The Senior Design Symposium at Saint Louis University’s Parks College of Engineering, Aviation and Technology is the culmination of our undergraduate students’ hard work and dedication to their academic excellence.

Within the pages of this book, you will see student abstracts describing the content and scope of their projects. These abstracts demonstrate how our students are able to execute a project from a concept through the design phase, and ultimately transform that into a poster presentation.

These senior design courses and projects provide our students with experience working on real-world projects – with design constraints, budgets, reviews and deadlines. Students are even encouraged to work in interdisciplinary teams to expose them to the type of work they will encounter in the industry.

I want to thank all our faculty, staff and industry advisors who have collaborated with students to bring these projects to fruition. Our students strive to solve everyday problems and provide sustainable solutions for the future. I am extremely proud to show you the groundbreaking research happening at Saint Louis University’s Parks College of Engineering, Aviation and Technology.

Best Regards,

MICHELLE B. SABICK, PH.D.
DEAN AND PROFESSOR

SLU’S PARKS COLLEGE OF ENGINEERING, AVIATION AND TECHNOLOGY

Saint Louis University’s Parks College of Engineering, Aviation and Technology has a worldwide reputation for research-inspired, project-based education in engineering and aviation. As the first federally recognized flight school, Parks College has a rich history of creating well-rounded leaders in aviation and engineering fields. The college also has become a leader in the aerospace, biomedical, civil, computer, electrical, mechanical and other engineering disciplines, including engineering physics.

SAINT LOUIS UNIVERSITY

Founded in 1818, Saint Louis University is one of the nation’s oldest and most prestigious Catholic institutions. Rooted in Jesuit values and its pioneering history as the first university west of the Mississippi River, SLU offers nearly 13,000 students a rigorous, transformative education of the whole person. At the core of the University’s diverse community of scholars is SLU’s service-focused mission, which challenges and prepares students to make the world a better, more just place.
Our faculty advisors are an important and vital part of the senior design program.

We take great pride in recognizing their outstanding contributions and excellence as instructors, advisors and mentors.
Team Heli-Thin Air is an undergraduate aerospace senior design team that has designed a rotorcraft to compete in the 2019 vertical flight society competition. The mission to be completed is a 3-hour long rescue mission starting at 4,600 ft., traveling up to 29,100 ft., hovering for 30 minutes at the peak of Mt. Everest, and then returning back to the starting location. As a result, a coaxial rotorcraft, HTA-1, has been designed, because it provides higher lift capabilities, increase in thrust to weight ratio, and an increase in velocity when compared to conventional helicopters.
The Project Centurion flight vehicle is a 2-stage high powered rocket that will be used as a research and development project for the Saint Louis University Rocket Propulsion Laboratory. The main focus of this project is to develop a transition section connecting the booster and sustainer, containing an apparatus which will initiate a stage separation upon booster motor burnout. The majority of components including motor hardware and propellant will be manufactured and tested by the team. The project will be concluded with a full-scale test flight and post flight analysis to ensure successful ignition, separation, and recovery.
The AeroBills designed and built a radio controlled aircraft that was entered in the SAE Aerodesign West competition. The objective of the competition was to design an experimental aircraft that would carry tennis ball passengers and metal luggage plates. Over the past ten months, the AeroBills wrote a technical design paper, gave an oral presentation and competed in flight demonstration rounds for the SAE Aerodesign West competition.
