

Propulsion Research and Academic Programs at the University of Alabama in Huntsville -- PRC Graduate Student Production History

Robert A. Frederick¹, Phillip M. Ligrani², and L. Dale Thomas³, UAH Propulsion Research Center, Huntsville, Alabama, 35899

The UAH Propulsion Research Center (PRC) is in its 29th year at the University of Alabama in Huntsville (UAH). The mission of the Propulsion Research Center is to provide an environment that connects the academic research community with the needs and concerns of the propulsion community while promoting an interdisciplinary approach to solving propulsion problems. This paper summarizes recent metrics from academic and research programs that are associated with the PRC. The emphasis this year is describing the graduate student production supported by the PRC over the past 29 years. This assessment identified over 270 theses and dissertations into 9 different propulsion categories. The results accumulated into 207 master's and 67 Ph.D.s with the highest production rate being 21 degrees per year in 2010. The documents are distributed into categories representing conventional propulsion, advanced propulsion, missile design, airbreathing propulsion, Propulsion Testing, and Propulsion Systems Engineering. About 83% of the graduates are estimated to be U.S. citizens and there was a 20% female graduation rate. For the current year the total research expenditures from fifteen different agencies are anticipated to rise to \$3.3 million which is a 33% compared to last year. PRC researchers published over 130 papers last year. The UAH student launch team placed 3rd in the NASA Student Launch national competition this year. The PRC continues to be a resource to accomplish high-quality research, education, and workforce development in propulsion and energy.

I. Introduction

THE Propulsion Research Center (PRC) marked its 29th year as a University of Alabama in Huntsville (UAH) research organization in 2020. This paper is part of a series of annual updates about PRC strategic goals, research activities, research capabilities, and history. The past PRC overview papers include a summary of the first 13 years of operations in 2004[1], a 25th anniversary review in 2016[2], an overview of nine technical research areas in 2017[4], a description of fifteen laboratories in 2018[5], and our most recent strategic plan in 2019[5]. This paper highlights PRC student thesis and dissertation production covering the last 29 years. There is an analysis of the main technical areas focused on in each thesis, production rates, and other overall metrics. The paper also summarizes recent PRC research metrics and academic programs at the Mechanical and Aerospace Engineering Department at the University of Alabama in Huntsville where most of these degrees have been supervised.

A. PRC Mission and Strategy

The mission of the PRC is to provide an environment that connects the academic research community with the needs and concerns of the propulsion community, while promoting an interdisciplinary approach to solving propulsion problems. Individuals and groups within the university collaborate to achieve the PRC's research goals. Researchers from government laboratories, other universities, small business, and the aerospace industry also collaborate with the

¹ Professor of Mechanical & Aerospace Engineering /Director of the Propulsion Research Center, Department of Mechanical & Aerospace Engineering, 301 Sparkman Drive, Olin B. King Technology Hall, Room S226, Huntsville, AL 35899, and AIAA Associate Fellow.

² Professor of Mechanical & Aerospace Engineering /Eminent Scholar of Propulsion, Department of Mechanical & Aerospace Engineering , 301 Sparkman Drive, Olin B. King Technology Hall, Room S236, Huntsville, AL 35899, and AIAA Associate Fellow.

³ Professor of Industrial and Systems Engineering/Eminent Scholar of Systems Engineering, Department of Industrial and Systems Engineering, 301 Sparkman Drive Olin B. King Technology Hall, Room N151, Huntsville, AL 35899, and AIAA Senior Member.

American Institute of Aeronautics and Astronautics

PRC. This environment produces leading-edge research results and scholarly activity leading to new discoveries and significant workforce development.



Fig. 1. The 2020 PRC Organization Chart.

Figure 1 shows the current PRC Organization Chart. Research centers at UAH are interdisciplinary business units that focus on specific technical disciplined areas. The Propulsion Research Center is an assembly of faculty, students, and support staff who work in research teams on projects related to propulsion and energy topics. Each box in Figure 1 represents a research topic area in the organization. Currently, there are over one hundred faculty, staff, and students associated with PRC research activities.

The PRC Center Director, Dr. Robert Frederick, oversees all operations and leads a research group in Propellants and Energetics. The PRC Deputy Director, Dr. L. Dale Thomas, advises in strategic planning and is also the Eminent Scholar in Industrial and Systems Engineering, the Director of the Alabama Space Grant Consortiums, and leader of his own Propulsion Systems Integration research team. The Eminent Scholar in Propulsion, Dr. Philip Ligrani, holds a named chair that resides in the Department of Mechanical and Aerospace Engineering. As the Eminent Scholar, he leads his own world-class research team in Energy and Power Systems and promotes the overall academic quality of research in the center.

The PRC staff includes Program Administrators/Budget Analysts who manage administrative/fiscal items, a Senior Researcher, Dr. David Lineberry, who directs Laboratory Projects, Safety, and Testing, and a Test Engineer, Mr. Anthony Hall, who oversees laboratory operations at the UAH Johnson Research Center. Figure 1 also shows eight technical topic areas ranging from Energy and Power Systems to Propulsion Systems Technology Test-bed. Each of these eight areas has a lead person/principal investigator, in most cases a faculty member, identified as a point of contact. Participating faculty principal investigators, staff, graduate students, and undergraduate students who are active in projects or in independent research are also shown in each area. The research areas emphasize the participation of graduate and undergraduate research assistants.

B. PRC Graduate Student Production Summary

The first overall metric presented is graduate student production. The total master's degree production for the PRC since its inception is now 200 and the total Ph.D. production is 60. During the 2019 academic year (fall 2019 through summer 2020), four PhD's [172],[173],[174],[293] and six master's degrees [27],[30],[276],[308],[309],[320] have been completed. Most of the students who receive advanced degrees are in the UAH School of Mechanical &

Aerospace Engineering (MAE). Section III of this paper entitled "PRC Graduate Student Production History," is the focus of this year's paper, and will present further detailed analysis.

The doctoral dissertations covered areas such as modeling solid fuel development for ramjet engines, heat transfer experiments for ablative cooling materials for use in warm gas thrusters, and modeling and simulation for Magnetoinertial Fusion Propulsion. Master's theses that involved topics such as space force development, liquid rocket injector pulsation, radiation shielding for pulse-fusion propulsion, heat transfer for turbomachinery cooling applications, and propulsion systems engineering. Section III of this paper entitled "PRC Graduate Student Production History," is the focus of this year's paper, and will present further analysis.

C. PRC Research Expenditure Summary

Figure 2 shows the annual research expenditures from external sources for the Propulsion Research Center since its inception in FY 1991 through a projection of FY 2020. The average annual expenditure level of the entire period is \$1.6 million dollars per year. The periodic "surges" in funding generally represent the growth and completion of significant research programs or with a particular major sponsor. The projection of \$3,300,000 for FY 20 shows a 33% increase over last year and is an overall result of increased funding of several team members. The overall research portfolio has increased by 160% in the past five years from \$1.3 million to \$3.3 million. The research expenditure numbers do not include cost shares, internal university research funds, state provided operating funds, or UAH Foundation investments into the PRC.



Fig. 2. Research expenditures distribution by FY.

D. PRC Current Research Funding

This section highlights the sponsors and funding award distributions for the first three quarters of FY20. The PRC currently manages these external funds in 66 separate research accounts. The PRC has received \$2,783,126 in new awards during the first three-quarters of FY20. Table 1 below shows the distribution of new funding of \$2,783,116. This is added to ongoing authorization from previous FY's of \$3,050,137 to a total of \$5,833,253. With research expenditures to date of \$2,524,477, the current net authorizations are \$3,308,776.

			_			
	Nev	w Funds	Ongo	ing Authorizations	Tota	Authorizations
Corporate	\$	708,635.15	\$	422,002.37	\$	1,130,637.52
DoD	\$	999,081.00	\$	477,261.46	\$	1,476,342.46
NASA	\$	1,075,400.00	\$	2,150,873.20	\$	3,226,273.20
Total	\$	2,783,116.15	\$	3,050,137.03	\$	5,833,253.18
			Total	Spending (7/31/20)	\$	(2,524,476.74)
			Net Authorizations		\$	3,308,776.44

Table 1. PRC Funding and Expenditure Summary (Oct. 1, 2019 through June 30, 2020)



Fig. 3, PRC Funding distribution by source for first three quarters of FY 20,

Figure 3 illustrates the distribution of new funds and total authorizations. Figure 4a shows funds for FY20 are evenly split between DOD and NASA with a slightly lower portion from corporate sponsors. Figure 4b shows that a significant amount of multi-year funding comes from NASA. This increases the NASA sector to over half of the current total research authorizations.

Several agencies, companies, and universities provide support for PRC research. Table 2 below shows a listing of recent sponsors (from past 5 years). The sponsors are listed according to the type of agency providing the funds. New sponsors this year include the FBI, Torch Technologies, and Northrup Grumman.

A. PRC Recent Publications

PRC researchers and students have produced over 130 publications since January 2019. Table 3 below shows the citations from the past year grouped by the technical areas and researchers. Many of the papers are multi-author among faculty, students, and research partners. Numerous other contract research reports are not included in the citations below.

	Federal Government			State Government				
	NASA Alabama Space Grant Consortium,			•	State of Alabama			
	NASA Headquarters,							
	NASA Goddard Spaceflight Center,			Academic				
	• NASA Marshall Spaceflight Center (MSFC),			Academic				
	• The Missile Defense Agency (MDA),			•	United States Air Force Academy			
	• U.S. Army Space and Missile Defense Command	d (SN	MDC)					
Corporate								
•	Aerojet Rocketdyne,			Hyperion Technology,				
•	• Barber-Nichols, Inc.,			Hyper V Technologies,				
•	• Boeing,		• Jacobs,					
•	C3 Propulsion,			IHI Corporation,				
•	• CFD Research,			Manufacturing Technical Solutions (MTS),				
•	• Combustion Research & Flow Tech., Inc.,			 McConnell Jones Lanier & Murphy LLP, 				
•	• Earth to Sky LLC,			• Science and Technology Applications, LLC,				
•	• ERC, Inc.,			• Solar Turbines, Inc.,				
•	• Department of the Air Force (USAF),			Northrop Grumman Corporation				
•	• FBI,			• TGV Rockets, Inc.,				
•	Gloyer-Taylor Laboratories (GTL),			Varian Medical Systems, Incorporated,				
•	HyperJet Fusion Corporation			Vector (formerly Garvey Spacecraft Corp).				

Table 2 – PRC Sponsors from FY17 to Present

Table 3– PRC Recent PRC Publications

Area/Researcher	Recent Publications
Energy and Power Systems	
Dr. Phillip T. Ligrani	[26], [53], [54], [55], [56], [57], [58], [59], [60], [61], [62], [63], [64],
	[65], [66], [67], [68], [69], [70], [71], [72], [73], [74], [75], [76]
Fusion Propulsion & Power	
Dr. Jason Cassibry	[11],[12],[13],[14],[15],[16],[17],[18],[19],[20],[21],[22],[23],[24]
Plasmas and Combustion	
Dr. Gabe Xu	[129], [130], [131], [132], [133]
Propulsion Systems Integration	
Dr. L. Dale Thomas	[26], [68], [106], [107], [108], [109], [110], [111], [112], [113], [114],
	[115], [116], [117], [118], [119], [120], [121], [122], [123], [124], [125],
	[126], [127], [128],
Computational Modeling	
Dr. Sarma Rani	[93], [94]
Dr. C-K Kang,	[41], [42], [43], [44], [45], [46], [47], [48], [49], [50], [51], [52],
Aerospace Materials & Structures	
Dr. George Nelson,	[77], [78], [79], [80], [81], [82], [83], [84], [85], [86], [87], [88], [89],
	[90], [91], [92]
Dr. Kavan Hazeli	[32], [33], [34], [35], [36]
Dr. Judy Schneider	[95], [96], [97], [98], [99], [100], [101], [102], [103], [104], [105]
Dr. Gang Wang	[134], [135], [136], [137]
Propellants, Energetics, Safety, and	
Overviews	
Dr. Robert A. Frederick, Jr.	[8], [25], [26], [27], [28], [29], [30], [31], [37], [38], [68], [114], [128]
Dr. Daniel Jones	[37], [38], [39], [40]
Dr. James K. Baird	[1], [7], [8], [25]
Propulsion System Techy and Testbed	
Dr. David Lineberry	[28], [31]

American Institute of Aeronautics and Astronautics

II. Academic Infrastructure

B. Mechanical & Aerospace Engineering

The MAE undergraduate programs consist of accredited components in Mechanical Engineering (ME) and Aerospace Engineering (AE). MAE has continued a high rate of growth and reached 1410 undergraduate students in fall 2019 and has current enrollment expectations of 1425 in fall 2020. The undergraduate AE program now represents over half the undergraduate population, at almost 750 students. As Fig. 5 shows, the ME cohort has grown steadily at several percent per year. However, the growth in BSAE students, starting in 2015, has reshaped our undergraduate profile. The UAH BSAE and BSME programs are, respectively, the largest and third-largest undergraduate programs on campus, and the MAE department makes up over 1/7 of the total UAH student population. The MAE graduate enrollment has been increasing slowly since 2015 and is expected to be over 180 students in the Fall 2020 term. The recent trend has been toward more graduate students in the Aerospace Systems program and fewer in the Mechanical Engineering program. This is a reversal of the opposite trend that was in place from 2008 to 2015. As the MAE research activity grows, the graduate student population shifts more to full-time research-active students.

The MAE full-time faculty count now stands at 26. Twenty are tenure-track, two are non-tenured Clinical Associate Professors, and four are full-time lecturers. MAE also employs around eight adjunct instructors each term from the Huntsville engineering and research community. In fall of 2019, a new junior faculty member joined MAE in the area of control of autonomous flying vehicles, and a new full-time lecturer is joining in fall 2020. The COVID-19 pandemic has affected the Department in several ways. Hiring of two Assistant Professors was cancelled in spring 2020, and the fall 2020 enrollment, while expected to grow slightly, will certainly deviate from the growth curve of recent years. Finally, the circumstances have required a shift to an online mode of instruction in most of our courses.



Fig. 5. UAH undergraduate enrollment trends in the Department of Mechanical and Aerospace Engineering. MAE is total enrollment. ME and AE are the separate degree programs.

