural validity of the DASS-21 when used for undergraduate college students in the United States. This study aimed to evaluate the latent structure of the DASS-21 when used in undergraduate populations (Kia-Keating et al., 2018). This study found that the DASS-21 is a reliable mental-health assessment tool to be used on emerging adults in the college environment (Kia-Keating et al., 2018). Specifically, the researchers recommend that the assessment can be used to quickly collect information from students in college counseling centers due to its strong psychometric properties (Kia-Keating et al., 2018).

## **Procedures**

The first step taken was to obtain Institutional Review Board (IRB) approval. The IRB application was approved on June 8<sup>th</sup>, 2022. The IRB protocol number is: 22-2158 7i and expires on June 30<sup>th</sup>, 2023 (Appendix A). After gaining IRB approval, a master list of courses offered in the summer was created. Pipeline was utilized to create the master list of courses. Pipeline is the name of the web interface at Middle Tennessee State University that contains information on course offerings, meeting times, registration status, and similar information for students and staff. Using Pipeline, the researcher was able to create a list of courses offered, the number of students in each class, and contact information for the professors of the courses. Once contact information for the instructors of the summer courses was collected the researcher then emailed and obtained permission to enter the courses and present the approved recruitment script. The researcher then went to selected sections of courses after permission had been obtained. The courses that were used in this study include courses in the Aerospace Department and other

departments at MTSU. A list of Aerospace and Non-Aerospace courses can be found in Appendix E and Appendix F.

The researcher then went into the classes and used the prepared recruitment script to describe the study goals, the instrument to be used, and the risks and benefits associated with participation. The researcher also answered any questions that the students might have about the research to be conducted. After ensuring the students were fully informed about the survey and research, the surveys were physically disseminated to participants. Students were provided with an informed consent form and a copy of the DASS-21 survey. The informed consent document was to be kept by participants, while the DASS-21 survey was completed and then handed back to the researcher. The researcher was present during the completion of the surveys and answered any questions that participants had while completing the survey. The survey asked participants to list their major of study, concentration, and year group of students (freshman, sophomore, junior, or senior). Due to the nature of the survey, no demographic data outside of the participant's major, concentration, and year group was collected. By completing the survey, the students indicated informed consent, therefore informed consent signatures were not required.

Once the surveys were completed by the participants, they were collected by the researcher and stored in the researcher's locked office. Students were assigned to one of three groups based on which major they indicated on the survey. Group 1 included students in the Aerospace Pro-Pilot program. Group 2 included students in the Aerospace major in concentrations other than Pro-Pilot. Group 3 included students who are in majors other than Aerospace. The group number for each survey was recorded in an Excel spreadsheet. The year group was also recorded for each survey in Excel. The surveys were then scored using the *Manual for the Depression Anxiety Stress Scales*. The manual included a scoring template with a

plastic sheet. Each item on the survey aligns with either the depression, anxiety, or stress scale. For each survey collected the total score was calculated using the scoring template provided in the manual. Since the survey used in this study was the DASS-21 item version rather than the 42-item version, each of the responses to the survey was multiplied by two (Lovibond & Lovibond, 1995). These scores were then recorded in Excel along with the scores for each sub-scale. Once the sub-scale scores were calculated and recorded in the spreadsheet, the *Manual for the Depression Anxiety Stress Scales* was used to determine the Z score values for each subscale. The Z scores for each sub-scale were recorded in the Excel spreadsheet.

Once the surveys had been scored and those scores had been recorded, any surveys with missing demographic data were excluded from the sample. If participants did not indicate their major or concentration the survey scores were not used. Additionally, any surveys with missing items were removed in accordance with the DASS-21 manual (Lovibond & Lovibond, 1995).

Once data collection was complete, data analysis began. Several statistical analyses were used to answer the proposed research questions. By converting the Likert scores provided by the participants to Z scores, quantitative data analysis techniques were then used on the collected data. The results of the statistical analyses are discussed in the next chapter.