Daedalus is a 6U CubeSat developed as an undergraduate aerospace engineering senior design project at Saint Louis University. Daedalus will launch into low earth orbit, escape earth orbit and rendezvous with at least two near-earth objects within four years using a solar sail as its only means of propulsion. Daedalus will be launched into high low-earth orbit (~1200km) as a secondary payload for a proposed larger communications satellite constellation, where it will then detumble, deploy the solar sail and begin escape maneuvers. After escaping earth orbit, Daedalus will then use the sail to propel it on an interplanetary trajectory to rendezvous with at least two near-earth objects. The overall goal of the mission is to demonstrate the possibility of beginning deep space missions in low-earth orbit, greatly reducing the cost and barrier to entry.
The Speedfest Alpha Class competition is an annual collegiate competition hosted by Oklahoma University. The 2019 competition is a quiet recon aircraft whose mission is to dash from an insertion point to a specified location where it will quietly loiter while recording and transmitting footage of an area. The competition consists of three main mission types: Speed, loiter and surveillance, reconnaissance and insertion (SRI). The aircraft is designed to be composite, modular, quiet and fast with an emphasis on designing an aircraft that would also be easy to manufacture, fix and maintain. The defining feature of the design is in its landing gear or lack thereof. The aircraft has been designed to allow for the integration of a rail launch system that will propel it to an initial speed of 35 knots. The rail launch is designed simultaneously by another SLU senior design team.
This project studies the relationship between airline fares and complementary goods. The research study first tests the relationship between a city’s cost of living index against the average domestic airfare for airports in the city’s region. Further, the study dwells deeper into studying popular U.S. destination cities on a case by case study. In each city, data was collected on hotel room prices for each month, total hotel inventory, and data on relevant tourist attractions associated with each city (theatre tickets, amusement parks, ski resorts, sporting events, etc.). The research analyzes and seeks to find trends or disseminate a relationship between the complementary goods and airfare data on a monthly basis.
Complacency is an unwarranted sense of security that can arise due to repeated successful outcomes over many cycles, in high-risk operations. General aviation flight training is repetitive by nature, and has a low accident rate; these two factors can lead to complacency among students and instructors. Factors such as cockpit management, operating environment, fatigue, and aircraft complexity can increase the chances of pilots becoming complacent. General aviation flight training in St. Louis, Missouri is examined; data is collected from students and instructors at four different flight schools operating in a similar environment and compared to existing knowledge about complacency in aviation.
We are comparing the CRM/TRM of military aviation versus civilian aviation. By looking at flight crews, air traffic controller, safety, operations (scheduling and dispatch), and maintenance, we want to break down the similarities and differences between the military and civilian process of TRM training. We also would like to determine if there are areas that we can bring together to better ease the transition between the two paths of training. By collecting qualitative data, we hope to identify different ways that military and civilian students implement their training in each of the various departments of aviation enterprises. Through examining the training environments of Part 141 flight schools versus the military, we hope to find similarities and differences between the two methods. While the TRM approach can be emphatically different in military and civilian training, both effectively set up a student for success in the industry environment.
Our study examines the challenges airlines are facing when it comes to recruiting new pilots and how different airlines are addressing the issue. Currently the industry is facing a pilot shortage due to the large amount of pilots reaching the mandatory retirement age of 65 (among other factors such as increased airline growth and stricter regulations on minimum required experience for new First Officers).