C. Propulsion-Related Courses

Tables 3 and 4 show several propulsion-related classes offered at UAH in Mechanical and Aerospace Engineering. The dual-level courses in Table 3 allow undergraduate and graduate students to learn together. Qualified undergraduates can participate in a Joint Undergraduate Master's Program (JUMP) in which they can simultaneously earn undergraduate and graduate credit for taking up to nine hours of approved graduate-level classes. Undergraduate AE students can choose either Rocket or

Airbreathing Propulsion to meet their program requirements.

It is significant to note the Rocket Propulsion I has doubled in enrollment since 2015-16 and is expected to increase next year. Introduction to Electric Propulsion is an elective course that is offered every All two years. undergraduate AE students take Spacecraft Propulsion. Rocket design is a two-semester capstone course where students design, fabricate, and build a sounding rocket with a payload. The rocket design course enrollment has been capped due to ensure safety due to limited staffing and resources to support the course. The increasing totals in the dual level classes of Table 1 show how the overall MAE student growth is increasing propulsion-related class enrollment.

Table 4 shows a wide array of graduate-level courses related to propulsion. Compressible Flow is offered each year. Other graduate courses are offered on two-year cycles as shown in Table 2. The Advanced Reading in Propulsion Course guides Master's and Ph.D. students a thorough review and evaluation of pertinent literature in preparing for their research projects. UAH also has a College of Professional and Continuing Studies (CPCS) which offers a certificate in propulsion by combining three of the following courses: Rocket Propulsion Fundamentals, Advanced Solid Rocket Propulsion, Combustion Instability in Solid Rockets, and Liquid Rocket These Engineering. courses assist professionals who might be transitioning into new technical areas and want to receive advanced material for professional development credit. CPCS offers these courses periodically in person or with on-demand, online learning.

Table 3. UAH undergraduate and graduate (dual level) course enrollments s related to propulsion and energy by academic year (AY).

Dual-Level Undergraduate/Graduate	AY 15- 16	AY 16- 17	AY 17- 18	AY 18- 19	AY 19- 20-
MAE 440/540 Rocket Propulsion I	55	34	67	79	110
MAE 441/541 Airbreathing Prop.	17	38	33	38	61
MAE 444/544 – Intro. To Electric Propulsion.	22	-	20	-	27
MAE 468/568–Elem. of Spacecraft Des,	56	62	87	99	122
MAE 490/491– Rocket Design	56	38	40	40	40

Table 4. UAH graduate propulsion and energy courses andenrollments by Academic Year (AY).

UAH Graduate Course	AY 15 - 16	AY 16- 17	AY 17 - 18	AY 18- 19	AY 19- 20
MAE 620-Compressible Flow	21	11	30	26	14
MAE 640–Rocket Propulsion II	-	21	-	29	-
MAE 64 -Adv. Solid Rocket Propulsion	22	-	15	-	23
MAE 645 – Combustion I	6	-	19	-	13
MAE 695/795–ST: Adv. Readings in Prop.	7	3	2	3	5
MAE 695: ST Intro to Nuclear Propulsion	-	22	-	26	-
MAE 695-ST: Comb. Instab. in Solid Rockets	15	-	-		-
MAE 695- ST: Liquid Rocket Engineering	20	-	-	-	-
MAE 681 – Missile Trajectory Analysis	-	-	-		-
MAE 740-Aerothermodynamics	18	-	-	19	-
MAE 745 Combustion II	-	-	-	-	-
MAE 754 – Hypersonic Flow	-	11	-	25	-
MAE 795–ST: Intro. to Fusion Propulsion	11	-	16	-	17

The special focus of this year's paper is on PRC graduate student production from 1991 to the present. The scope of this work was to collect the student data, categorize each thesis and dissertation, verify the citation and advisor, verify the graduation year, categorize into technical areas, and make first estimates of associated data. In the next year we plan to review this approach and also re-connect with the graduates to verify and collect additional data from them.

A team researched our records and those of the library and compiled a database of over 400 entries which also included non-thesis master's degrees, thesis master's degrees, and PhD dissertations. The selection of the degrees has some subjectivity as the PRC supports these thesis and dissertations to varying degrees through contracts and use of facilities. For this exercise we have included the broadest array of associated degrees to fully populate the database, and we plan to refine the analysis in the coming year.

Figure 6 shows a compilation of the cumulative number of Master's theses and PH.D. dissertations completed each calendar year. The total number of degrees is 274 including 207 master's and 67 Ph.Ds. Having 75% of the degrees being Master's degrees stems from two main factors. First, they are shorter in duration. Second, since aerospace funding is typically not multi-year, it is easier to support students for master's degrees than for the longer periods required for PhD's.



Fig. 6 - Cumulative number of master's and PhD. degrees completed

Figure 7 shows the detail on the rate of completion for each calendar year. The figure illustrates the dynamic nature of degree production. It should also be noted that the completion of a PhD may represent three to five years of work ahead of the actual graduation year. The highest year in 2010 produced 21 degrees. It is also noted that there has been a more sustained and consistent production of PhD over the last few years.



Fig. 7 – Annual number of master's and PhD. degrees completed each calendar year

For a further analysis, each thesis and dissertation was tagged with a technical area that is descriptive of the topic of the work. Table 5 shows the areas and the citations of the thesis and dissertations associated with the areas. The categorization is somewhat subjective, but gives insights into the broad areas of education and research supported by the PRC over the past 29 years. The first three categories are the conventional areas of solid, liquid, and hybrid propulsion. Advanced propulsion which includes electric, nuclear, fusion, solar, and others. Air-Breathing propulsion includes working heat transfer for rotating machinery, wind tunnel work and other areas related to airbreathing propulsion. Propulsion systems engineering includes topics related to system performance trades, costs, reliability, and reducing complexity of systems. Propulsion testing and safety are related to studies of measurement uncertainty and development of new test methods or diagnostic methods. Missile design relates to work related to missile performance. Propulsion-related covers the balance and includes CFD studies, structural work and other items that do not fit neatly into the previous categories.

Technical Area	Master's	PhD's
Solid Propulsion	[138], [139] [140], [141] [142], [143], [144],	[168], [169], [170]
	[145][146], [147], [148], [149], [150], [151], [152]	[171], [172], [173],
	[153], [154], [155], [156], [157], [158], [159],	[174]
	[160], [161], [162], [163], [164], [165], [166],	
	[167]	
Liquid Propulsion	[175], [176], [177], [178], [179], [180], [181],	[220], [221], [222],
	[182], [183], [184], [185], [186], [187], [188],	[223], [224], [225],
	[189], [190], [191], [192], [193], [194], [195],	[226], [227], [228],
	[196], [197], [198], [199], [200], [201], [202],	[229], [230], [231],
	[203], [204], [205], [206], [207], [208], [209],	[232]
	[210], [211], [212], [213], [214], [215], [216],	
	[217], [218], [219]	
Hybrid Propulsion	[233], [234], [235], [236], [237], [238], [239]	[240], [241]
Advanced Propulsion	[242], [243], [244], [245], [246], [247], [248],	[277], [278], [279],
	[249], [250], [251], [252], [253], [254], [255],	[280], [281], [282],
	[256], [257], [258], [259], [260], [261], [262],	[283], [284], [285],
	[263], [264], [265], [266], [267], [268], [269],	[286], [287], [288],
	[270], [271], [272], [273], [274], [275], [276]	[289], [290], [291],
		[292], [293]
Air-Breathing Propulsion	[294], [295], [296], [297], [298], [299], [300],	[311], [312], [313],
	[301], [302], [303], [304], [305], [306], [307],	[314], [315], [316]
	[308], [309], [310]	
Propulsion Systems Engineering	[317], [318], [319]	[321]
Propulsion Testing and Safety	[322], [323], [324], [325], [326], [327], [328],	[337], [338]
	[329], [330], [331], [332], [333], [334], [335],	
	[167], [336]	
Missile Design	[339], [340], [341], [342], [343], [344], [345],	[351], [352], [353]
	[346], [347], [348], [349], [350]	
Propulsion-Related	[354], [355], [356], [357], [358], [359], [360],	[399], [400], [401],
	[361], [362], [363], [364], [365], [366], [367],	[402], [403], [404],
	[368], [369], [370], [371], [372], [373], [374],	[405], [405], [406],
	[375], [376], [377], [378], [379], [380], [381],	[407], [408], [409]
	[382], [383], [384], [385], [386], [387], [388],	[410]
	[389], [390], [391], [392], [393], [394], [395],	
	[396], [397], [398]	

Table 5. Technical Categories of PRC Master's	Thesis and Ph.D. Dissertations from 1991 to present.
---	--

Figures 8 and 9 show the distribution of master's and PhD. Degrees in the technical areas. The distribution of the technical areas is relatively constituent between the two figures. The combination of solid, liquid, and hybrid propulsion comprises about a third of the degrees in both categories. Advanced propulsion is another significant area covered by the theses and dissertations with a greater percentage at the dissertation level. Our strategic plan last year recommended more emphasis in the advanced propulsion area for the future. The air-breathing component has grown substantially in the last 5 years with the addition of Dr. Ligrani, Emener Scholar in Propulsion. The propulsion systems engineering is also growing with Dr. L. Dale Thomas joining UAH as the Eminent Scholar in Industrial and Systems Engineering.



Fig. 8 – Distribution of master's theses completed by technical areas



Fig. 9 – Distribution of master's theses completed by technical areas

American Institute of Aeronautics and Astronautics

Figure 9 shows the percentage of advanced degree graduates each year by gender. The overall rate is 20% female and 80% male. Figure 9 shows the annual percentage of graduates who are U.S. citizens. The overall average is 93 percent. The large number of U.S. citizens is partly driven by contracts that require citizenship and the high-density of aerospace work for U.S. citizens in the Huntsville area.

Advanced Degree Percentages, M and F



Graduation Year

Fig. 10 – Distribution percentage of degrees each year by M – male, F – Female





Year

Fig. 11 - Estimated distribution percentage of U.S. citizen degrees each year

IV. Student Launch Initiative

Figure 12 shows the UAH 2020 UAH Student Launch Team with their sounding rocket at our UAH laboratory. This year the team's rocket reached an apogee of 4,454 feet above ground level. The team's goal was 4,500 feet. Originally this launch was a payload demonstration, but due to schedule changes caused by COVID-19, the mission objective was changed to a full flight demonstration of the rocket and payload. The SLI final launch that had previously been set for April 4 at Bragg Farms in Toney, Ala., was scrubbed. The SLI program typically has a very tight schedule, but this year because of the COVID-19 outbreak, in addition to new design and programmatic challenges, the team had to deal with a schedule reduced by an additional month. Completing the design, manufacturing, and testing of both the payload and rocket, and demonstrating the full mission prior to the shutdown was a monumental accomplishment. The team members, their role, and hometown are:

- Nicholas Roman, project manager; senior, aerospace engineering, Cullman, Ala.
- Joshua Jordan, chief engineer; senior, mechanical engineering, Mount Vernon, Wash.
- Peter Martin, vehicle team lead; senior, mechanical engineering, Coopersburg, Penn.
- James Venters, payload team lead; senior, mechanical engineering, Huntsville, Ala.
- Jessy McIntosh, safety officer; senior, mechanical engineering, Beaufort, N.C.
- Maggie Hockensmith, technical writing coordinator and vehicle safety deputy; senior, aerospace engineering, Lexington, Ky.
- Claudia Hyder, payload safety deputy; senior, mechanical engineering, Knoxville, Tenn.
- Patrick Day, project management team; senior, aerospace engineering, Johnson City, Tenn.
- Will Snyder, project management team; senior, aerospace engineering, Cleveland, Ohio
- Rodney L Luke, vehicle team; senior, aerospace engineering, Pleasant Grove, Ala.
- Roman Benetti, vehicle team; senor, aerospace engineering, Woodbury, Minn.
- Rachel O'Kraski, vehicle team; senior, aerospace engineering, Huntsville, Ala.
- Ben Lucke, vehicle team; senior, aerospace engineering, Saint Petersburg, Fla.
- Jeremy Hart, vehicle team; senior, aerospace engineering, Gainesville, Ga.
- Jacob Zilke, vehicle team; senior, aerospace engineering, Wilmington, N.C.
- Joseph Agnew, payload team; senior, mechanical engineering, New Market, Ala.
- Johnathon Jacobs, payload team; senior, aerospace engineering, Valley Head, Ala.
- Thomas Salverson, payload team; senior, mechanical engineering, Gretna, Neb.
- Kevin Caruso, payload team; senior, mechanical engineering, Lawrenceburg, Tenn.
- Jacob Moseley, payload team; senior, aerospace engineering, Gaylesville, Ala.

The UAH team is advised by Dr. David Lineberry, a Research Engineer at the UAH Propulsion Research Center, and mentored by Jason Winningham, who has assisted rocket launches and advised throughout the project. The University of Alabama in Huntsville (UAH) earned first place in project safety and third place overall in competition at a COVID-shortened national 2020 NASA Student Launch.



Fig. 12 –UAH 2020 Student Launch Team

V. People Make the Difference and Comments of COVID -19

During the past year, we continued to intentionally maintain and build our relationships with each other and our community. The PRC hosted periodic student mentoring cookout lunches at the lab that included guest speakers and tours of the facilities for guests. Luncheon talks are usually kept short (about 20 minutes) to ensure that we have time to meet new people and interact with each other. We often have participants from our supporting organizations such as security, purchasing, sponsored programs, and accounting. We keep a light atmosphere, celebrate birthdays, and recognize achievements. Our team also meets periodically offsite at local restaurants where we enjoy good food and several members perform music.



Fig. 13 – Propulsion Research Center faculty, staff, students, colleagues, and friends at the fall 2019 Recognition of Graduates Reception (left) and spring 2020 graduate calibration (COVID-19 Zoom). "Keep relationships more important than tasks or problems" – Dr. Robert A. Frederick, Jr., Director, UAH Propulsion Research Center.

Figure 13 shows the PRC team at our December 2019 and May 2020 Graduate Recognition gatherings. The difference in the left and right photo illustrate the difference that COVID-19 has made on our interactions. In December we stood shoulder to shoulder throwing hats into the air, while in May we all connected through the internet

from our remote work sites to maintain social distancing. Our laboratory reopened a few weeks ago has been operating under strict COVID guidelines.