### Chapter III: Data Analysis

The DASS-21 consists of twenty-one items and responses are given in a Likert scale format. Each item on the DASS-21 corresponds to one of three subscales, depression, anxiety, and stress. Responses to each item were scored to the appropriate subscale to create sub-scores for depression, anxiety, and stress. Since the responses and sub-scores are given in a Likert scale format, the scores were converted to their corresponding Z-scores to be able to run quantitative statistical analysis on them. The Z-scores were calculated based on the normative values provided in the DASS manual (Lovibond & Lovibond, 1995).

#### Severity Profiles

A severity profile was also created using the DASS manual. The DASS Profile Sheet (Appendix D) provides a way to graph and convert individual scores or group averages for each subscale and allows comparisons between the three subscales (Lovibond & Lovibond, 1995). The severity categories for each subscale are listed in the chart below. Using the criteria for the severity ratings, the severity percentages were calculated for the average scores of each group of participants. In the descriptive statistics section for each group, a severity profile is shown for percentages of participants within that group. This allows for further visibility of the scope of severities present within each group than is allowed when looking at only the group average.

	<i>Depression</i>	<i>Anxiety</i>	<i>Stress</i>
<i>Normal</i>	0-9	0-7	0-14
<i>Mild</i>	10-13	8-9	15-18
<i>Moderate</i>	14-20	10-14	19-25
<i>Severe</i>	21-27	15-19	26-33
<i>Extremely Severe</i>	28+	20+	34+

Table 1. DASS Scoring Rubric

Using the Professional-Pilot group average for each subscale a severity profile was created. For the Professional-Pilot depression, anxiety, and stress, the severity levels all fell within the normal range (Table 2).

<i>Pro-Pilot</i>	<i>Average Score</i>	<i>Rank</i>
<i>Depression</i>	7.07	Normal
<i>Anxiety</i>	6.87	Normal
<i>Stress</i>	10.69	Normal

Table 2. Professional Pilot Group Average Severity

Using the Aerospace Non-Professional Pilot group average for each subscale a severity profile was created. For the Aerospace Non-Professional Pilot group depression, anxiety, and stress, the severity levels all fell within the normal range (Table 3).

<i>Aero Non-Pilot</i>	<i>Average Score</i>	<i>Rank</i>
<i>Depression</i>	7.55	Normal
<i>Anxiety</i>	6.72	Normal
<i>Stress</i>	10.68	Normal

Table 3. Aerospace Non-Professional Pilot Group Average Severity

Using the Non-Aerospace group average for each subscale a severity profile was created. For the Non-Aerospace group depression and stress were mild, while the severity of stress was moderate (Table 4).

<i>Non-Aero</i>	<i>Average Score</i>	<i>Rank</i>
<i>Depression</i>	12.53	Mild
<i>Anxiety</i>	10.48	Moderate
<i>Stress</i>	16.27	Mild

Table 4. Non-Aerospace Group Average Severity

## Professional Pilot Descriptive Statistics

A total of 333 Aerospace Pro-pilot participants provided responses to the survey. The year group distribution for the Professional Pilot group consisted of 104 freshmen, 69 unknown/did not indicate, 67 seniors, 62 juniors, and 30 sophomores. The depression subscale mean was 0.105, and the standard deviation was 1.177. The anxiety subscale mean was 0.441, and the standard deviation was 1.392. The stress subscale mean was 0.073, and the standard deviation was 1.002. Other descriptive statistics are provided in the table below.