The scope of our research includes several regional carriers, major carriers, cargo carriers, and corporate flight departments. The majority of the information we’re presenting was obtained through interviews with airline employees. Also included are firsthand experiences from the members of our group who have been researching potential aviation employers over the past four years.
In our study, we examined the effects that various types of diversity have on the performance of pilots in the cockpit. While aviation is a relatively non-diverse industry, pilots of different backgrounds are beginning to enter aviation as the industry continues to grow. During the course of our data collection phase of the study, we were able to collect data from Part 121 and 135 pilots that currently work as a part of a multi-pilot flight crew. We were able to determine the degree to which pilots feel that ethnic, racial, cultural, and age/experience differences among flight crews affect their performance as a crew. By examining the effects of various diversity types on pilot performance, we can better understand how to implement crew resource management (CRM) skills into pilot training in order to reduce any negative effects that may exist.
RESORBABLE RADIOPAQUE MICROSHERES FOR THE CATHETER EMBOLIZATION OF PROSTATE CANCER USING MICROFLUIDICS

Lavanya Aryan | Biomedical Engineering

As part of the BS/MS program, I have the opportunity to continue my ongoing research of prostates by utilizing two years to use microfluidics to create resorbable radiopaque microspheres that are drug-eluting for the catheter embolization of prostate cancer. I will be doing this under the guidance of Dr. Hall, Dr. Zustiak, and Dr. Pereira, an Interventional Radiologist from SLU hospital. This includes working with a graduate student under Dr. Zustiak, Kyle Vogt, to create microspheres made of Polyethylene Glycol that are radiopaque by incorporating Barium Sulfate and infused with chemotherapy agents (Docetaxel). The radiopaque agents will be used to visualize the chemotherapy beads to observe their dispersion rate while the chemotherapy agents will hopefully aid in the destruction of the cancerous cells. My focus includes looking at the imageability of the microspheres under uCT for distribution and radiopacity analysis, an injection phantom for 2D Clinical X-ray, and 3D volumes for clinical imaging under Cone beam CT, and Multi-slice CT to ensure that the techniques employed create equal distribution of the radiopaque agent and stability.
Among the many diagnostics first taken at the doctor’s office, blood pressure plays a key role. It gives vital information about the health of the cardiovascular system and is used as a predictor of many diseases. Some issues in these readings is infrequent and inaccurate measurements, like at the doctor’s office and its related white coat syndrome. At home devices can still be bulky or include user error, as well. This project focuses on a wrist blood pressure device that provides measurement at least as accurate as current products, is comfortable for portable wear, and is connected to a smartphone app via bluetooth to track blood pressure trends.
The development of a technique to reliably control the deposition of polymer nanofibers will address a significant need in the field of tissue engineering. We can accomplish this through the combination of near-field electrospinning (NFES) with a 3D printer. NFES has been shown to increase control of polymer fiber deposition, and therefore shows promise in application to tissue engineering. In this project, we will modify a 3D printer to support NFES and optimize parameters to facilitate controlled deposition of polymer nanofibers. The device will require minimal interaction: creation of a 3D model, input into a slicing software, and setting of parameters for the fabrication of each construct. This product will ultimately assist researchers in creating specific polymer scaffold designs to optimize pore size, mechanical properties, or fiber size.
Macular degeneration usually results from leaky blood vessels which grow near the retina to cause loss in vision. This project consists of a device which tests the eye for signs of macular degeneration by implementing an instructive program that uses the Amsler Grid, Peripheral Hyperacuity Perimetry, and Radial Shape Discrimination. This device will allow patients to access a preliminary diagnosis of macular degeneration in hopes of catching the disease and treating it before it causes permanent blindness. Another difficulty with macular degeneration detection stems from a lack of education to the patient when performing a self-diagnostic test. This can be amended by creating a program that will walk the patient through, step by step, telling them what to look for and what to avoid.
METRIX OPIOID SENSOR

Kaitlin Gallatin | Biomedical Engineering
Paul Richard | Biomedical Engineering and Electrical Engineering
Luke Vest | Biomedical Engineering

More than 100 deaths occur in the United States every day from opioid overdose. In response to drug use, distinct physiological changes occur in biometrics such as heart rate, skin temperature, and triple axis acceleration. Our device will be worn on the individual’s wrist when collecting data and will show the physiological changes of each biometric as the body metabolizes opioids. This device will be one of the first of its kind, and it will address an unmet need in the face of the national opioid crisis.
My project is to design a toy car to activate based on muscle activity. My design uses an electromyogram (EMG) to read muscle activation. After filtering, multiple features are extracted such as average energy, peak value, and minimum value. Next, we input these features into an algorithm derived from Linear Discriminant Analysis, a well-known linear classification method. The final product is a robotic toy car with an Arduino on top. The Arduino has an electromyographic function which reads muscle activation. After gathering enough data, machine learning was used to find the optimal cutoff for car activation.
We've studied the market for what's out there regarding prosthetics. It's baffling to us how expensive some of the competition’s products are. As a group we strive to create a product that is simply to use, aesthetically pleasing, and above all functioning for people who unfortunately suffer from upper limb paralysis. Our team understands that it by no means can replicate a fully functioning arm, but we pride ourselves in striving to make life a little bit easier for someone with upper arm paralysis. That has always been the goal for us as we delved into this.

RoboPro™ is a proposal for a prosthetic glove-like arm attachment that will allow a patient who is paralyzed in their upper limbs to utilize his/her arm to the full extent of its natural capabilities and regain the once lost dexterity. Our device will feature a customizable 3D printed design with a hardware/software combination that includes an integrated voice-control system, allowing the user to utilize his or her voice to control the glove-like apparatus. The 3D printed design serves to slim current iterations on the market and provide an easy to maintain device that will survive the expected wear and tear that will inevitably occur in the user’s life. With our design, users can easily remove and reattach as needed, clean and maintain the artificial limb, and regain a degree of comfortability that won’t feel as if their disability is hindering their life. Ultimately, our goal is to bridge the distance between the patient and their environment, ensure comfort by improving self-confidence and assurance, and to lower the cost of traditional fully functioning prosthetics.
MOBILE GAIT ANALYZER

Grace Brinkmann | Biomedical Engineering
Alex Eldridge | Biomedical Engineering
Ann Harlos | Biomedical Engineering