VI. Remarks

The UAH PRC stands poised to build upon a rich legacy of research advances in propulsion. One of our original strategies was to pursue funding support for projects that would support students. The faculty associated with the PRC have followed that vision and could produce 300 graduates with advanced degrees on propulsion topics in the first 30 years (projecting to next year). If we also project 30 years of total expenditures at \$50 million, that averages to about \$170,000 per degree. The strategy forward will focus on continuing a legacy of excellence in traditional student production in the propulsion arena, equipping the future workforce for success in their future careers.

VII. Acknowledgements

The authors acknowledge Mrs. Gabriel Cromartie, Jacqueline Crews, Kaitlin Neese, and James Venters for their significant and diligent work in collecting and organizing data on the past graduates. The authors acknowledge the inputs and contributions of the faculty, staff, students, and graduates of the Propulsion Research Center for providing valuable inputs and suggestions for this paper. Dr. Keith Hollingsworth, Chairman of the Mechanical and Aerospace Engineering Department, provided valuable inputs on the academic programs. Thanks to Anna Frederick for copyediting the document.

The support of the UAH Office of Vice President for Research and the UAH College of Engineering are gratefully acknowledged. Thanks also go to our recent sponsors mentioned in this paper. Grateful acknowledgements to all those potential new collaborators who teamed with us to write proposals last year that will fund future students and researchers at the PRC.

VII. References¹

- ^[1] Hawk, C.W. and Frederick, R.A., "University Propulsion Programs at the University of Alabama in Huntsville," AIAA Paper 2004-3323, July 2004.
- ^[2] Frederick, R. A., "UAH Propulsion Research Center 25th Anniversary Highlights," AIAA Paper 2016-4722, July 2016.
- ^[3] Frederick, R.A., Ligrani, P. M., and Thomas, L.D., "Propulsion Research and Academic Programs at the University of Alabama in Huntsville," <u>https://doi.org/10.2514/6.2017-4801</u>
- ^[4] Frederick, R.A., Ligrani, P. M., and Thomas, L.D., "Propulsion Research and Academic Programs at the University of Alabama in Huntsville – 2018," AIAA Paper 2018-4805, 2018. <u>https://doi.org/10.2514/6.2018-4805</u>
- ^[5] Frederick, R.A., Thomas, L.D., and Ligrani, P., "Propulsion Research and Academic Programs at the University of Alabama in Huntsville PRC Strategic Plan– 2019, AIAA Paper AIAA 2019-3891, 2019. https://doi.org/10.2514/6.2019-3891

Baird

- [6] Baird, J. K., Wang, X., Lang, J. R., and Norris, P. "Phase Rule Classification of Physical and Chemical Critical Effects in Liquid Mixtures." *Chemical Physics Letters*, Vol. 729, 2019, pp. 73–78. <u>https://doi.org/10.1016/j.cplett.2019.05.020</u>.
- [7] Baird, J. K., Lang, J. R., Wang, X., Mukherjee, A., and Norris, P. "Phase Rule and the Universality of Critical Phenomena in Chemically Reacting Liquid Mixtures." *Journal of Physical Chemistry B*, Vol. 123, No. 26, 2019, pp. 5545–5554. <u>https://doi.org/10.1021/acs.jpcb.9b02978</u>.
- ^[8] Baird, J. K., Huang, S., and Frederick, R. A. "Space Charge Limited Conduction in Polyvinyl Alcohol+Hydroxylammonium Nitrate Solid Propellant." *Journal of Propulsion and Power*, Vol. 36, No. 3, 2020, pp. 479–484. https://doi.org/10.2514/1.B37573.

Cassibry

- ^[9] Schillo, K., Cassibry, J., Thompson, S., and Rodriguez, M., "Test Suite for Smooth Particle Hydrodynamic Code Relevant to Spherical Plasma Liner Formation and Implosion," *ASME Journal of Nuclear Engineering and Radiation Science*, 5(4), 042201 (Jul 19, 2019).
- ^[10] Taylor, B., J. Cassibry, R. Adams, G. Doughty, B. Seidler, R. Cortez, P. Giddens, et al. 2018. "An Overview of the Charger-1 Pulsed Power Facility." *IEEE Transactions on Plasma Science* 46 (11): 3986– 92. https://doi.org/10.1109/TPS.2018.2862860.
- ^[11] Cassibry, J., Winterling, B., Schillo, K., "Pulsed Magnetic Nozzle for Fusion Propulsion," J. of British Interplanetary Society, 71, pp.119-125
- ^[12] Aueron, A., Thomas, D., and Cassibry, J., "Analytical Modeling of Heat Deposition in Propellant for Nuclear Thermal Rockets," *J. of Spacecraft and Rockets*, **56**(5), March 2019.
- ^[13] Thompson, S., Cassibry, J., "Effects of propagation distance and half angle on the merging of hypervelocity plasma jets," *Physics of Plasmas*, 26 (5): 052701.
- ^[14] Thio, Y. C. F., Hsu, S.C., Witherspoon, F.D., Cruz, E., Case, A., Langendorf, S., Yates, K., Dunn, J., Cassibry, J., Samulyak, R., Stoltz, P., Brockington, S.J., Williams, A., Luna, M., Becker, R., and Cook A., (2019), "Plasma-Jet-Driven Magneto-Inertial Fusion," *Fusion Science and Technology*, *DOI*: 10.1080/15361055.2019.1598736
- ^[15] Schillo, K., Cassibry, J., "Effects of initial conditions and transport on ram pressure, Mach number, and uniformity for plasma liner formation and implosion," *Physics of Plasmas* **27**, 042707 (2020); <u>https://doi.org/10.1063/1.5143009</u>.
- ^[16] Thompson, S., Cassibry, J., "2D Modeling of Fusion Ignition Conditions for a Multilayer Plasma Liner MagnetoInertial Fusion Target in a Cylindrical Configuration," *Physics of Plasmas* 27, 022701 (2020); <u>https://doi.org/10.1063/1.5132336</u>.
- ^[17] Englestad, T. J., and Cassibry, J.T., "Smoothed Particle Hydrodynamic Investigation of Model Vibrations in Hypersonic Flow." *Computers & Fluids*, May, 2020 104538. <u>https://doi.org/10.1016/j.compfluid.2020.104538</u>.
- ^[18] Taylor, B., Cassibry, J., and Adams, R., 2020. "Ignition and Burn in a Hybrid Nuclear Fuel for a Pulsed Rocket Engine." *Acta Astronautica* 175 (October): 465–75. <u>https://doi.org/10.1016/j.actaastro.2020.04.007</u>

American Institute of Aeronautics and Astronautics

- ^[19] Yates, K., Langendorf, S., Hsu, S., Dunn, J., Gilmore, M., Samuel Brockington, S., Andrew Case, A., Edward Cruz, E., Witherspoon, F., Thio, Y. C. F., Cassibry, J., and Schillo, K., "Experimental characterization of a section of a spherically imploding plasma liner formed by merging hypersonic plasma jets," *Physics of Plasmas*, 27, 062706 (2020); https://doi.org/10.1063/1.5126855.
- ^[20] Cassibry, J., Thomas, D., Richard Wood, R., Frederick, R., and Kumar, S., "Development Plan for a Fission and Fusion Powered Propulsion System to Reach Mars in 45 Days," AAS 19-085, Proceedings of the 42nd Annual AAS Guidance and Control Conference, January 31 to February 6, 2019, Breckenridge, CO, Vol. 169, Advances in the Astronautical Sciences.
- [21] Kumar, S., and Cassibry, J., "Round-Trip Mission to Neptune Using Nuclear Fusion Propulsion", 2019 Joint Propulsion Conference, AIAA Propulsion and Energy Forum, (AIAA 2019-4033), https://doi.org/10.2514/6.2019-4033.
- ^[22] Schilling, N. and Cassibry, J. T., "Development of a pulse-recharge magnetic nozzle for PuFF," 2019 Joint Propulsion Conference, AIAA Propulsion and Energy Forum, (AIAA 2019-4284), https://doi.org/10.2514/6.2019-4284.
- ^[23] Wagner, R., Westrich, S., Burns, E., and Cassibry, J., "Fusion Research Development at the University of Alabama in Huntsville," 2019 Joint Propulsion Conference, AIAA Propulsion and Energy Forum, (AIAA 2019-4287), <u>https://doi.org/10.2514/6.2019-4287</u>
- ^[24] Langendorf, S., Byvank, T. Dunn, J. Witherspoon, F. Case, A. Cruz, E., and Cassibry, J., "Progress Toward the Formation of Fully Spherical Imploding Plasma Liners on PLX," 61st Annual Meeting of the APS Division of Plasma Physics, 64 (11), <u>http://meetings.aps.org/Meeting/DPP19/Session/TO6.12</u>.

Frederick

- ^[25] Baird, J. K., Huang, S., and Frederick, R. A., Jr., "Space Charge Limited Conduction and Internal Electric Field in the Polyvinyl Alcohol + Hydroxyl Ammonium Nitrate Solid Propellant," *AIAA Journal of Propulsion and Power*, Published Online: Feb 27, 2020; <u>https://doi.org/10.2514/1.B37573</u>.
- [26] Frederick, R.A, Jr., Thomas, L.D., and Ligrani, P.M., "Propulsion Research and Academic Programs at the University of Alabama in Huntsville - PRC Strategic Plan – 2019," AIAA Paper 2019-3891, August 2019. https://doi.org/10.2514/6.2019-3891
- [27] Godshall, S., and Frederick, R., "Collaborative Space and Propulsion Education: Leveraging all Sectors of the Space Enterprise to Benefit the Future U.S. Space and Propulsion Workforce!," AIAA Paper 2019-3804, August 2019. <u>https://doi.org/10.2514/6.2019-3804</u>
- ^[28] Venters, J., Costa, M., Unruh, E., Lineberry, D., Frederick, R., "Uncertainty Analysis of Experimental Discharge Coefficients in Additively Manufactured Liquid Injector Elements," AIAA Paper 2019-3932, August 2019. <u>https://doi.org/10.2514/6.2019-3932</u>
- ^[29] Patel, A., Frederick, R., "Gas Cooling Generator Technologies for Aerospace Applications," AIAA Paper 2019-4068, August 2019. <u>https://doi.org/10.2514/6.2019-4068</u>
- ^[30] Ranade, I., Frederick, R., "Experimental Study of Swirl Coaxial Injector Hydrodynamics Under High-Frequency Self-Pulsation," AIAA Paper 2019-4118, August 2019. <u>https://doi.org/10.2514/1.B36177</u>
- ^[31] Unruh, E., Spaulding, M., Lineberry, D., Xu, K. G., and Frederick, R. "Development of an Optically Accessible Racetrack-Type Rotating Detonation Rocket Engine," AIAA Paper 2020-xxxx, August 2020.

Hazeli

- ^[32] Babamiri, B. B., Askari, H., and Hazeli, K. "Deformation Mechanisms and Post-Yielding Behavior of Additively Manufactured Lattice Structures." *Materials and Design*, Vol. 188, 2020, p. 108443. https://doi.org/10.1016/j.matdes.2019.108443.
- [33] Hazeli, K., Babamiri, B. B., Indeck, J., Minor, A., and Askari, H. "Microstructure-Topology Relationship Effects on the Quasi-Static and Dynamic Behavior of Additively Manufactured Lattice Structures." *Materials and Design*, Vol. 176, 2019, p. 107826. <u>https://doi.org/10.1016/j.matdes.2019.107826</u>.
- ^[34] Babamiri, B. B., Indeck, J., Demeneghi, G., Cuadra, J., and Hazeli, K. "Quantification of Porosity and Microstructure and Their Effect on Quasi-Static and Dynamic Behavior of Additively Manufactured

American Institute of Aeronautics and Astronautics

Inconel 718." *Additive Manufacturing*, Vol. 34, 2020, p. 101380. https://doi.org/10.1016/j.addma.2020.101380.

- ^[35] Indeck, J., Cuadra, J., Williams, C., and Hazeli, K. "Accumulation and Evolution of Elastically Induced Defects under Cyclic Loading: Quantification and Subsequent Properties." *International Journal of Fatigue*, Vol. 127, 2019, pp. 522–536. <u>https://doi.org/10.1016/j.ijfatigue.2019.05.025</u>.
- ^[36] Liang, B., Cuadra, J., Hazeli, K., and Soghrati, S. "Stress Field Analysis in a Stony Meteorite under Thermal Fatigue and Mechanical Loadings." *Icarus*, Vol. 335, 2020, p. 113381. https://doi.org/10.1016/j.icarus.2019.07.015.