	<i>Depression Subscale</i>	<i>Anxiety Subscale</i>	<i>Stress Subscale</i>
<i>Mean</i>	0.105525526	0.441471471	0.07357358
<i>Standard Error</i>	0.064538654	0.064538654	0.0549222
<i>Median</i>	-0.34	-0.14	-0.01
<i>Mode</i>	-0.91	-0.55	-0.27
<i>Standard Deviation</i>	1.177719914	1.39248865	1.00223613
<i>Sample Variance</i>	1.387024196	1.93902464	1.00447725
<i>Kurtosis</i>	1.941875444	4.3163902	1.94187544
<i>Skewness</i>	1.540272426	1.31884999	0.75813217
<i>Range</i>	5.45	6.52	4.81
<i>Minimum</i>	-0.91	-0.96	-1.28
<i>Maximum</i>	4.54	5.56	3.53
<i>Sum</i>	35.14	147.01	24.5
<i>Count</i>	333	333	333

*Table 5. Professional Pilot Descriptive Statistics*

The severity profiles for each subscale are broken down into percentages of participants in the Professional-Pilot group and are displayed in the table below (Table 6). The majority of participants in this group showed normal severity for all three scales with 71.77% of participants falling into the normal severity category for depression, 63.06% for anxiety, and 73.27% for stress.

<i>SEVERITY LEVEL</i>	<i>PERCENTAGE OF DEPRESSION SEVERITY</i>	<i>PERCENTAGE OF ANXIETY SEVERITY</i>	<i>PERCENTAGE OF STRESS SEVERITY</i>
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NORMAL	71.77%	63.06%	73.27%
MILD	9.61%	9.31%	9.91%
MODERATE	10.21%	12.61%	11.41%
SEVERE	4.20%	8.41%	4.20%
EXTREMELY SEVERE	4.20%	6.61%	1.20%

Table 6. Professional Pilot Severity Distribution

### Aerospace Non-Professional Pilot Descriptive Statistics

A total of 102 Aerospace Non-Professional Pilot participants provided responses to the survey. The year group distribution for the Aerospace Non-Professional Pilot group consisted of 21 freshmen, 14 sophomores, 13 juniors, 29 seniors, and 26 unknown/did not indicate. The depression subscale mean was 0.179, and the standard deviation was 1.154. The anxiety subscale mean was 0.418, and the standard deviation was 1.513. The stress subscale mean was 0.081, and the standard deviation was 1.035. Other descriptive statistics are provided in the table below.

	DEPRESSION SUBSCALE	ANXIETY SUBSCALE	STRESS SUBSCALE
MEAN	0.17980392	0.41862745	0.08196078
STANDARD ERROR	0.11428854	0.14987985	0.10254839
MEDIAN	-0.34	-0.14	-0.01
MODE	-0.91	-0.96	0.24
STANDARD DEVIATION	1.15425771	1.51371227	1.03568798
SAMPLE VARIANCE	1.33231085	2.29132483	1.07264958
KURTOSIS	-0.0292403	0.78127747	-0.2222256
SKEWNESS	0.99384876	1.26693113	0.68337981
RANGE	4.59	5.71	4.3
MINIMUM	-0.91	-0.96	-1.28
MAXIMUM	3.68	4.75	3.02
SUM	18.34	42.7	8.36
COUNT	102	102	102

Table 7. Aerospace Non-Professional Pilot Descriptive Statistics



The severity profiles for each subscale are broken down into percentages of participants in the Aerospace Non-Professional Pilot group and are displayed in the table below (Table 8). Similarly, to the Professional-Pilot group, the majority of Aerospace Non-Professional Pilot participants showed normal severity for all three scales with 61.76% of participants falling into the normal severity category for depression, 62.75% for anxiety, and 72.55% for stress.