Gait analysis is the study of human motion using instrumentation to measure body movement and mechanics to analyze gait. In order to best identify issues in locomotion gait analysis devices are needed to measure gait defects in an everyday setting. This device will obtain accurate gait data to diagnose and identify issues associated with gait. Foot drop is a condition which occurs as a result of weak dorsiflexion, or flexion of the ankle toward the knee and is commonly associated with neuropathy. This can also lead to other gait impairments if allowed to become severe; including increased risk of falling. To measure this gait abnormality in real world settings, a wireless IMU based gait analyzer was designed. This will allow for the tracking of flexion in the ankle to determine whether the subject is presenting symptoms of foot drop.
Electromyography (EMG) is the technique by which skeletal muscle electrical conduction is measured. It is an effective tool to evaluate a patient’s functional deficit or recovery after a traumatic injury. In cases of volumetric muscle loss (VML), or a critical size muscle defect that is incapable of recovery, EMG peaks have a lower amplitude and occur at lower frequency. There is currently no clinically approved way to treat VML, allowing for a significant opportunity to create a biomaterial that can enhance skeletal muscle regeneration. Our idea is to create a mini-scale EMG for rats. It will have smaller probes with higher sensitivity to rat muscle electrical conduction, as well as filters applied to cancel out the noise, producing cleaner and more reliable data. This system will then be used to test therapies for VML in rats and allow for more thorough treatment research.
The Simulated Stomach device will be a dynamic system that accurately simulates the physiological environment of a human stomach. The system will mimic the pH (gastric fluid), temperature, shape, and mechanical action of a human stomach. This device will assist Cardinal Health, Inc., a medical device company in St. Louis, with testing their feeding tube products to determine the actual physiological performance of their products. Our device will supplement current standard testing to further prove the efficacy of the feeding tube products and help identify improvements that can be made.
WOUND SNACK: USING COMPLEMENTARY MEDICINE TO PROMOTE WOUND HEALING

Ian Galbreath | Biomedical Engineering
Chandana Kamaraj | Biomedical Engineering
Ben Kellen | Biomedical Engineering
Leigh-Ann Kesper | Biomedical Engineering

Our design group proposed a design for the use of complementary medicine in a tissue engineered scaffold to promote wound healing. The innovative combination of biomaterials with plant derivatives will effectively modify inflammation, while promoting angiogenesis and cellular infiltration. The product that we achieve to introduce is not another type of wound dressing, but instead a dermal regeneration template (DRT). The scaffold will be positioned in a wound bed by a medical professional and covered with a standard dressing. The use of this lower-cost product will lead to healthy tissue growth, effective wound closure, and a decrease in scar tissue development and focus on patients with pressure and diabetic ulcers. The various drugs that were considered with our scaffold include turmeric, pure curcumin, piperine, aloe vera, manuka honey, and various cannabinoids (CBD). Since, CBD promote delayed inflammatory, we will focus on Cannabidiols for our DRT.
The project I am working on is creating a mechanically stimulating bioreactor to help combat degenerative disc disease and lower back pain. Bioreactors are used to help cells grow in vitro but also help create a sustainable environment similar to what happens in the body. The cells that I would be focusing on would be nucleus pulposus cells. These are the cells that are present in the inner core of the invertebrate disk and the function of them are to distribute hydraulic pressure in all directions when the disk undergoes a compressive load. These cells are important to the discs but also for cell based therapies to help combat degenerative disk disease. The goal of this project is to create the bioreactor so the nucleus pulposus cells can proliferate in vitro and then can be put back into the body in the disk to help fight the degeneration.
HANdHELD proBE TO dETERMiNE SKIN ELASTICity

Venz Almeria | Biomedical Engineering
Autumn Biliskov | Biomedical Engineering
Jonas Dalide | Biomedical Engineering