Jones

- ^[37] Jones, D., and Frederick, R., "Ramjet Fuel Mixture Optimization," *AIAA Propulsion and Energy Forum*, Virtual Event, August 2020.
- ^[38] Jones, D., and Frederick, R., "Flammability Characterization of a Polysulfide Based Ramjet Fuel," *Journal of Energetic Materials* (submitted for review July 2020).
- [39] Jones, D., "Effect of Sulfur and a Perfluoropolyether on the Ignition and Decomposition of Solid Fuels for Ramjets," Ph. D. Dissertation, Department of Mechanical and Aerospace Engineering, University of Alabama in Huntsville, Huntsville, AL, 2020.
- ^[40] McDonald, B., Rice, J., Hayes, B., Marshall, C., Pledger, L., Myers, D., and Jones, D., "High Density Solid Ramjet Fuel Based on 1,6-Hexanediol Diglycidyl Ether and Methyltetrahydrophtalic Anhydride," *Fuel*, Volume 278, 2020. DOI: 10.1016/j.fuel.2020.118354

Kang

Downloaded by Robert Frederick on October 12, 2020 | http://arc.aiaa.org | DOI: 10.2514/6.2020-3909

- [41] Nedunchezian, K., Kang, C., and Aono, H. "A Numerical Analysis of the Effects of Wing Kinematics on Flapping Wing Aeroacoustics," *Journal of Sound and Vibration*, Vol. 442, pp. 366 - 383, 2019 (2018 impact factor: 3.123)
- [42] Raghu, S. L., Kang, C., Whitehead, P., Takeyama, A., and Conners, R., "Static Accuracy Analysis Of Vicon T40s Motion Capture Cameras Arranged Externally For Motion Capture In Constrained Aquatic Environments", *Journal of Biomechanics*, Vol. 89, 2019, pp. 139–142 (2018 impact factor: 2.576)
- [43] McCain, J., Pohly, J., Sridhar, M.K., Kang, C., Landrum, D.B., Aono, H., "Experimental Force and Deformation Measurements of Bioinspired Flapping Wings in Ultra-Low Martian Density Environment", AIAA 2020-2003, AIAA Scitech, Orlando, FL, 6-10 January 2020
- ^[44] Dunne, S., Palma, G., Pohly, J., Mesmer, B., Landrum, D.B, Kang, C. "System Analyzer for a Bioinspired Mars Flight Vehicle System for Varying Mission Contexts," AIAA 2020-0665, AIAA Scitech, Orlando, FL, 6-10 January 2020
- ^[45] Twigg, R., Sridhar, M., Pohly, J., Hildebrandt, N., Kang, C., Landrum, D.B., Roh, K., <u>Salzwedel, S.</u>, "Aeroelastic Characterization of Real and Artificial Monarch Butterfly Wings," AIAA 2020-2002, AIAA Scitech, Orlando, FL, 6-10 January 2020
- ^[46] Sridhar, M.K., Kang, C., and Lee, T, "Geometric Formulation for the Dynamics of Monarch Butterfly with the Effects of Abdomen Undulation," AIAA 2020-1962, AIAA Scitech, Orlando, FL, 6-10 January 2020
- ^[47] Sridhar, M.K., Kang, C., Landrum, D.B., Aono, H., "Fluid-Structure Interaction of Flexible Flapping Wings at High Altitude Conditions", AIAA 2020-1781, AIAA Scitech, Orlando, FL, 6-10 January 2020
- [48] Aono, H., Kikkawa, K., Ishikawa, H., and Kang, C., "A Numerical Study of Sound Generation on Pitch and Plunge Wing at Low Reynolds Numbers", AIAA 2020-1495, AIAA Scitech, Orlando, FL, 6-10 January 2020
- ^[49] Sridhar, M.K., Kang, C., and Landrum, D.B., "Beneficial Effect of the Coupled Wing-Body Dynamics on Power Consumption in Butterflies," AIAA 2019-0566, AIAA 2019 Scitech Forum, San Diego, California, January 7 - 11, 2019 (AIAA Atmospheric Flight Mechanics Best Student Paper)
- ^[50] Nedunchezian, K., Kang, C., and Aono, H., "Sound Generation of Flexible Plunging Wings in Hover at Low Reynolds Numbers," AIAA 2019-1072, AIAA 2019 Scitech Forum, San Diego, California, January 7 - 11, 2019
- ^[51] Pohly, J., Kang, C., Sridhar, M.K., Landrum, D.B., Fahimi, F., Mesmer, B., Bluman, J.E., Aono, H., Lee, T. "Scaling Bioinspired Mars Flight Vehicles for Hover," AIAA 2019-0567, AIAA 2019 Scitech Forum, San Diego, California, January 7 - 11, 2019

^[52] Pohly, J., McCain, J., Sridhar, M.K., Kang, C., Landrum, D.B., Mesmer, B.L., Bluman, J., Lee, T., Aono, H., "Marsbees: Bio-inspired Flapping Wing Flight Vehicles for Mars Exploration", AIAA 2020-2003, AIAA Scitech, Orlando, FL, 6-10 January 2020, Invited oral presentation

Ligrani

- Ligrani, P., McInturff, P., Suzuki, M., and Nakamata, C. "Winglet-Pair Target Surface Roughness Influences on Impingement Jet Array Heat Transfer." *Journal of Enhanced Heat Transfer*, Vol. 26, No. 1, 2019, pp. 15–35. <u>https://doi.org/10.1615/JEnhHeatTransf.2018027282</u>.
- ^[54] Marko, S., and Ligrani, P. M. "Analysis of Shock Wave Unsteadiness Using Space and Time Correlations Applied to Shadowgraph Flow Visualization Data." *Advances in Aerodynamics*, Vol. 1, No. 1, 2019, pp. 1– 25. <u>https://doi.org/10.1186/s42774-019-0002-y</u>.
- ^[55] Ligrani, P., Ren, Z., Vanga, S. R., Allgaier, C., Liberatore, F., Patel, R., Srinivasan, R., and Ho, Y. H. "Double Wall Cooling of a Full Coverage Effusion Plate with Cross Flow Supply Cooling and Main Flow Pressure Gradient." *Journal of Engineering for Gas Turbines and Power*, Vol. 141, No. 3, 2019. https://doi.org/10.1115/1.4041451.
- ^[56] Vanga, S. R., Ritchie, D., Click, A. J., Ligrani, P. M., Liberatore, F., Patel, R., Srinivasan, R., and Ho, Y. H. "." ASME Transactions-Journal of Turbomachinery, Vol. 141, No. 4, 2019, pp. 041002–1 to 041002–11.
- ^[57] Ritchie, D., Click, A. J., Ligrani, P. M., Liberatore, F., Patel, R., and Ho, Y. H. "Double Wall Cooling of an Effusion Plate With Simultaneous Cross Flow and Impingement Jet Array Internal Cooling." *ASME Transactions-Journal of Engineering for Gas Turbines and Power*, Vol. 141, No. 9, 2019, pp. 091008–1 to 091008–11.
- ^[58] Lu, X., Li, W., Li, X., Ren, J., Jiang, H., and Ligrani, P. "Flow and Heat Transfer Characteristics of Micro Pin-Fins under Jet Impingement Arrays." *International Journal of Heat and Mass Transfer*, Vol. 143, 2019, p. 118416. <u>https://doi.org/10.1016/j.ijheatmasstransfer.2019.07.066</u>.
- [59] Ligrani, P. M., and Marko, S. M. "Parametric Study of Wind Tunnel Test Section Configurations for Stabilizing Normal Shock Wave Structure." *Shock Waves*, Vol. 30, No. 1, 2020, pp. 77–90. <u>https://doi.org/10.1007/s00193-019-00911-5</u>.
- ^[60] Ligrani, P. M., Su, M., Pippert, A., and Handler, R. A. "Thermal Transport of Viscoelastic Fluids Within Rotating Couette Flows." *Journal of Thermophysics and Heat Transfer*, Vol. 34, No. 1, 2020, pp. 121–133. https://doi.org/10.2514/1.T5807.
- [61] Ligrani, P. M., McNabb, E. S., Collopy, H., Anderson, M., and Marko, S. M. "Recent Investigations of Shock Wave Effects and Interactions." *Advances in Aerodynamics*, Vol. 2, No. 1, 2020, pp. 1–23. <u>https://doi.org/10.1186/s42774-020-0028-1</u>.
- [62] Handler, R. A., Blaisten-Barojas, E., Ligrani, P. M., Dong, P., and Paige, M. "Vortex Generation in a Finitely Extensible Nonlinear Elastic Peterlin Fluid Initially at Rest." *Engineering Reports*, Vol. 2, No. 3, 2020. <u>https://doi.org/10.1002/eng2.12135</u>.
- [63] Ligrani, P. M., Click, A. J., Ritchie, D., Liberatore, F., Patel, R., and Ho, Y. H. "Double Wall Cooling of An Effusion Plate With Cross Flow and Impingement Jet Combination Internal Cooling: Comparisons of Main Flow Contraction Ratio Effects." *International Journal of Heat and Mass Transfer*, Vol. 150, 2020, pp. 119196–1 to 13.
- ^[64] Click, A., Ligrani, P., Ritchie, D., Liberatore, F., Patel, R., and Ho, Y. H. "Effects of Coolant Supply Arrangement on Double Wall Cooling: Hot-Side Effusion Performance and Cold-Side Nusselt Numbers at Different Initial Blowing Ratios." *International Journal of Heat and Mass Transfer*, Vol. 156, 2020, p. 119808. <u>https://doi.org/10.1016/j.ijheatmasstransfer.2020.119808</u>.
- ^[65] Click, A. J., Ligrani, P. M., Hockensmith, M., Knox, J., Larsen, C., Fairbanks, A., Liberatore, F., and Ho, Y. H., "Louver Slot Cooling and Full-Coverage Film Cooling With a Combination Internal Coolant Supply." *ASME Transactions-Journal of Engineering for Gas Turbines and Power*, 2021. (accepted 2020)
- [66] Collopy, H., Sampson, M., Ligrani, P.M., "Recent Research Developments for Turbine Blade Tip Heat Transfer, Including Development and Effects of Tip Leakage Vortices" *Heat and Mass Transfer and Hydrodynamics in Swirling Flows*, Vol. 2211, Paper No. 020002, AIP Publishing, American Institute of Physics, Melville, New York, USA, March 2020.

American Institute of Aeronautics and Astronautics

- ^[67] Sampson, M., Fairbanks, A., Moseley, J., Ligrani, P. M., Xu, H., and Fox, M., "Linear Cascade and Wind Tunnel Development for Turbine Blade Tip Heat Transfer Investigations with and without Film Cooling," No. 5A-2019, 2019. Paper Number GT2019-91074, ASME TURBO EXPO 2019: Turbomachinery Technical Conference and Exposition, Phoenix, Arizona, USA, June 17-21, 2019.
- [68] Frederick, R.A, Jr., Thomas, L.D., and Ligrani, P.M., "Propulsion Research and Academic Programs at the University of Alabama in Huntsville - PRC Strategic Plan – 2019," AIAA Paper 2019-3891, August 2019. https://doi.org/10.2514/6.2019-3891
- ^[69] Ritchie, D., Click, A. J., Ligrani, P. M., Liberatore, F., Patel, R., and Ho, Y.-H., "Double Wall Cooling of an Effusion Plate With Cross Flow and Impingement Jet Combination Internal Cooling: Comparisons of Main Flow Contraction Ratio Effects", Paper Number AIAA-2019-3967, 2019 AIAA Propulsion and Energy Forum, AIAA – American Institute of Aeronautics and Astronautics, Indianapolis, Indiana, USA, August 19-22, 2019.
- [70] Click, A. J., Ritchie, D., Ligrani, P. M., Liberatore, F., Patel, R., and Ho, Y.-H., "Effects of Coolant Supply Arrangement on Double Wall Cooling: Hot-Side Effusion Performance and Cold-Side Nusselt Numbers at Different Initial Blowing Ratios", Paper Number AIAA 2019-3965, 2019 AIAA Propulsion and Energy Forum, AIAA – American Institute of Aeronautics and Astronautics, Indianapolis, Indiana, USA, August 19-22, 2019.
- [71] Collopy, H., Sampson, M., Ligrani, P.M., "Recent Research Developments for Turbine Blade Tip Heat Transfer, Including Development and Effects of Tip Leakage Vortices", Invited Plenary Keynote Paper, HMTHSF-2019, Seventh International Conference "Heat and Mass Transfer and Hydrodynamics in Swirling Flows," National Committee on Heat and Mass Transfer of the Russian Academy of Sciences, Rybinsk, Russian Federation, October 16-18, 2019.
- [72] Ligrani, P. M., "Academic and University Roles and Partnerships in the Development of Hypersonic Weapons", Invited Keynote Paper, 1st Annual Hypersonic Weapons Summit, 2019 Hypersonic Weapons Conference, IDGA -Institute for Defense and Government Advancement, Washington, D.C., USA, October 28-30, 2019.
- ^[73] Ligrani, P. M., "Physical Phenomena Associated With Hypersonic Weapon Vehicles", Invited Briefing Paper, 2nd Annual Hypersonic Weapons Summit, 2020 Hypersonic Weapons Conference, IDGA - Institute for Defense and Government Advancement, Washington, D.C., USA, March 31-April 2, 2020.
- ^[74] Click, A. J., Ligrani, P. M., Hockensmith, M., Knox, J., Larsen, C., Fairbanks, A., Liberatore, F., and Ho, Y. H., "Louver Slot Cooling and Full-Coverage Film Cooling With a Combination Internal Coolant Supply", Paper Number GT2020-14520, ASME TURBO EXPO 2020: Turbomachinery Technical Conference and Exposition, London, England, United Kingdom, June 22-26, 2020.
- [75] Ligrani, P. M., "Physical Phenomena Associated With Hypersonic Weapon Vehicles", Invited Briefing Paper, Hypersonic Weapon Systems, Defense iQ, London, England, United Kingdom, June 30-July 1, 2020.
- [76] Ligrani, P. M., "Hypersonic Weapon Vehicles: Physical Effects and Phenomena", Invited Plenary Paper, Countermeasures Hypersonic Weapons Summit, 2020 Hypersonic Weapons Conference, IDGA - Institute for Defense and Government Advancement, Washington, D.C., USA, July 22-24, 2020.

Nelson

- [77] Fondard, J., Irisarri, E., Courrèges, C., Palacin, M. R., Ponrouch, A., and Dedryvère, R. "Mitigating Metal Dissolution and Redeposition of Pt-Co Catalysts in PEM Fuel Cells: Impacts of Structural Ordering and Particle Size." *Journal of The Electrochemical Society*, Vol. 167, No. 7, 2020, p. 070526. <u>https://doi.org/10.1149/1945-7111</u>.
- [78] Shin, S. Y., Rajendra, T., and Nelson, G. J. "Mesoscale Transport-Geometry Interactions in Lithium Ion Cathode Active Materials: Particle Scale Galvanostatic Simulations Based on X-Ray Nanotomography Data." *Journal of Power Sources*, Vol. 454, 2020, p. 227891. https://doi.org/10.1016/j.jpowsour.2020.227891.
- [79] Patel, P., and Nelson, G. J. "The Influence of Structure on the Electrochemical and Thermal Response of Li-Ion Battery Electrodes." *Journal of Energy Resources Technology*, Vol. 142, No. 5, 2020. <u>https://doi.org/10.1115/1.4045820</u>.