<i>Severity Level</i>	<i>Percentage of Depression Severity</i>	<i>Percentage of Anxiety Severity</i>	<i>Percentage of Stress Severity</i>
<i>Normal</i>	61.76%	62.75%	72.55%
<i>Mild</i>	13.73%	9.80%	9.80%
<i>Moderate</i>	15.69%	13.73%	11.76%
<i>Severe</i>	7.84%	8.82%	4.90%
<i>Extremely Severe</i>	0.98%	4.90%	0.98%

*Table 8. Aerospace Non-Professional Pilot Severity Distribution*

### **Non-Aerospace Descriptive Statistics**

A total of 139 Non-Aerospace participants provided responses to the survey. The year group distribution for the Non-Aerospace group consisted of 24 freshmen, 33 sophomores, 26 juniors, 32 seniors, and 24 unknown/did not indicate. The depression subscale mean was 0.888, and the standard deviation was 1.604. The anxiety subscale mean was 1.746, and the standard deviation was 2.179. The stress subscale mean was 0.778, and the standard deviation was 1.250. Other descriptive statistics are provided in the table below.

	<i>Depression Subscale</i>	<i>Anxiety Subscale</i>	<i>Stress Subscale</i>
<i>Mean</i>	0.888273381	1.74690647	0.77856115
<i>Standard Error</i>	0.136119107	0.18483942	0.10610637

Median	0.24	1.49	0.74
Mode	-0.62	-0.96	-0.01
Standard Deviation	1.604820604	2.17922465	1.2509756
Sample Variance	2.575449171	4.74902007	1.56493994
Kurtosis	-0.168397418	-0.4097844	-0.4783373
Skewness	0.894837494	0.61642122	0.37859215
Range	6.03	8.56	5.31
Minimum	-0.91	-0.96	-1.28
Maximum	5.12	7.6	4.03
Sum	123.47	242.82	108.22
Count	139	139	139

Table 9. Non-Aerospace Descriptive Statistics

The severity profiles for each subscale are broken down into percentages of participants in the Non-Aerospace group and are displayed in the table below (Table 10). The Non-Aerospace participants showed normal severity for the depression and stress scales with 51.08% for depression, and 48.92% for the stress subscale. The anxiety scale had 33.09% of participants reporting normal severity while 30.22% reported extremely severe.

Severity Level	Percentage of Depression Severity	Percentage of Anxiety Severity	Percentage of Stress Severity
Normal	51.08%	33.09%	48.92%
Mild	10.07%	9.35%	15.83%
Moderate	19.24%	17.27%	13.67%
Severe	5.04%	10.07%	15.11%
Extremely Severe	14.39%	30.22%	6.47%

Table 10. Non-Aerospace Severity Distribution

### Analysis of Groups Depression, Anxiety, and Stress Scales

To test that the degree program status of participants affected the independent variables of depression, anxiety, and stress levels of students, a between-groups ANOVA was performed for each of the three subscales.

Due to the unequal sample sizes in responses, a Bartlett test was used to determine the homogeneity of variances across groups. An ANOVA was used to statistically analyze the data, and since one assumption of ANOVA is that the variances are equal across groups, the Bartlett test was used to confirm the assumption. The Bartlett test showed that the P-value for the depression subscale was 0.80328, the anxiety subscale P-value was 0.29254, and the stress subscale P-value was 0.68151. Since all the P-values for the three subscales were greater than .05 the homogeneity of the groups is confirmed.

The ANOVA results as well as the Tukey-Kramer post hoc test results are discussed below.

### Depression

A one-way ANOVA revealed that there was a statistically significant difference in the depression scale between at least two groups ( $F(2, 571) = [18.663]$ ,  $p = 1.408 \times 10^{-8}$ ). A Tukey-Kramer HSD post-hoc test was run to determine which of the groups were statistically different. The results of the Tukey-Kramer test are shown in the table below (Table 8).

	<i>Tukey HSD Q statistic</i>	<i>Tukey HSD p-value</i>
<i>Professional-Pilot v. Aerospace Non-Pilot</i>	0.7195	0.852
<i>Aerospace Pro-Pilot v. Non-Aerospace</i>	8.4966	0.001
<i>Aerospace Non-Pilot v. Non-Aerospace</i>	5.9564	0.001

*Table 11. Depression Scale Tukey-Kramer HSD Results*

The Tukey-Kramer HSD test reveals that the significant differences occur between the Aerospace Pro-Pilot and Non-Aerospace group, as well as between the Aerospace Non-Pilot group and the Non-Aerospace group.