Limiting the scarring process is a primary goal in the development of advanced wound healing strategies for a variety of skin injuries and conditions. Normal skin has different mechanical properties from scarred skin. Hence, skin mechanical properties can provide one type of evaluation for clinicians to use when comparing different types of treatment strategies. While a Cutometer® is a device that can be used for determining skin properties in the clinic the cost of the device appears to be a barrier to its wide-spread use. Therefore, this project consists of a handheld probe that can be used at the bedside that automates and improves upon manual palpation for the evaluation of elasticity of healthy skin, scarred skin, and skin healed by advanced wound healing strategies. This is accomplished through the use of tactile piezoelectric resonance sensors, which measure frequency shifts when the sensor comes into contact with the skin. The frequency shift indicative of the skin stiffness, or the resistance to elastic deformation.
Our team constructed a head mounted five-axis passive robot used for neurosurgical navigation. More specifically, the robot was designed to guide the insertion of a drain into the lateral ventricles of the brain. The robot will allow for a surgeon to register points in real space on a patient’s head and map them to points outlined in a preoperative medical image such as a cone-beam computed tomography scan. This registration will determine the optimal tool angulation and Cartesian location of the drain to within one degree and five millimeters, so as to minimize brain tissue affected during the procedure. Our design aims to improve upon the existing technology by being inexpensive in both monetary value and spatial requirements, and to improve on ease of use.
In the modern era of technology, the average person’s daily life moves faster than ever, communicating clearly and effectively has never been more important. The human ability to communicate has grown from taking weeks to talk to family a couple hundred miles away to being able communicate with several people spread all around the world in real time, and all this change in the past 100 to 150 years. However, since a large part of the communication technology boom has been focused around verbal communication, the deaf community all around the world has not been able to fully reap the benefits of the communication boom. Unfortunately, there is still a large gap between the deaf and non-deaf community. Our proposal is the creation of an app that will translate sign language in near real time for the user. The basic idea is to take a pictures of signs, and then process the image, translating the symbol being created by the hand and outputting the written translation. We will train a deep neural network, a type of machine learning, by running thousands of images of different signs through the program, which will allow our app to recognize and translate the sign being made. If it is unable to recognize the sign it will instruct the user to try the sign again, making our app user friendly. Overall, our app will be used primarily to increase communication ability with the deaf community.
BALLPARK VILLAGE EXPANSION PROJECT

Tony Celano | Civil Engineering
Dillen Myers | Civil Engineering
Ellen Stonner | Civil Engineering

Our senior capstone design project was to develop a high-end retail store (Apple Store) and outdoor water features for the Ballpark Village area near the Cardinals Busch Stadium. Our comprehensive design looks at numerous sub-disciplines within the field of civil engineering. Some unique design features include an indoor waterfall feature rising 25 feet along the south wall, a custom designed building shape with overlooking loft area, and an outdoor water fountain. The steel structure is supported by micropile foundations and shear wall or cross bracing is revisiting the lateral load. Ultimately, the goal of the project is to deliver a completed design with a detailed final report, engineering plans, and specifications. We have also created a 3D model to show what the final product will look like upon completion.
The goal of this project is to retrofit the single-story restaurant, formerly known as Diablitos Cantina, located at 3761 Laclede Avenue with a video arcade themed bar. The existing structure is unoccupied and outdated. Bright Top Arcade, a more modern structure, is to replace and provide services more appealing to college-aged students. The building's main use will be for students to hang out and have fun with their peers while enjoying the many entertainment options that Bright Top Arcade has to offer. Some of the amusements that will be added to this building includes a new rooftop area, an E gaming area, and multiple arcade games.
SLURUBA REDESIGN

Ahmed Aouad | Civil Engineering
Sasha Fornario | Civil Engineering
Tim Kmet | Civil Engineering
Dylan McCluskey | Civil Engineering