20

- [80] G. M. Cavalheiro, T. Iriyama, G. J. Nelson, S. Huang and G. Zhang, "Effects of Non-Uniform Temperature Distribution on Degradation of Lithium-ion Batteries," ASME Journal of Electrochemical Energy Conversion and Storage, 2020, 17(2), Article 021101.
- ^[81] Lu, Z., Liu, X., Zhang, B., Gan, Z., Tang, S., Ma, L., Wu, T., Nelson, G. J., Qin, Y., Turner, C. H., and Lei, Y. "Structure and Reactivity of Single Site Ti Catalysts for Propylene Epoxidation." *Journal of Catalysis*, Vol. 377, 2019, pp. 419–428. <u>https://doi.org/10.1016/j.jcat.2019.07.051</u>.
- [82] Rajendra, T., Mistry, A. N., Patel, P., Ausderau, L. J., Xiao, X., Mukherjee, P. P., and Nelson, G. J. "Quantifying Transport, Geometrical, and Morphological Parameters in Li-Ion Cathode Phases Using X-Ray Microtomography." ACS Applied Materials and Interfaces, Vol. 11, No. 22, 2019, pp. 19933–19942. https://doi.org/10.1021/acsami.8b22758.
- [83] Fontalvo, V. M., Nelson, G. J., Gomez, H. A., and Sanjuan, M. E. "An Enhanced Fuel Cell Dynamic Model with Electrochemical Phenomena Parameterization as Test Bed for Control System Analysis." *Journal of Electrochemical Energy Conversion and Storage*, Vol. 16, No. 3, 2019. https://doi.org/10.1115/1.4042726.
- ^[84] Juarez-Robles, D., Gonzalez-Malabet, H. J., L'Antigua, M., Xiao, X., Nelson, G. J., and Mukherjee, P. P. "Elucidating Lithium Alloying-Induced Degradation Evolution in High-Capacity Electrodes." ACS Applied Materials and Interfaces, Vol. 11, No. 1, 2019, pp. 563–577. https://doi.org/10.1021/acsami.8b14242.
- ^[85] H. J. Gonzalez Malabet and G. J. Nelson, "X-ray Imaging of Metallic Anodes for Lithium Ion Batteries and Beyond," 2020 TMS Annual Meeting and Exhibition, San Diego, California, February 23-27, 2020. (Invited Talk)
- ^[86] T. R. Rajendra, P. Patel, S. Y. Shin and G. J. Nelson, "Analysis of Structure-Transport Interactions in Lithium Ion Batteries Supported by X-ray Imaging," NASA Aerospace Battery Workshop, Huntsville, Alabama, November 19-21, 2019.
- ^[87] G. J. Nelson, "Multiscale Analysis of Battery Materials Using X-Ray Microscopy," 236th ECS Meeting, Atlanta, Georgia, October 13-17, 2019. (Invited Talk)
- [88] G.M. Cavalheiro, T. Iriyama, G.J. Nelson, S. Huang, G. Zhang," Effects of Non-Uniform Temperature Distributions on Lithium- Ion Battery Degradation," 2019 ASME InterPACK Conference, Anaheim, California, October 7-9, 2019.
- ^[89] J. R. Buckley, R. T. White and G. J. Nelson, "Experimental Validation of the X-ray Determined Pore Size Distribution of Porous Hybrid Motor Grains," 2019 AIAA Propulsion and Energy Forum, Indianapolis, Indiana, August 19-22, 2019.
- [90] P. Patel and G. J. Nelson, "The Influence of Structure on the Electrochemical and Thermal Response of Li-Ion Battery Electrodes," 2019 ASME Energy Sustainability Conference, Bellevue, Washington, July 14-17, 2019.
- ^[91] T. Rajendra, Prehit Patel and G. J. Nelson, "Mutliscale Analysis of Lithium Ion Battery Materials Using Xray Tomography," 2019 TMS Annual Meeting and Exhibition, San Antonio, TX, March 10-14, 2019. (Invited Talk)
- ^[92] G. J. Nelson, S. H. Vijapur, T. D. Hall, B. Brown, A. Pena-Duarte and C. R. Cabrera, "Electrochemistry for Space Life Support," The Electrochemical Society Interface, 2020, 29(1), 47-52.

Rani

- [93] Rani, S. L., Gupta, V. K., and Koch, D. L. "Clustering of Rapidly Settling, Low-Inertia Particle Pairs in Isotropic Turbulence. Part 1. Drift and Diffusion Flux Closures." *Journal of Fluid Mechanics*, Vol. 871, 2019, pp. 450–476. <u>https://doi.org/10.1017/jfm.2019.204</u>.
- [94] Rani, S. L., Dhariwal, R., and Koch, D. L. "Clustering of Rapidly Settling, Low-Inertia Particle Pairs in Isotropic Turbulence. Part 2. Comparison of Theory and DNS." *Journal of Fluid Mechanics*, Vol. 871, 2019, pp. 477–488. https://doi.org/10.1017/jfm.2019.294.

Schneider

[95] Laquai, R., Mueller, B.R., Schneider, J.A., Kupsch, A., Guenster, J., Bruno, G., "Non-Destructive Defect Analysis of SLM-Manufactured INCONEL 718 Using Synchrotron X-ray Refraction Techniques," accepted Met. Trans. A, May 18, 2020.

American Institute of Aeronautics and Astronautics

- ^[96] Schneider, J. "Comparison of Microstructural Response to Heat Treatment of Inconel 718 Prepared by Three Different Metal Additive Manufacturing Processes." *JOM*, Vol. 72, No. 3, 2020, pp. 1085–1091. https://doi.org/10.1007/s11837-020-04021-x.
- [97] Schneider, J., Terrell, J., Farris, L., Tucker, D., Leonhardt, T., and Goldbeck, H. "Low-Cost Fabrication of Tungsten-Rhenium Alloys for Friction Stir Welding Applications." *Metallurgical and Materials Transactions B: Process Metallurgy and Materials Processing Science*, Vol. 51, No. 1, 2020, pp. 35–44. https://doi.org/10.1007/s11663-019-01726-6.
- [98] Anderson, R., Terrell, J., Schneider, J., Thompson, S., and Gradl, P. "Characteristics of Bi-Metallic Interfaces Formed During Direct Energy Deposition Additive Manufacturing Processing." *Metallurgical and Materials Transactions B: Process Metallurgy and Materials Processing Science*, Vol. 50, No. 4, 2019, pp. 1921–1930. <u>https://doi.org/10.1007/s11663-019-01612-1</u>.
- ^[99] Fullen, M. D., and Schneider, J. A. "Effects of Varying Heat Treatments on the Microstructure and Mechanical Properties of Blown Powder Inconel 625." *JOM*, Vol. 71, No. 3, 2019, pp. 1127–1133. https://doi.org/10.1007/s11837-019-03339-5.
- [100] Stockman, T., Schneider, J. A., Walker, B., and Carpenter, J. S. "A 3D Finite Difference Thermal Model Tailored for Additive Manufacturing." *JOM*, Vol. 71, No. 3, 2019, pp. 1117–1126. <u>https://doi.org/10.1007/s11837-019-03338-6</u>.
- [101] Schneider, J., Chen, P., and Nunes, A. C. "Entrapped Oxide Formation in the Friction Stir Weld (FSW) Process." *Metallurgical and Materials Transactions A*, Vol. 50. <u>https://doi.org/10.1007/s11661-018-4974-8</u>.
- ^[102] Farris, L., Lee, E., Schneider, J.A., "Microstructural Evolution of Inconel 718 Fabricated by Powder Bed Fusion," TMS Annual Meeting, San Diego, CA Febr. 25, 2020.
- ^[103] Naden, N., Puerto, G., "Evaluation of varying surface finishes on thin-walled blown powder deposition Inconel 625," Perpetua, Vol. 4, Issue 1, pp. 9-14, Fall 2019.
- [104] Nguyen, A., Schneider, J.A., "Effects of Homogenization Heat Treatment on the Microstructure and Mechanical Properties of Blown Powder Deposition Inconel 625 Specimens," Perpetua, Vol. 4, Issue 1, pp. 15-20, Fall 2019.
- [105] Stockman, T., Schneider, J., Knapp, C., Horan, C., Carpenter, J., Henderson, K., Patterson, B., "Differentiating Defect Types in LENS Metal AM via In Situ Pyrometer Process Monitoring," Additive Manufacturing and Welding: Physical and Mechanical Metallurgy of Rapidly Solidified Metals Symposium, TMS 2019 Conf. Proc., March 10-14, 2019, San Antonio, TX.

Thomas

- ^[106] D. Nikitaev & D. Thomas, "Seeded Hydrogen in Mars Transfer Vehicles Using Nuclear Thermal Propulsion," *AIAA Journal of Spacecraft and Rockets*. (accepted)
- ^[107] J. Kolligs & D. Thomas, "The Origins and Evolution of Requirements in Engineering," *IEEE Systems Journal*. DOI: 10.1109/JSYST.2020.2999557 (accepted)
- ^[108] D. Nikitaev & D. Thomas, "Seeded Hydrogen in Nuclear Thermal Propulsion Engines," *AIAA Journal of Spacecraft and Rockets*, 2019-11-A34711.R1. (accepted)
- ^[109] D. Thomas & E. Patterson, "Systems Modeling Language Viewpoint Utilization to Facilitate Shared Mental Models Among System Stakeholders," *Systems Research and Behavioral Science*, 2020;37 (1),128–140.
- ^[110] A. Aueron, D. Thomas, & J. Cassibry, "Analytical Modeling of Radiation Attenuation and Heat Deposition in Propellant for Nuclear Thermal Rockets," *AIAA Journal of Spacecraft and Rockets*, March 2019.
- [111] V. Lopez & D. Thomas. "Complexity Assessment Using SysML Models." *Procedia Computer Science* 153 (2019): 225-232.
- ^[112] A. Aueron and D. Thomas, "Value Driven Mars Architecture Design," AIAA Propulsion and Energy Forum and Exposition, New Orleans, August 24-26, 2020. (accepted)
- [113] S. Kumar, D. Thomas, and J. Cassibry, "Preliminary Trajectory Design for Jupiter Rendezvous Mission Using Nuclear Thermal Propulsion," AIAA Propulsion and Energy Forum and Exposition, New Orleans, August 24-26, 2020. (accepted)

- ^[114] S. Kumar, D. Thomas, J. Cassibry, and R. Frederick, "Review of Nuclear Thermal Propulsion Technology for Deep Space Missions," AIAA Propulsion and Energy Forum and Exposition, New Orleans, August 24-26, 2020. (accepted)
- ^[115] N. Morris and D. Thomas, "A Cool Model to Analyze Heat Deposition on MTV Propellant Tanks," AIAA Propulsion and Energy Forum and Exposition, New Orleans, August 24-26, 2020. (accepted)
- ^[116] S. L. Raghu and D. Thomas, "Model Based FMEA (MBFMEA) generation for the RS-25 engine using SysML", AIAA Propulsion and Energy Forum and Exposition, New Orleans, August 24-26, 2020. (accepted)
- [117] E. Wood, D. Thomas, and J. Cassibry, "Minimally-Intrusive Power Generation Alternatives from a Nuclear Thermal Propulsion Engine," AIAA Propulsion and Energy Forum and Exposition, New Orleans, August 24-26, 2020. (accepted)
- ^[118] A. Aueron & D. Thomas, "Mars Mission Architecture Decision through Value Models," Nuclear and Emerging Technologies for Space, American Nuclear Society Topical Meeting, Knoxville, Tennessee, April 6-9, 2020.
- [119] N. Morris & D. Thomas, "Stay cool Alternatives for Long Term Storage of Large Quantities of Liquid Hydrogen on a Mars Transfer Vehicle", Nuclear and Emerging Technologies for Space, American Nuclear Society Topical Meeting, Knoxville, Tennessee, April 6-9, 2020.
- [120] E. Wood & D. Thomas, "Alternatives for Electrical Power Production from a Nuclear Thermal Propulsion Engine", Nuclear and Emerging Technologies for Space, American Nuclear Society Topical Meeting, Knoxville, Tennessee, April 6-9, 2020.
- [121] D. Nikitaev, D. Thomas, & J. Cassibry, "A Laboratory Test to Evaluate Seeded Hydrogen in a Nuclear Thermal Rocket Engine, Nuclear and Emerging Technologies for Space, American Nuclear Society Topical Meeting, Knoxville, Tennessee, April 6-9, 2020.
- ^[122] I. Rountree, V. Lopez, & D. Thomas, "Change Management Processes in MBSE," 18th Conference on Systems Engineering Research, Redondo Beach, California, March 19-21, 2020.
- [123] A. Aueron, D. Thomas, & P. Collopy, "The Value of Enhanced Delta V Capacity: A Europa Clipper Case Study," 70th International Astronautical Congress, Paper IAC-19, D2, 8-A5.4, 12, x51117, Washington, DC, October 21-25, 2019.
- [124] A. Aueron & D. Thomas, "Nuclear Thermal Propulsion Vehicle Scaling and the Importance of Densified Propellant," AIAA Propulsion & Energy Forum, Indianapolis, Indiana, Paper AIAA-2019-3942, August 19-22, 2019.
- ^[125] D. Thomas, A. Aueron, V. Lopez, & A. Bower, "Virtual Systems Integration Applied to Advanced Space Systems," AIAA Propulsion & Energy Forum, Indianapolis, Indiana, August 19-22, 2019.
- [126] A. Aueron & D. Thomas, "Trades on Densified Propellant for Nuclear Thermal Propulsion," Nuclear and Emerging Technologies for Space, American Nuclear Society Topical Meeting, Richland, Washington, February 25 – 28, 2019.
- [127] S. Rawlins & D. Thomas, "A Proposed Solution to Address Nuclear Thermal Propulsion Fuel Embrittlement and Cryogenic Hydrogen Requirements," Nuclear and Emerging Technologies for Space, American Nuclear Society Topical Meeting, Richland, Washington, February 25 – 28, 2019.³
- [128] J. Cassibry, D. Thomas, R. Wood, R. Frederick, and S. Kumar, "Development Plan for a Fission and Fusion Powered Propulsion System to Reach Mars in 45 Days," AAS Guidance Navigation and Control Conference, Breckenridge, Colorado, February 1-6, 2019.
- Xu
- [129] Gott, R. P., and Xu, K. G. "Time-Resolved Imaging and Spectroscopy of Atmospheric Pressure Plasma Bullet Propagation and RONS Production." *Journal of Physics D: Applied Physics*, Vol. 53, No. 31, 2020, p. 11. <u>https://doi.org/10.1088/1361-6463/ab876a</u>.
- ^[130] Dextre, R. A., Yamauchi, T., Polzin, K. A., and Xu, K. G. "Concentric Split-Ring Resonator Microwave Microplasma Generation at Off-Resonant Frequencies." *IEEE Transactions on Plasma Science*, Vol. 48, No. 4, 2020, pp. 827–834. <u>https://doi.org/10.1109/TPS.2020.2978838</u>.