## Anxiety

A one-way ANOVA revealed that there was a statistically significant difference in the anxiety scale between at least two groups ( $F(2, 571) = [33.769]$ ,  $p = 1.376 \cdot 10^{-14}$ ).

	<i>Tukey HSD Q statistic</i>	<i>Tukey HSD p-value</i>
<i>Professional-Pilot v. Aerospace Non-Pilot</i>	0.1744	0.8999
<i>Aerospace Pro-Pilot v. Non-Aerospace</i>	11.1667	0.001
<i>Aerospace Non-Pilot v. Non-Aerospace</i>	8.8003	0.001

*Table 12. Anxiety Scale Tukey-Kramer HSD Results*

The Tukey-Kramer HSD test reveals that the significant differences occur between the Aerospace Pro-Pilot and Non-Aerospace group, as well as between the Aerospace Non-pilot group and the Non-Aerospace group.

## Stress

A one-way ANOVA revealed that there was a statistically significant difference in the stress scale between at least two groups ( $F(2, 571) = [22.599]$ ,  $p = 3.584 \cdot 10^{-10}$ ).

	<i>Tukey HSD Q statistic</i>	<i>Tukey HSD p-value</i>
<i>Professional-Pilot v. Aerospace Non-Pilot</i>	0.0977	0.8999
<i>Aerospace Pro-Pilot v. Non-Aerospace</i>	9.1988	0.001
<i>Aerospace Non-Pilot v. Non-Aerospace</i>	7.04	0.001

*Table 13. Stress Scale Tukey-Kramer HSD Results*

The Tukey-Kramer HSD test reveals that the significant differences occur between the Aerospace Pro-Pilot and Non-Aerospace group, as well as between the Aerospace Non-pilot group and the Non-Aerospace group.

## Chapter IV: Discussion

This research sought to determine if Aerospace students at Middle Tennessee State University prone to exhibit higher levels of depression, anxiety, and stress than students in majors other than Aerospace.

The first research question proposed by the researcher is as follows: will Middle Tennessee State University Aerospace students in the Professional Pilot concentration exhibit higher levels of depression, anxiety, and stress as exhibited by responses on the DASS-21, than MTSU Aerospace students who are in concentrations other than Professional Pilot? The null hypothesis proposed that there would be no difference in the depression, anxiety, or stress levels indicated on the DASS-21 between the Aerospace Professional-Pilot group and the Aerospace Non-Professional Pilot group. The results of the ANOVA and the Tukey-Kramer test show that there is no statistical difference between these two groups for all three scales and it can thus be concluded that the null hypothesis was not rejected. There is not a significant difference in stress levels between Aerospace students in the Professional Pilot concentration taking Aerospace courses and Aerospace students that are not in the Professional Pilot concentration

The second research question proposed was that Middle Tennessee State University Aerospace students in the Professional Pilot concentration enrolled in Aerospace flight training courses will exhibit higher levels of stress than Middle Tennessee State University Non-Aerospace students. The null hypothesis proposed that there would not be any significant difference in stress levels between Aerospace students in the Professional Pilot concentration and Non-Aerospace students. The ANOVA and subsequent Tukey-Kramer post hoc test determined that there was a statistically significant difference between these two groups, therefore the null hypothesis is rejected.

While there is a statistically significant difference between these two groups this research proposed the hypothesis that Aerospace students in the professional pilot concentration would exhibit higher levels of depression, anxiety, and stress than students in Non-aerospace courses. This hypothesis was proven false. Non-Aerospace students reported having higher levels of depression, anxiety, and stress.

