**$1.8 MILLION**

NASA Funding at Vanderbilt in FY 2019

Vanderbilt to assist NASA’s TESS mission in observing 400,000 stars for habitable exoplanets

NASA’s Transiting Exoplanet Survey Satellite is designed to ferret out habitable exoplanets, but with hundreds of thousands of sunlike and smaller stars in its camera views, which of those stars could host planets like our own? TESS is observing 400,000 stars across the whole sky to catch a glimpse of a planet transiting across the face of its star, one of the primary methods by which exoplanets are identified. A team of astronomers from Vanderbilt, Cornell, and Lehigh universities has identified the most promising targets for this search. This new catalog draws from one originally developed at Vanderbilt that contains hundreds of millions of stars. The goal is not only to detect hundreds of Earth-like worlds in other solar systems, but also to find them around our closest neighboring solar systems.

One exoplanet identified in Vanderbilt's catalog is LHS 3844b. First detected by TESS in 2018, the exoplanet has recently been found to be similar to Earth in size with a surface which may resemble Mercury or Earth's moon.

The findings are illustrative of the broader scientific mission to understand the factors that could preserve or destroy atmospheres in planets with Earth-like characteristics, as scientists embark on research for habitable environments beyond our solar system.

Rocketeers claim sixth NASA championship with novel UAV search and deploy mission

Vanderbilt’s Aerospace Design Laboratory again earned top honors in NASA’s 2019 National Student Launch Competition. This is the team’s sixth national championship in the last seven years: 2013, 2014, 2015, 2016, 2018, and 2019. The 2019 NASA launch challenge required student teams to propose, design, build, and test a reusable rocket that had to reach a team-selected altitude between 4,000 and 5,500 feet. The payload had to be a drone or rover that autonomously deployed from the rocket after the rocket landed, then deployed a beacon on a Future Excursion Area. The VADL team crafted their payload mission finding relevance to NASA’s Mars 2020 mission, specifically addressing NASA’s goal of independent autonomous agents collaborating for enhanced exploration. VADL chose to replicate this with dual UAVs that undertook different roles—explore and experiment.

The NASA student launch competition is a NASA-conducted and aerospace industry-evaluated engineering design challenge built around a NASA mission. It is an intense eight-month contest involving payload and rocket designs, project reports, design reviews, outreach activities, and website design, followed by a grand finale launch each April. The Marshall Space Flight Center Office of STEM Engagement manages student launch to stimulate innovation and advance NASA’s mission through collaboration with educational institutions.
Vanderbilt astrophysicist plans to observe a black hole ‘symphony’ using gravitational wave astronomy

Shrouded in mystery since their discovery, black holes continue to be enigmatic phenomena. In recent years, many researchers have made strides toward understanding black holes using observational astronomy and gravitational wave astronomy, an emerging field first hypothesized by Albert Einstein, which directly measures the gravitational waves emitted by black holes. Limitations in current observation technologies have kept scientists from grasping a more complete picture of black holes. That could soon change thanks to new research out of Vanderbilt, supported by NASA, on what’s next for gravitational wave astronomy using a compelling roadmap for capturing four- to 10-year snapshots of intermediate-mass black hole activity. As a symphony orchestra emits sound across an array of frequencies, the gravitational waves emitted by black holes occur at different frequencies and times. Observing all of the frequencies allows astronomers to get a complete picture and help fill in many gaps in the understanding of black holes.

Tennessee Space Grant Consortium

Vanderbilt is the lead institution for the Tennessee Space Grant Consortium (TSGC), which is composed of affiliate institutions from around the state. The goal of the space grant consortium is to inspire students from K-12 through the graduate level to pursue careers in NASA-related fields and the greater STEM arena. TSGC provides scholarships and fellowships to undergraduate and graduate students at the affiliate institutions, sponsors competition teams, promotes research and teacher training, and supports Tennessee students at NASA summer programs and similar activities.

Modeling risk to make future air travel safer

Statistically airline travel is the safest mode of transportation but that doesn’t make the list of what can go wrong any less troubling. Low visibility, bird strikes, incorrect landing approach speed, runway debris, airframe icing, engine fires, unexpected weather, and sensor malfunctions are but a handful of potential accident causes. They are also among more than 60 incident scenarios identified by an ambitious NASA project to develop the next generation National Airspace System, known as NextGen NAS.

Vanderbilt risk and reliability engineering experts are involved in simulating many of them. They are playing a key role in a $10 million, five-year project to integrate complex data sources that will be the future of air traffic management systems. The project is part of NASA's Aeronautics University Leadership Initiative, which gives top academic centers and their industry collaborators a larger role in shaping best practices and translating them into commercial use. NASA and the grant recipients want to identify, quantify, and prioritize risks that can be best anticipated and address those that would do the most to improve safety.

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