Downloaded by Robert Frederick on October 12, 2020 | http://arc.aiaa.org | DOI: 10.2514/6.2020-3909

- ^[131] Sanderson, C. R., Ballmann, C. W., Han, J., Clark, A. B., Hokr, B. H., Xu, K. G., and Heaven, M. C. "Demonstration of a Quasi-CW Diode-Pumped Metastable Xenon Laser." *Optics Express*, Vol. 27, No. 24, 2019, p. 36011. https://doi.org/10.1364/oe.27.036011.
- [132] Gott, R. P., and Xu, K. G. "OH Production and Jet Length of an Atmospheric-Pressure Plasma Jet for Soft and Biomaterial Treatment." *IEEE Transactions on Plasma Science*, Vol. 47, No. 11, 2019, pp. 4988–4999. <u>https://doi.org/10.1109/TPS.2019.2942576</u>.
- [133] Volkov, A. G., Hairston, J. S., Patel, D., Gott, R. P., and Xu, K. G. "Cold Plasma Poration and Corrugation of Pumpkin Seed Coats." *Bioelectrochemistry*, Vol. 128, 2019, pp. 175–185. <u>https://doi.org/10.1016/j.bioelechem.2019.04.012</u>.

Wang

- [134] Yu, Z., Pillsbury, T., Wang, G., and Wereley, N. M. "Hyperelastic Analysis of Pneumatic Artificial Muscle with Filament-Wound Sleeve and Coated Outer Layer." *Smart Materials and Structures*, Vol. 28, No. 10, 2019, p. 105019. <u>https://doi.org/10.1088/1361-665X/AB300D</u>.
- [135] Barot, D., Wang, G., and Duan, L. "High-Resolution Dynamic Strain Sensor Using a Polarization-Maintaining Fiber Bragg Grating." *IEEE Photonics Technology Letters*, Vol. 31, No. 9, 2019, pp. 709–712. <u>https://doi.org/10.1109/LPT.2019.2905951</u>.
- ^[136] Wang, G., and Shen, J. "Flutter Instabilities of Cantilevered Piezoelectric Pipe Conveying Fluid." *Journal of Intelligent Material Systems and Structures*, Vol. 30, No. 4, 2019, pp. 606–617. https://doi.org/10.1177/1045389X18818774.
- ^[137] Wang, G. and Ewere, F., *Airflow Sensing Systems and Methods*, US patent, 10,191,076, Issued on January 29, 2019.

Solid Propulsion

- Master's
- ^[138] Little, R., "An Investigation into Sources of Variability in Mechanical Property Characterization for Composite Solid Propellants," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1992, ProQuest Ebrary.
- [139] Cooper, D., "The Measurement of Electron Density in a Rocket Motor Plume," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1993, ProQuest Ebrary.
- ^[140] Blevins, J., "An Analytical and Experimental Assessment of Microwave Diagnostics in Rocket Exhaust Applications," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1993, ProQuest Ebrary.
- ^[141] Komai, I., "An Analytical Assessment for the Temperature Sensitivity in Ducted Rocket Gas Generators," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1993, ProQuest Ebrary.
- [142] Hughes, C., "Solid Rocket Plume Design for Microwave Interferometry Measurements," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1994, ProQuest Ebrary.
- ^[143] Bishop, R., "An Analytical Assessment of the Temperature and Pressure Sensitivities of Solid Rocket Motor Propellants," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1997, ProQuest Ebrary.
- ^[144] Darby, S., "Assessment of Uncertainty in the Determination of Kinetic Reaction Parameters for Polymeric Materials," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1997, ProQuest Ebrary.
- [145] Rasmussen, B., "An Intrinsic, Heterogeneous Model of Composite Solid Propellant Combustion," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1998, ProQuest Ebrary.

- [146] Chiyyarath, K., "Ballistic Characteristics of Bi-Plateau Solid Propellants," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1998, ProQuest Ebrary.
- [147] McQuade, W., "Ultrasonic Technique Resolution for Solid Propellant Burning Rate Measurement," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 1998, ProQuest Ebrary.
- ^[148] Dauch, F., "Uncertainty Analysis of the Ultrasonic Technique Applied to Solid Propellant Burning Rate Measurement," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 1999, ProQuest Ebrary.
- ^[149] Rochford, E., "Temperature Sensitivity Measurements of Solid Rocket Propellants," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 1999, ProQuest Ebrary.
- ^[150] Davis, C., "Pintle Controlled Solid Rocket Motor, Anticipated Defense," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2004, ProQuest Ebrary.
- ^[151] Blankenship, C., "Demonstration of Solid Propulsion Control Through Use of Pintle Technology," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2006, ProQuest Ebrary.
- ^[152] Geralds, A., "High Pressure Ballistic Evaluation Motor: The Development and Characterization of the Army Ten-Pound Charge (ATPC) Motor," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2006, ProQuest Ebrary.
- ^[153] Hahn, P., "Feasibility of a Guided Interceptor," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2006, ProQuest Ebrary.
- ^[154] Fink, L., "Uncertainty analysis of probability of kill in indirect fire simulations," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2008, ProQuest Ebrary.
- ^[155] Marshall, M., "Methods of Analysis of Ultrasonic Echoes to Determine Solid Propellant Burning Rates," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2008, ProQuest Ebrary.
- ^[156] Durojaye, R., "Cold Flow Simulation of Vortex Shedding in a Segmented Solid Rocket Motor," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2010, ProQuest Ebrary.
- ^[157] Olaniyi, B., "Accuracy of Real Time Radiography Burning Rate Measurement," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2010, ProQuest Ebrary.
- ^[158] Williams, J., "Development of a Hover Test Bed," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2010, ProQuest Ebrary.
- [159] Penton, A., "Determination of a Solid Propellant's Burn Rate Using a New Digital Burn Rate Analysis Method," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2011, ProQuest Ebrary.
- ^[160] Richman, B., "On the Method of Combustion Instability Mode Determination in a Cylindrical Chamber and Usage with Experimental Data," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2012, ProQuest Ebrary.
- ^[161] Evans, J., "Monte Carlo Assessment of Solid Propellant Burning Rate," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2013, ProQuest Ebrary.
- ^[162] Butt, A., "Dynamic Calibration and Analysis of Crack Tip Propagation in Energetic Materials Using Real-Time Radiography," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2015, ProQuest Ebrary.
- ^[163] Patel, A., "Magnetically Levitating Low-friction Test Stand for the Evaluation of Micro-Thrusters, "Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2015, ProQuest Ebrary.

Downloaded by

American Institute of Aeronautics and Astronautics

- ^[164] Colbaugh, L., "Indirect and Direct Methods for Measuring a Dynamic Throat Diameter in a Solid Rocket Motor," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2015, ProQuest Ebrary.
- ^[165] Denny, M., "Measurement of Solid Rocket Propellant Burning Rate Using X-ray Imaging," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2015, ProQuest Ebrary.
- ^[166] Jones, D., "Advanced Digital Methods for Solid Propellant Burning Rate Determination," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2015, ProQuest Ebrary.
- ^[167] Freeman II, C., "Solid Rocket Motor Static Fire Test Stand Optimization: Load Cell Effects and Other Uncertainties," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2018, ProQuest Ebrary.

PhD

- ^[168] Miyata, K., "Combustion Mechanisms of Mixed Oxidizer Composite Propellant Systems," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1997, ProQuest Ebrary.
- ^[169] Greiner, B., "An Experimental Investigation of Ammonium Nitrate-Oxidized Propellant Combustion Mechanisms," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1998, ProQuest Ebrary.
- ^[170] Di Salvo, R., "Direct Measurement of Solid Propellant Pressure -Coupled Response Functions with Ultrasound," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2002, ProQuest Ebrary.
- ^[171] Hyatt, A., "Evaluation of Electric Solid Propellant Responses to Electrical Factors and Electrode Configurations," 2018, ProQuest Ebrary.
- ^[172] Haring, D., "Ablation Heat Transfer Characteristics of a Polymer Coolant Medium for Warm Gas Generator Applications, Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2020, ProQuest Ebrary.
- ^[173] Jones, D., "Effect of Sulfur and a Perfluoropolyether on the Ignition and Decomposition of Solid Fuels for Ramjets," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2020, ProQuest Ebrary.
- ^[174] Patel, A., Experimental Investigation of PMMA Cooling Beds for Warm Gas Generator Applications," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2020, ProQuest Ebrary.

Liquid Propulsion

- Master's
- ^[175] Holmes, S., "Experimental Investigation of the Heat Transfer to Cavities in Tandem," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1993, ProQuest Ebrary.
- ^[176] Sekita, R., "Staged Combustion Hybrid Rocket Test facility Design," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1993, ProQuest Ebrary.
- ^[177] Carmenn, C., "Monte-Carlo Computation of Turbulent Premixed Methane/Air Ignition," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1994, ProQuest Ebrary.
- ^[178] Hallit, R., "The Compatibility of 1100 and 2014 Aluminum Alloys with Gelled Inhibited Red Fuming Nitric Acid," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1995, ProQuest Ebrary.
- ^[179] Hartline, T., "Space Shuttle Main Engine (SSME) Block II Controller Software Logic FMEA/CIL," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1995, ProQuest Ebrary.

- [180] Rhys, N., "Tripropellant Combustion: Chemical Kinetics and Combustion Instability," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1995, ProQuest Ebrary.
- ^[181] Beard, R., "Numerical Simulation of Film-Cooled LOX/RP-1 Rocket Nozzles," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1997, ProQuest Ebrary.
- ^[182] Thames, M., "A Thermal/Fluid Analysis of Perforated Plates for Transpiration Cooled Rocket Chambers," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1998, ProQuest Ebrary.
- ^[183] Ibrahim, Z., "Numerical Simulation of the Regenerative Cooling Tubes in the 15-K Fastrac Rocket Engine," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2000, ProQuest Ebrary.
- ^[184] Shelton, J., "Uncertainties in nozzle heat flux and hot gas wall temperatures," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2001, ProQuest Ebrary.
- ^[185] Driscoll, E., "Uncertainty Analysis on Heat Transfer Correlations for RP-1 Fuel in Copper Tubing," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2003, ProQuest Ebrary.
- ^[186] Lineberry, D., "Uncertainty Analysis of Liquid Rocket Engine," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2003, ProQuest Ebrary.
- ^[187] Smith, N., "Development of a Nitrous Oxide Propane Combustor," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2003, ProQuest Ebrary.
- ^[188] Brown, Sara Paul, "Developing a Standard for the Thermal Stability of RP-1 Fuel," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, August, 2005.
- ^[189] Ellison, L., "Combustion Instability and the Design of a Liquid Droplet Injector," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2005, ProQuest Ebrary.
- ^[190] Brown, S., "Developing a Standard for the Thermal Stability of RP-1 Fuel," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2005, ProQuest Ebrary.
- ^[191] Emens, J., "Experimental Analysis of the High Reynolds Number Thermal Stability Test Method," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2005, ProQuest Ebrary.
- ^[192] Khodabandeh, J., "Hydrocarbon Fuel Deposition in HiReTS Tubes," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2005, ProQuest Ebrary.
- ^[193] Paul, S., "Developing a standard for the thermal stability of RP-1 fuel," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2005, ProQuest Ebrary.
- [194] Higdon, K., "Analysis of Annular Plug Nozzle Performance and Thrust Vectoring Control," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2005, ProQuest Ebrary.
- ^[195] Locke, J., "Analysis of Heat Transfer Correlations for Supercritical Hydrogen in Regenerative Cooling Channels," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2005, ProQuest Ebrary.
- ^[196] Villegas, Y., "Flammability Limits In Confined Spaces, Anticipated Defense," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2005, ProQuest Ebrary.

- ^[197] Berthiau, G., "Development and Optimization of a Model of Behavior of an Expander Cycle," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2006, ProQuest Ebrary.
- ^[198] Eddleman, D., "Reciprocating Propellant Feed System Development Program," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2006, ProQuest Ebrary.
- ^[199] Cavitt, R., "Experimental Methodology for Measuring Combustion and Injector Coupled Responses," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2007, ProQuest Ebrary.
- [200] Hood, C., "A Two-Dimensional Cartesian and Axisymmetric Study of Combustion-Acoustic Interaction," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2006, ProQuest Ebrary.
- ^[201] Byrd, R., "Laboratory-Scale Injector Instability Mode Assessment," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2008, ProQuest Ebrary.
- ^[202] Morton, C., "Experimental and Analytical Development Program of the Sequential Feed System," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2008, ProQuest Ebrary.
- ^[203] Huynh, H., "Mode Assessment of a Single-Element Shear Coaxial Injector," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2009, ProQuest Ebrary.
- ^[204] Saffell, R., "Characterization of Gaseous Oxygen and Methane Injectors Under High Pressure Combustion," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2009, ProQuest Ebrary.
- ^[205] Brooks, J., "Evaluating Combustion Instability in a Sub-Scale Combustion Experiment with Three Scaling Parameters," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2010, ProQuest Ebrary.
- [206] Eberhart, C., "The Effects of Chamber Pressure Variation on Swirl Injector Atomization," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2010, ProQuest Ebrary.
- ^[207] Ikard, R., "Experimental Injector Element Stability Characterization and Combustion Imaging," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2010, ProQuest Ebrary.
- ^[208] Mulkey, H., "Development of a liquid oxygen facility for rocket engine injector performance testing," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2010, ProQuest Ebrary.
- [209] Rojahn, J., "Numerical Optimization of a Liquid Propellant Settling Scenario," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2010, ProQuest Ebrary.
- ^[210] Sweeney, B., "Scaling a Single Element Combustor to Replicate Combustion Instability Modes of a Liquid Rocket Engine," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2010, ProQuest Ebrary.
- [211] Wilson, M., "Evaluation of Hydro-Mechanical Pulsation for Rocket Injector Research," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2010, ProQuest Ebrary.
- ^[212] Betts, E., "Determination of a New Throttling Liquid Rocket Engine for a Mars Lander," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2011, ProQuest Ebrary.
- ^[213] Casey, D., "CFD Analysis of Combustion Instability for a Rocket Injector," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2011, ProQuest Ebrary.