The third research question proposed that Middle Tennessee State University Aerospace students in concentrations other than Professional Pilot will exhibit higher levels of stress than students in majors other than Aerospace. The null hypothesis proposed that there would be no significant difference in stress levels between Middle Tennessee State University Aerospace students in concentrations other than Professional Pilot and students in majors other than Aerospace. The ANOVA and subsequent Tukey-Kramer post hoc test determined that there was a statistically significant difference between these two groups, therefore the null hypothesis is rejected.

While there is a statistically significant difference between these two groups this research proposed the hypothesis that Aerospace students in concentrations other than Professional Pilot will exhibit higher levels of stress than students in majors other than Aerospace. This hypothesis was proven false. Non-Aerospace students reported having higher levels of depression, anxiety, and stress than the Aerospace students in concentrations other than professional pilot.

This study had no significant findings regarding depression, anxiety, and stress levels among the three groups of students, but there are still some important implications to be made about the students at Middle Tennessee State University. First, even though the surveys were completely anonymous, it is possible that students (especially Aerospace students) did not feel comfortable expressing their true feelings in the survey. Even though the average of depression,

anxiety, and stress for the Professional Pilot group was normal, there were still 4.20% that reported extremely severe depression, 6.61% that reported severely extreme anxiety, and 1.20% that reported extremely severe stress. While these numbers are low, it still shows that a small number of Aerospace students in the professional flight concentration are experiencing extreme versions of these emotions. The number of students in the Professional Pilot concentration experiencing these elevated emotions could be higher due to students not feeling comfortable answering the survey truthfully. The Aerospace students in concentrations other than professional pilot show similar numbers. While the average for each of the scales was normal there were still 4.90% that reported extremely severe levels of stress. Even though these numbers are small they still show that Aerospace students are experiencing these negative emotions at varying levels.

Another reason for the findings of this study could come from the construct of the pilot personality. A pilot personality is described as a personality type that is typically associated with those who choose aerospace as a career path. This personality type is described as an individual who is “emotionally stable, who has low anxiety, vulnerability, angry hostility, impulsiveness, and depression,” (Fitzgibbons et al., 2004, p. 3). The results of the study conducted at Middle Tennessee State University show that Aerospace students are experiencing lower levels of depression, anxiety, and stress when compared to students who are not in Aerospace majors. This could potentially be due to students exhibiting the ‘pilot personality’ and being able to handle high stress and negative emotions better than non-Aerospace students.

### **Limitations and Recommendations**

There are several limitations that affect the generalizability of this study. Such limitations include the data collection timeframe, limited sample size and unequal sample sizes, and the high number of international students at Middle Tennessee State University.

This research was conducted during the entirety of the summer semester and during the first three weeks of the fall semester at Middle Tennessee State University. Future studies should expand the data acquisition phase of this study and collect data during a longer time. This could positively affect the number of responses obtained for each group. Additionally, further data could be collected at various points throughout the semester rather than at the very beginning of the semester. Doing so could provide a wider range of responses as participants experience different stressors at various points in the semester. Additionally, this study focuses solely on the students at Middle Tennessee State University. Further research should be done examining students from multiple universities from various geographical locations to expand the generalizability of the study.

The group sizes of this study varied greatly between groups. There were 333 participants in the Professional Pilot group, 102 participants in the Aerospace students in concentrations other than Professional Pilot group, and 139 participants in the Non-Aerospace group. The unequal sample sizes impacted the data analysis techniques used, for example a Tukey-Kramer post hoc test was utilized due to the unequal sample size groups. Further research expanding the scope or collection time could assist in the disparities between groups. Additionally, it could increase the sample size and provide a stronger comparison between groups.

Another consideration for this study is the high number of international students in the Aerospace program. During the time of survey distribution there were 100 international students enrolled in the Aerospace program across all concentrations (Middle Tennessee State University,



2015). The international student body poses limitations in this study due to variations in cultural perception on depression, anxiety, and stress. In a study conducted by Misra and Castillo, American and international student academic stress were compared. This study found that international students “reported lower academic stress and fewer reactions to stressors,” (Misra & Castillo, 2004b, p. 138). However, this was not due to international students lack academic stress, but rather cultural differences in how they perceive and react to stress (Misra & Castillo, 2004b). There could be a multitude of factors affecting the international student body in the study such as cultural stigmas surrounding depression, anxiety, and stress in international cultures. The differences in perceptions and reactions to stress from the international student body creates a limitation in this study.