SLURuba is an outdoor recreation space located on the North Campus. The space is outdated and in need of a redesign. A survey was conducted and the results were implemented into a new design. The new space includes a large swimming pool, lazy river, pavilion, fire pits, restroom and office space.
The City Foundry project aims to redevelop the currently unused 15-acre Century Electric Foundry complex located in Midtown Saint Louis. The complex contains historic buildings that will be developed into a mixed-use facility for commercial, retail, and entertainment purposes. This project will add value to the Midtown area of Saint Louis by providing an area of leisure and entertainment for the employees of Cortex, the students at Saint Louis University as well as other nearby universities, and the general Saint Louis population. The main developer on the site is The Lawrence Group. While the City Foundry has design plans for much of the property, a 0.75-acre section near the western boundary has not yet been designed. LANJJ Engineering is proposing to develop the property into a premier building to serve the City Foundry by providing a functional space for local businesses, employees, and individuals to host large scale events.
The goal of our project is to develop a power supply to function as the electrical power system on a satellite. The supply is intended to safely charge a battery from solar panels located on the satellite, and to discharge the battery onto three different rails. The power supply needs to be able to function in the vacuum of space, and fit inside a 100 cubic centimeter cube with the rest of the satellite’s systems.
This is a wearable device that uses basic properties of solar and kinetic energy collection to generate enough voltage and current to charge a portable device (i.e., a cell phone or watch) through a USB port. There is a need for this product as many fields are moving towards renewable energy and portable devices like cellular phones require constant charging which can be quite constraining to daily life. For instance, imagine that you are expecting an important business call and your phone goes off, especially when you are not near any electric socket. Would it be nice to have an alternative device to fall back on during this time? This is where this device comes into play. This design is neither inconvenient nor heavy to carry. Therefore, travelers find it very useful to take it along while leaving their homes or cities. Additionally, this device is operable for all brands, no matter whether you have a Samsung or Nokia phone, you can charge any brand of mobile device using this tool.
We are designing a robot that is capable of navigating a board with various obstacles, picking up labeled cubes, and placing them in corresponding slots in a ‘mother-ship’. Our plan is to build a 4-wheeled robot to navigate the course. In order to properly sort the cubes, we created an optical character recognition (OCR) algorithm to identify the letters on the top face of the cube. We are using a Raspberry Pi with camera. To avoid the obstacles present on the course, we will use the provided JSON file to find a course through the obstacles.
Dynamic Launches is creating a ground launching device for RC aircraft. Our target customer is university teams participating in the Speedfest competition, but there are many other applications for military, first responder, or hobbyist use. Our product is a safer alternative to hand launching, and eliminates the need for a runway and landing gear.
RIDEABLE ELECTRIC TOY CAR FOR A CHILD WITH DISABILITIES

Sarah Determan | Mechanical Engineering
Kendra Finney | Mechanical Engineering
Rebekah Nagy | Mechanical Engineering
Megan Shockley | Mechanical Engineering
Sarah Silverberg | Mechanical Engineering

Our client is a 3-year-old boy with spina bifida, which has caused him lower extremity paralysis. Our goal was to design and build an electric vehicle to help our client become more mobile, and give him the opportunity to explore the world in a play environment. This vehicle is entirely hand controlled and comes with an emergency stop that the parents can use as a safety precaution to stop the vehicle from a distance. The car uses an Arduino as the control system and runs on two 12 V rechargeable batteries. The maximum speed the vehicle can go is 5 mph, but the parents can lower the max speed as they see fit. The acceleration of the vehicle is controlled with a lever in the custom-made steering wheel, and a dead-man switch in the seat prevents the car from being powered on without someone sitting in it.
ALKAMIxo

Elliot Boerding | Mechanical Engineering
Andrew Denkinger | Mechanical Engineering
Dennis Kress | Mechanical Engineering
Karley Kucera | Mechanical Engineering

Alkamixo is a fully automated drink making system that allows for the customization of liquors and mixers used. Through the combined use of an Arduino, a Raspberry Pi, DC diaphragm pumps, and other electromechanical components, Alkamixo creates custom mixed drinks in under a minute. The system is controlled by the user through a touch screen interface mounted on the front of the frame in an optimal ergonomic position.
DESIGN AND DEVELOPMENT OF AN AUTOMATED PEDESTAL FOR AN INDUSTRIAL ROBOT

Ricardo Albacete | Mechanical Engineering
Teressa Jaron | Mechanical Engineering
Oscar Pachon | Mechanical Engineering
Samah Salha | Mechanical Engineering

Improvement of a commercial robot by designing and developing automation capabilities to its pedestal. The project consists of including the ability to perform tasks at different locations by modifying the pedestal so it can transport itself autonomously. In order to allow adaptability to different room layouts, a line following feature along with other sensing elements that would ensure a correct displacement between locations are applied.
The principle objective of this investigation is to design a solution that allows a lightbulb to be removed and installed via an unmanned aerial vehicle (UAV). With a target market of electrical contractors and in-house maintenance departments, the solution seeks to eliminate the costs and risks associated with using scissor lifts to change burnt-out lamps in high ceilings. The proposed solution consists of two subsystems: the adapter and the UAV, both of which utilize magnetic interfaces to allow a lamp to be removed and installed with only a single operator on the ground. Further increasing its appeal to the market by being retrofittable within existing light fixtures, the constructed prototype screws into the E26 socket of a 6-in diameter household recessed lighting fixture and supports a wide variety of LED lamps. The solution’s application-specific UAV has a uni-body frame to reduce weight and improve rigidity, allowing for easy transport to work sites and efficient operation.