- ^[214] Brown, M., "Fatigue Life Variability Due to Variations in Interference Fit of Steel Bushings in 7075-T651 Aluminum Lugs," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2012, ProQuest Ebrary.
- ^[215] Carpenter, J., "Combustion Instability Automated Acoustic Mode Detection Methodology for a Subscale Combustion Chamber with a Single Injector," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2012, ProQuest Ebrary.
- [216] Hitt, M., "Experimental Investigation of Cavitation Instability Through a Circular Orifice," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2012, ProQuest Ebrary.
- ^[217] Salvador, P., "A Study of Electric Field Modified Flames with Variable," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2016, ProQuest Ebrary.
- [218] Hicks, R., "Manufacturing Effects on Water Cavitation in Long L/D Sharp Edge Inlet Orifices," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2019, ProQuest Ebrary.
- ^[219] Ranade, I., "Experimental Investigation of Liquid-Gas Dual-Swirl Coaxial Injector Under Self-Pulsation, "Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2020, ProQuest Ebrary.

<u>PhD</u>

- [220] Carmen, C., "Monte Carlo Computation of Turbulent Premixed Methane/Air Ignition," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1995, ProQuest Ebrary.
- [221] Al-Qutub, A., "Friction Factor for Smooth and Honeycomb Annular Gas Seals and Prediction of Rotordynamic Coefficients," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1997, ProQuest Ebrary.
- [222] Chojnacki, K., "Atomization and Mixing of Impinging Non-Newtonian Jets," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1998, ProQuest Ebrary.
- [223] Schallhorn, P., "Unsteady Analysis of the Fluid Film Forces in a Long Bearing Squeeze Film Damper," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1998, ProQuest Ebrary.
- ^[224] Rhys, N., "Acoustic Excitation and Destruction of Liquid Sheets," Ph.D. Dissertation, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 1999, ProQuest Ebrary.
- [225] Sims, J., "Estimating the Uncertainty in Thermochemical Calculations for Oxygen-Hydrogen Combustors," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2005, ProQuest Ebrary.
- ^[226] Madhanabharatam, B., "Modeling of Turbulence Effects on the Heat and Mass Transfer of Evaporating Sprays," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2006, ProQuest Ebrary.
- [227] Kenny, J., "Influence of Variable Thrust Parameters on Swirl Injector Fluid Mechanics," Ph.D. Dissertation, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2008, ProQuest Ebrary.
- ^[228] Bennewitz, J., "High-Frequency Combustion Instability Control Through Acoustic Modulation at the Inlet Boundary for Liquid Rocket Engine Applications," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2015, ProQuest Ebrary.
- ^[229] Holcombe, Brian K., "Early Stages of Methane Combustion in an Atmospheric Cylindrical Chamber with On-axis or Off-axis Shear Co-axial Injector, PhD Dissertation, Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2015, ProQuest Ebrary.
- ^[230] Eberhart, C., "Investigation of Liquid Rocket Swirl Coaxial Injection Dynamics Under Self-Excited High Frequency Oscillations," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2016, ProQuest Ebrary.

American Institute of Aeronautics and Astronautics

- ^[231] Sweeney, B., "Like-Double Injectors: The Effects of Varying the Impingement Distance and an Analysis of the Primary Atomization Zone," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, 2016, AL, ProQuest Ebrary.
- [232] Rani, V., "Analytical Investigation of Thermoacoustic Instabilities in Premixed Combustion Systems," Ph.D. Dissertation, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2017, ProQuest Ebrary.

Hybrid Propulsion

Master's

- ^[233] Greiner, B., "Experimental Investigation of Combustion Instability Using a Labscale Hybrid Rocket Motor," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1993, ProQuest Ebrary.
- [234] McCormick, S., "Performance of Micro-Porous LOX Injectors in a Hybrid Rocket Motor," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1997, ProQuest Ebrary.
- ^[235] Gray, W., "A Study of the Possible Use of Hybrid Rocket Systems as Targets in Ballistic Missile Defense Tests," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2002, ProQuest Ebrary.
- [236] Knox, R., "Experimental Determination of Regressing Rates of Mixed Hybrid Propellants," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2004, ProQuest Ebrary.
- ^[237] Whitehead, J., "Experimental Evaluation of a Mixed Oxidizer Hybrid Concept," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2004, ProQuest Ebrary.
- ^[238] Wingard, Z., "Experimental Evaluation of Regression Rates in a Hypergolic Hybrid Motor System," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2009, ProQuest Ebrary.
- [239] Mascaro, M., "Regression Rate Determination of a Gas Generator Hybrid Rocket Motor with GOX," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2015, ProQuest Ebrary.

PhD

- ^[240] Whitehead, J., "Mixed Oxidizer Hybrid Propulsion System Optimization Under Uncertainty Using Applied Response Surface Methodology and Monte Carlo Simulation," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2008, ProQuest Ebrary.
- [241] Hitt, M., "Regression Rate Study of Porous Axial-Injection, Endburning Hybrid Fuel Grains," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2016, ProQuest Ebrary.

Advanced Propulsion

- [242] Travis, T., "Analysis of Advanced Solar and Laser Sail Propulsion Concepts for Near Term Interstellar Probe," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1994, ProQuest Ebrary.
- [243] Pearson, B., "Analysis of Low-Thrust Solar Thermal Rocket Nozzle Performance," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1995, ProQuest Ebrary.
- ^[244] Markopoulos, P., "An Uncertainty Assessment of Performance Evaluation Methods for Solar Thermal Absorber/Thruster Testing," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1996, ProQuest Ebrary.

- ^[245] Tucker, T., "Solar Thermal Rocket Nozzle Analysis and Experiment Design," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1996, ProQuest Ebrary.
- [246] Alexander, R., "Thermal/Fluids Analysis of a Direct Gain Solar Thermal Upper Stage Engine," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1998, ProQuest Ebrary.
- [247] Adams, R., "Preliminary Analysis of a Fusion-Powered Transatmospheric Airbreathing Vehicle," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2000, ProQuest Ebrary.
- ^[248] Moton, T., "Design Optimization of a Nuclear Reactor for Earth-To-Orbit Applications," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2001, ProQuest Ebrary.
- ^[249] Turner, M., "Inductive measurement of plasma jet electrical conductivity," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2001, ProQuest Ebrary.
- ^[250] Buch, K., "Solar Sail Material Optical Test Design," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2002, ProQuest Ebrary.
- ^[251] Skinner, T., An experimental Investigation into the Temperature and Angular Dependence of Carbon-Carbon Optical Properties," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2003, ProQuest Ebrary.
- ^[252] Tunstall, M., "Aerocapture Ballute Performance," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2003, ProQuest Ebrary.
- ^[253] Gittemeier, K., "Low Earth Orbit Environmental Effects on Space Tether Materials," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2005, ProQuest Ebrary.
- ^[254] Peters, B., "Magnetic Field Penetration and Enhanced Diffusion in Pulsed Plasma Thrusters," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2005, ProQuest Ebrary.
- ^[255] Schuettpelz, B., "Examination of Faraday Probe Measurements and Plasma Conditions Supporting Detachment," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2006, ProQuest Ebrary.
- ^[256] Thompson, S., "Lindl-Widner Diagrams for Plasma Liner Driven," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2007, ProQuest Ebrary.
- ^[257] Dhote, N., "Numerical Modeling of Alpha-Particle Deposition in a Field Reversed Configuration," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2009, ProQuest Ebrary.
- [258] Ims, K., "Integration of a Magnetic Bias Field Coil in a Plasmoid," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2009, ProQuest Ebrary.
- ^[259] Turner, A., "Mission Analysis Using Experimental Results from an 8-cm Ion Thruster," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2009, ProQuest Ebrary.
- ^[260] Jones, A., "Achieving Mars Sample Return on a Single Ares V Launch," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2010, ProQuest Ebrary.
- McColgin, C., "Magnetic Field Mapping in the Plasmoid Thruster Experiment," Master's Thesis,
 Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL,
 2010, ProQuest Ebrary.
- [262] Cortez, R., "Initial Design Process for a Pulsed Thermonuclear Fusion Reaction Engine," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2011, ProQuest Ebrary.

American Institute of Aeronautics and Astronautics

- ^[263] Dowell, B., "Numerical Analysis of a Plasmoid Thruster," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2011, ProQuest Ebrary.
- [264] Riehm, B., "Preliminary Trajectory Analysis of a Nuclear Fusion Propulsion Fly-By Mission to Saturn and Beyond," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2012, ProQuest Ebrary.
- [265] Stanic, M., "Effects of Plasma Jet Parameters, Ionization, Thermal Conduction, and Radiation on Stagnation Conditions of an Imploding Plasma Liner," Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2013, ProQuest Ebrary.
- ^[266] Agnew, R., "Analytic Model to Estimate Thermonuclear Neutron Yield in Z-pinches using the Magnetic Noh Problem," Master's Thesis, Mechanical and Aerospace Engineering Dept, The University of Alabama in Huntsville, Huntsville, AL, 2014, ProQuest Ebrary.
- ^[267] Barkette, L., "3D Modeling of Heat Transfer and Gas Flow in a Grooved Ring Fuel Element for Nuclear Thermal Propulsion," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2014, ProQuest Ebrary.
- [268] Jackson, L., "Three-Dimensional Model of a Plasma Railgun Using Smoothed Particle Hydrodynamics," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2014, ProQuest Ebrary.
- ^[269] Schillo, K., "Three-dimensional Modeling of an Ideal Nozzle for Advanced Propulsion, { Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2014, ProQuest Ebrary.
- ^[270] Jacobs, S., "A Study of Ion and Electron Responses to DC Electric Fields," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2015, ProQuest Ebrary.
- ^[271] Hopping, E., "Design and Testing of a Hall Effect Thruster with Additively Manufactured Components," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2017, ProQuest Ebrary.
- ^[272] Aueron, A., "Analytical Modeling of Radiation Attenuation and Heat," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2018, ProQuest Ebrary.
- ^[273] Kumar, S., "Preliminary Trajectory Design Using Nuclear Fusion Propulsion for Rendezvous Missions to Jupiter and Saturn.," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2018, ProQuest Ebrary.
- ^[274] Bickett, W., "Aerodynamic Effects of Integrated Lifting Surfaces on Very Low Earth Orbit Small Satellites," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2019, ProQuest Ebrary.
- [275] Nikitaev, D., "Seeding Hydrogen Propellant in Nuclear Thermal Propulsion Engines," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2019, ProQuest Ebrary.
- [276] Hewitt, D., "MCNP Design of Radiation Shielding for Pulsed Fusion Propulsion," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2020, ProQuest Ebrary.

PhD

- [277] Villarreal (Musielak), D., "Axisymmetric Expansion of an Ionized Propellant Gas Under the Effect of Magnetic Fields in Advanced Rocket Nozzle," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1994, ProQuest Ebrary.
- ^[278] Bonometti, J., "Surface Interactions with Electromagnetic Spectrum Relevant to Solar Thermal Propulsion," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1998, ProQuest Ebrary.
- ^[279] Jones, J., "An Assessment of Microwave-Generated Plasmas for Use in Magnetohydrodynamic Accelerators," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2003, ProQuest Ebrary.

- [280] Deaconu, S., "Experimental study of plasma energization at magnetic neutral points," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2002, ProQuest Ebrary.
- [281] Matsuura, S., "Investigation of Plasma Injection into Water," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2002, ProQuest Ebrary.
- [282] Emrich, B., "Plasma Stability Studies of the Gasdynamic Mirror Fusion Propulsion Experiment," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2003, ProQuest Ebrary.
- ^[283] Li, Z., "Experimental Study of a Hall Current Plasma Accelerator," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2003, ProQuest Ebrary.
- ^[284] Cassibry, J., "Numerical Modeling Studies of a Coaxial Plasma Accelerator as a Standoff Driver for Magnetized Target Fusion," Ph.D. Dissertation, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2004, ProQuest Ebrary.
- ^[285] Koelfgen, S., "Magnetic Field and Quadruple Langmuir Probe Measurements in the Plume of the Plasmoid Thruster Experiment," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2005, ProQuest Ebrary.
- ^[286] Turner, M., "Three-Dimensional Numerical Modeling of a Diagonal Magnetohydrodynamic Accelerator," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2007, ProQuest Ebrary.
- [287] Adams, R., "Theoretical and Computational Considerations for an Approximation to the Medium Thrust Two -Body Problem," Ph.D. Dissertation, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2008, ProQuest Ebrary.
- ^[288] Girgis, B., "Numerical Simulations of Plasma Dynamics Using the Flowfield Dependent Variation (FDV) method," Ph.D. Dissertation, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2013, ProQuest Ebrary.
- [289] Stutz, J., "Analytical Evaluation of the Trajectories of Hypersonic Projectiles Launched into Space," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2013, ProQuest Ebrary.
- ^[290] Cortez, R., "Physics of Ignition and Burn Wave Propagation in Advanced Thermonuclear Fusion Targets," Doctoral Dissertation, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2018, ProQuest Ebrary.
- ^[291] Dextre, R., "Plasma Characterization of a Single and Double Split," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2015, ProQuest Ebrary.
- ^[292] Schillo, K., "Three-Dimensional Modeling of Fusion Yield in Plasma Jetdriven Magneto-Inertial Fusion," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2019, ProQuest Ebrary.
- ^[293] Thompson, S., "Two Dimensional Magnetohydrodynamic Modeling of Cylindrical Plasma Jets Confined Magneto-inertial Fusion Targets," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2020, ProQuest Ebrary.

Air-Breathing Propulsion

- ^[294] John, A., "Optimization of Gas Turbine Cycles for Power Generation from Pyrolysis Gas," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1996, ProQuest Ebrary.
- [295] DePlachett, C., "Application of the GECATÔ Software for Instruction in Gas Turbine Propulsion Analysis," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2000, ProQuest Ebrary.