### **Future Research**

As stated above, future research could benefit from collecting data from participants at different points of time throughout the semester. Further research should focus on stress levels of Aerospace students during the beginning, middle, and end of the semester, as there are different stressors that appear throughout the semester. This is especially true for Aerospace students in the Professional flight concentration who have evaluations of their flight training spaced throughout the semester. Future research should also focus on the perspectives that Aerospace students have surrounding mental health. By further understanding the perceptions of stigmas and perceptions that Aerospace students have about mental health institutions can focus on creating ways for students to be able to discuss their mental health issues comfortably without fear of stigma.

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## Appendices

## Appendix A

### Institutional Review Board Approval

#### IRB

#### INSTITUTIONAL REVIEW BOARD

Office of Research Compliance,  
010A Sam Ingram Building,  
2269 Middle Tennessee Blvd  
Murfreesboro, TN 37129  
FWA: 00005331/IRB Regn. 0003571



#### IRBN001 - EXPEDITED PROTOCOL APPROVAL NOTICE

Wednesday, June 08, 2022

*Ing* **Stress, Anxiety, and Depression Levels in Collegiate Aerospace Students: A Study Comparing Traditional and Aerospace Students at Middle Tennessee State University**

*Protocol ID* **22-2158 7i**

*Principal Investigator* **Harley Waters** (Student) *Faculty Advisor:* Paul Craig  
*Co-Investigators* NONE  
*Investigator Email(s)* *hlh4x@mtmail.mtsu.edu*  
*Department* Aerospace  
*Funding* NONE

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU IRB through the **EXPEDITED** mechanism under 45 CFR 46.110 and 21 CFR 56.110 within the category (7) *Research on individual or group characteristics or behavior*. A summary of the IRB action is tabulated below:

<i>IRB Action</i>	<b>APPROVED for ONE YEAR</b>		
<i>Date of Expiration</i>	<b>6/30/2023</b>	<i>Date of Approval:</i> 6/8/22	<i>Recent Amendment:</i> NONE
<i>Sample Size</i>	THREE HUNDRED AND FIFTY (350)		
<i>Participant Pool</i>	<i>Target Population:</i> Primary Classification: <b>General Adults (18 or older)</b> Specific Classification: <b>University/College Students</b>		
<i>Type of Interaction</i>	<input type="checkbox"/> Non-interventional or Data Analysis <input type="checkbox"/> Virtual/Remote/Online interaction <input checked="" type="checkbox"/> <b>In person or physical interaction – Mandatory COVID-19 Management</b>		
<i>Exceptions</i>	Permitted to conduct in-person data collection		
<i>Restrictions</i>	<b>1. Mandatory ACTIVE Informed Consent.</b> <b>2. Other than the exceptions above, identifiable data/artifacts, such as, audio/video data, photographs, handwriting samples, personal address, driving records, social security number, and etc., MUST NOT be collected. Recorded identifiable information must be deidentified as described in the protocol.</b> <b>3. Mandatory Final report (refer last page).</b> <b>4. CDC guidelines and MTSU safe practice must be followed</b>		
<i>Approved Templates</i>	<i>IRB Templates:</i> In person Informed Consent <i>Non-MTSU Templates:</i> Recruitment Script		
<i>Research Inducement</i>	NONE		
<i>Comments</i>	NONE		

# Appendix B

## Participant Informed Consent

Institutional Review Board

Office of Compliance

Middle Tennessee State University

### IRBF016 – Participant Informed Consent

#### B. Consent Segment 1 - IN PERSON INTERACTION (Researchers' Copy)

**Study Title** Stress, Anxiety, and Depression Levels in Collegiate Aerospace Students: a Study Comparing Traditional and Aerospace Students at Middle Tennessee State University

**Primary Investigator(s)** Harley Waters (Student)

**Contact information** HLH4x@mtmail.mtsu.edu

**Department & Institution** Middle Tennessee State University Aerospace Department

**Faculty Advisor** Dr. Paul Craig *MTSU Department Aerospace*

**Protocol ID** 22-2158 7i      **Approval:** 06/08/2022      **Expiration:** 06/30/2023

#### PARTICIPANT SECTION

<b>The participant must review the following questionnaire</b>	<b>Participants give consent</b>
I have read this informed consent document	No Yes
The research procedures to be conducted have been explained to me verbally	No Yes
I understand all of the interventions and all my questions have been answered	No Yes
I am aware of any potential risks of the study	No Yes
I understand that there will be NO audio/video recording	No Yes
I understand that there will be no compensation for my responses and I can stop the survey at any time	No Yes
I confirm I am 18 years or older	No Yes

If you agree to all of the above statements, please complete the attached survey. This informed consent text is for you to keep in case you wish to contact the investigators for more information.

Appendix C

DASS-21 Survey Instrument

DASS21

Major:

Concentration:

Year Group (circle one): Freshman Sophomore Junior Senior

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

- 0 Did not apply to me at all
1 Applied to me to some degree, or some of the time
2 Applied to me to a considerable degree, or a good part of time
3 Applied to me very much, or most of the time

Table with 11 rows of statements and 4 columns of rating options (0, 1, 2, 3). Statements include: 'I found it hard to wind down', 'I was aware of dryness of my mouth', 'I couldn't seem to experience any positive feeling at all', etc.

## Appendix C (Cont.)

### DASS-21 Survey Instrument

12	I found it difficult to relax	0	1	2	3
13	I felt downhearted and blue	0	1	2	3
14	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
15	I felt I was close to panic	0	1	2	3
16	I was unable to become enthusiastic about anything	0	1	2	3
17	I felt I wasn't worth much as a person	0	1	2	3
18	I felt that I was rather touchy	0	1	2	3
19	I was aware of the action of my heart in the absence of physical exertion (eg sense of heart rate increase, heart missing a beat)	0	1	2	3
20	I felt scared without any good reason	0	1	2	3
21	I felt that life was meaningless	0	1	2	3



## Appendix E

<b>Aerospace Courses</b>		
Course Number	Course Name	Number of Responses
AERO 1010	Introduction to Aviation	18
AERO 1020	Theory of Flight (3 Sections)	36
AERO 1340	Introduction to Aerospace Maintenance (2 Sections)	21
AERO 2010	Aviation Weather (2 Sections)	47
AERO 2342	Powerplant Inspection	12
AERO 2381	Non-Metallic Structures	9
AERO 3020	Aerospace Materials	46
AERO 3080	Weather II	36
AERO 3170	Aviation Safety	21
AERO 3230	Crew Resource Management (2 Sections)	43
AERO 3322	Aerospace Reciprocating Engine Overhaul (2 Sections)	18
AERO 4040	Professional Aviation Pathways	15
AERO 4250	Professional Pilot V	37
AERO 4310	Aerospace Vehicle Systems	32
AERO 4440	Aircraft Performance (2 Sections)	13

## Appendix F

Non-Aerospace Courses		
Course Number	Course Name	Number of Responses
ART 1910	Survey of Non-Western Art	8
ART 3220	Secondary Art Education	10
BIOL 1120	General Biology II	22
CJA 2100	Criminal Theory	11
ENGL 1010	Expository Writing (2 Sections)	36
HIST 2010	Survey of U.S. History I (2 Sections)	28
HIST 2030	Tennessee History (2 Sections)	15
JOUR 4250	Mass Media Law	9