- ^[296] Dolbeer, C., "Evaluation of Heavy Fuel Engines for Small Unmanned Air Vehicles," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2006, ProQuest Ebrary.
- ^[297] Kimbel, J., "A Model for Turboshaft Engine Test Facility Uncertainty Analysis," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2007, ProQuest Ebrary.
- ^[298] Bukac, R., "Experimental Performance Characterization of a One Megawatt Continuous Duty Arc Heater," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2008, ProQuest Ebrary.
- ^[299] Wood, D., "Investigations of an Innovative Combined Cycle Nozzle," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2009, ProQuest Ebrary.
- ^[300] Vanga, S., "Performance of Full Coverage Effusion Cooling," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2016, ProQuest Ebrary.
- ^[301] McInturff, P., "Influences of Impingement Hole Shape and Small Roughness On Impingement Jet Array Heat Transfer." Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2017, ProQuest Ebrary.
- ^[302] Suzuki, M., "Influences of Impingement Hole Shape and Small Plus Large Roughness On Impingement Jet Array Heat Transfer," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2017, ProQuest Ebrary.
- ^[303] Marko, S., "Experimental Investigation of Shock Wave Boundary," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2018, ProQuest Ebrary.
- ^[304] Basu, S., "On the Neumann Boundary Condition for the Acoustic-Wave Helmholtz Equation, and the Relationship between Pressure and Density Fluctuations," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2019, ProQuest Ebrary.
- ^[305] Pierce, C., "A Numerical Model of the High-Temperature," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2019, ProQuest Ebrary.
- ^[306] Ritchie, D., "Supply Channel Heat Transfer With Simultaneous Impingement Jet Array Cooling and Cross Flow Cooling," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2019, ProQuest Ebrary.
- ^[307] Su, M., "Investigation of Augmented Heat Transfer Due to Elastic Instabilities Within Low-inertia Flows with Streamline Curvature," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2019, ProQuest Ebrary.
- ^[308] Click, A., "Double Wall Heat Transfer With Full-Coverage Effusion With and Without Louver Slot Cooling," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2020, ProQuest Ebrary.
- ^[309] Sampson, M., "Aerodynamic and Heat Transfer Characteristics of a Transonic Turbine Blade Tip With Pressure Side Film Cooling," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2020, ProQuest Ebrary.
- [310] Rogers, N., "Performance of Full Coverage Effusion Cooling With Cross Flow Supply," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2016, ProQuest Ebrary.

PhD

- ^[311] Brophy, C., "Characterization of Four-Inlet Ducted Rocket Engine Geometries: An Optical Diagnostics Approach," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1997, ProQuest Ebrary.
- ^[312] Brown, K., "Assessment of the Experimental Uncertainty Associated with Regressions," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1997, ProQuest Ebrary.

American Institute of Aeronautics and Astronautics

- ^[313] Blevins, J., "An Evaluation of Performance Determination and Scaling Methods in Connected-Pipe Ramjet Testing," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1998, ProQuest Ebrary.
- Hudson, S., "Improved Turbine Efficiency Test Techniques Based on Uncertainty Analysis Application,"
 Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1998, ProQuest Ebrary.
- ^[315] Nelson, C., "Experimental Investigation of an Ejector Scramjet RBCC at Mach 4.0 and 6.5 Simulated Flight Conditions," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2003, ProQuest Ebrary.
- ^[316] Lineberry, D., "Characterization of a Cold Flow Non-Axisymmetric Supersonic Ejector," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2007, ProQuest Ebrary.

Propulsion Systems Engineering

Master's

- ^[317] Bower, A., "The Effects of Structural Margin in the Test-Fail-Fix Cycle for Rocket Engines," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2019, ProQuest Ebrary.
- ^[318] Jennings, G., "A SysML Based X in the Loop System Modeling," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2019, ProQuest Ebrary.
- ^[319] Lopez, V., "Complexity Assessment Using Systems Modelling Language," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2019, ProQuest Ebrary.
- ^[320] Rountree, I., "TBD," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2019, ProQuest Ebrary.

PhD

^[321] Shelton, J., "Modeling and Simulation of Launch Vehicles," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2004, ProQuest Ebrary.

Propulsion Testing and Safety

- ^[322] Deaconu, S., "Statistical Design of Experiments and the Validation of Regression Models," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1997, ProQuest Ebrary.
- ^[323] Budisalich, D., "Lens-Coupled Pinhole Camera for Use in Rocket Combustion Chambers," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 1998, ProQuest Ebrary.
- ^[324] Culley, M., "Development and Study of a Rayleigh Scattering Technique for Microwave Plasma Measurement Taken in Vacuum," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2000, ProQuest Ebrary.
- ^[325] Mao, R., "Supersonic Freejet Facility Design," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2000, ProQuest Ebrary.
- [326] Sims, J., "Hysteresis Effects on Thrust Measurement and Its Uncertainty," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2000, ProQuest Ebrary.
- ^[327] Bert, F., "Design of a Thrust Stand for Electric Thrusters," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2004, ProQuest Ebrary.
- [328] Damiani, P., "Development of a Low-Cost, Light Weight DAQ for Aerodynamic Pressure Measurements," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2004, ProQuest Ebrary.
- ^[329] Belanger, S., "Water Tunnel Facility Design for External Flow Visualizations," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2005, ProQuest Ebrary.

- ^[330] Demaneuf, O., "Water Tunnel Facility Design for External Flow Visualizations," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2005, ProQuest Ebrary.
- ^[331] Samuel, E., "Design of an Air Vitiation Heater," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2006, ProQuest Ebrary.
- [332] Akins, B., "Design of a System for Intact Recovery of Ballistic Projectiles at Hypervelocities," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2009, ProQuest Ebrary.
- ^[333] Fisher, A., "Observation of Rocket Pollution with Overhead Sensors," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2011, ProQuest Ebrary.
- ^[334] Sandlin, D., "Direct Retroreflective Laser Strobography Shadowgraphs," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2011, ProQuest Ebrary.
- ^[335] Doyle, S., "A Study of Optical and Physical Probe Diagnostic Techniques," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2017, ProQuest Ebrary.
- ^[336] Smith, N., "An Experimental Investigation of a Supersonic Non-Axisymmetric Cold-Flow Ejector," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2002, ProQuest Ebrary.

PhD

- ^[337] Nofal, M., "Experimental and Analytical studies of Doppler-shifted Filtered Rayleigh Scattering in a Supersonic Gas Flow," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1997, ProQuest Ebrary.
- ^[338] Canibal, F., "Suppression of the Ignition Overpressure Generated by Launch Vehicles," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2004, ProQuest Ebrary.

Missile Design

- ^[339] Landers, M., "Prediction of Hinge Moment Coefficient for Nose-Mounted Canard Controls at Supersonic Speeds," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1997, ProQuest Ebrary.
- ^[340] Muller, S., "Mixing of Supersonic Jets in a RBCC Strutjet Propulsion System," Master's Thesis, Delft University of Technology in conjunction with Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL.
- [341] Kreeger, E., "Spinning Tail Aerodynamics of a Guided Missile," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2002, ProQuest Ebrary.
- ^[342] Mullis, J., "Application of Response Surface Method to the Design of an Air Defense Interceptor," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2005, ProQuest Ebrary.
- ^[343] Pei, J., "Introduction of Control Pins in the Vicinity of Missile Fins for Roll and Yaw Control," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2006, ProQuest Ebrary.
- ^[344] Long, A., "Application of Response Surface Methods to Characterize Missile Performance," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2007, ProQuest Ebrary.
- [345] Osborne, S., "Study of the Stability of Scaled Uncontrolled Kinetic Energy Kill Projectiles," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2008, ProQuest Ebrary.

- ^[346] Colbaugh, J., "An Investigation of the Effect of Spring Forces on the Separation of Rocket Motor and Payload," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2009, ProQuest Ebrary.
- ^[347] Hembree, B., "Efficient Tethered Aerostat Model Formulation Using Non-Recursive and Recursive Rigid Body Dynamics," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2010, ProQuest Ebrary.
- [348] Stough, R., "The Dynamics of Vehicles Under Solid Rocket Propulsion," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2011, ProQuest Ebrary.
- ^[349] Couchman, A., "Analysis of Launch-Vehicle Separation Dynamics Using Perturbation Techniques," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2012, ProQuest Ebrary.
- ^[350] Schoukroun, L., "Rendezvous and Berthing of a Spacecraft Using Solid," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2013, ProQuest Ebrary.

PhD

- ^[351] Moylan, B., "Raindrop Demise in a High-Speed Projectile Flowfield," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2010, ProQuest Ebrary.
- ^[352] Gorman, C., "Modeling, Comparison and Analysis of Multi-body Parafoil Models with Varying Degrees of Freedom," Ph.D. Dissertation, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2011, ProQuest Ebrary.
- ^[353] Fisher, A., "Observation of Rocket Pollution with Overhead Sensors," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2019, ProQuest Ebrary.

Propulsion Related

- [354] Moylan, B., "Convective Heat Transfer of a Sphere in a Subsonic Transitional Flow," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1992, ProQuest Ebrary.
- ^[355] Diggle, F., "Solar Distillation of Volatile Organic Compounds," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 1993, ProQuest Ebrary.
- ^[356] Fazah, M., "Transport Phenomena in the Micropores of Plug-Type Phase Separators," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 1994, ProQuest Ebrary.
- ^[357] Palmiter, C. "A Computer Program for Analyzing a General Arrangement of Chambers and Vents Containing Offgassing Materials," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2000, ProQuest Ebrary.
- ^[358] Pourpoint, T., "Direct Determination of Thermal Diffusivity in a Disk-Shaped Sample: Applications to Graphite and Boron Nitride," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2000, ProQuest Ebrary.
- ^[359] Burgess, C., "Nonlinear Vibration of Clamped 2024-T3 Aluminum Panels," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2004, ProQuest Ebrary.
- [360] Devarapalli, C., "Automobile Related Applications of Wireless Sensor Networks," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2004, ProQuest Ebrary.
- ^[361] Nuar, A., "Aerodynamic Analysis of the Quick Monoplane," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2004, ProQuest Ebrary.

- ^[362] Obermark, "Analyzing Helicopter Store Separation Using Scale Models," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2004, ProQuest Ebrary.
- [363] Smith, S., "Determination of Permeation Constants for Gases Through Teflon Hose Walls," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2005, ProQuest Ebrary.
- ^[364] Bensnard, L., "Control of a Quadrotor Vehicle Using Sliding Mode Disturbance Observer," Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2006, ProQuest Ebrary.
- ^[365] Farbman, M., "Trajectory Reconstruction with a Multi-Order Least Squares Sliding Window (LSSW) filter," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2007, ProQuest Ebrary.
- ^[366] Horton, A., "Aerodynamic Testing and Analysis of Offset Planar Wings and Opposing Offset Tails," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2007, ProQuest Ebrary.
- ^[367] Entrekin, S., "Experimental Investigation of the Qu Tube Solid State Heat Pipe," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2008, ProQuest Ebrary.
- ^[368] Harris, J., "A simulation approach to predicting tactical missile performance with a broken wing," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2008, ProQuest Ebrary.
- ^[369] Tashakkor, S., "Application of the Loci-Based Discontinuous Galerkin Method," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2008, ProQuest Ebrary.
- ^[370] Gorman, C., "Model Predictive Control Method for Continuous Nonlinear Systems," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2009, ProQuest Ebrary.
- ^[371] Hawkins, R., "Experimental Techniques in Infrared Measurements of Thin-Film Plastics," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2009, ProQuest Ebrary.
- ^[372] Owen, M., "A Semi-Empirical Jet Noise Model Derived Using the Energy Spectrum Function," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2009, ProQuest Ebrary.
- ^[373] Rao, "Thermal Characterization Tests of the Qu Tube Heat Pipe," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2009, ProQuest Ebrary.
- ^[374] Ables, B., "Hardware-Assisted Path Profiling in Microprocessor Systems Implemented on Top of an FPGA," Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2010, ProQuest Ebrary.
- ^[375] Britton, H., "Prediction of Bond Failure of FRP Layers and Concrete Interface Using a Finite Element Method," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2010, ProQuest Ebrary.
- ^[376] Ewere, F., "Flow-Induced Vibration on Piezoelectric Structures: Theory, Characterization, and Application," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2010, ProQuest Ebrary.
- ^[377] Lackey, S., "Weapons Bay Acoustic Suppression Using a Novel Rod in Crossflow Configuration," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2010, ProQuest Ebrary.
- ^[378] Lee, J., "Rocket Motor Segmenting," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2010, ProQuest Ebrary.
- ^[379] Olatoyinbo, S., "Investigation of the Numerical Characteristics of the Flowfield Dependent Variation Method," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2010, ProQuest Ebrary.

American Institute of Aeronautics and Astronautics

- ^[380] Pierce, S., "Failure Analysis of Braided U-Shaped Metal Bellows fFexible Hoses," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2010, ProQuest Ebrary.
- ^[381] Dunn, M., "A Methodology for the Uncertainty Quantification and Sensitivity Analysis of Turbulence Model Coefficients," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2011, ProQuest Ebrary.
- [382] Peugeot, J., "A Numerical Investigation of Flow Induced Vibrations in a Rocket Engine Manifold," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2011, ProQuest Ebrary.
- ^[383] Mattox, E., "Carbon Dioxide Removal System for Closed Loop Atmosphere Revitalization, Candidate Sorbents Screening and Test Results," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2012, ProQuest Ebrary.
- ^[384] McElroy, T., "Static Testing of a COTS Electric UAV Motor in an Altitude Chamber," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2012, ProQuest Ebrary.
- ^[385] Savin, I., "Statistical Fracture Mechanics: An Unconventional Approach to Crack Formation in Brittle Solids," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2012, ProQuest Ebrary.
- ^[386] Buzzard, W., "Effects of Target Surface Roughness on Impingement Jet Array Heat Transfer," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2015, ProQuest Ebrary.
- ^[387] Ren, Z., "Jet Array Impingement Heat Transfer: Effects of Target Plate Distance, Reynolds Number, and Hole Spacing," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2015, ProQuest Ebrary.
- ^[388] Sridhar, M., "Aerodynamic performance of flexible flapping wings at fruit fly and bumblebee scales in hover flight," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2015, ProQuest Ebrary.
- ^[389] Cranford, J., "A Novel Experimental Method for Studying Trajectories and Wing Kinematics of Freely Flying Butterflies," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2015, ProQuest Ebrary.
- ^[390] Salmon, J., "A comparison of the quasi-steady to the Navier-Stokes equation solutions of flapping wing aerodynamics," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2016, ProQuest Ebrary.
- ^[391] Lund, B., "Investigation of Elastic Turbulence Phenomena Within a Miniature Viscous Disk Pump," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2016, ProQuest Ebrary.
- [392] Medina, C., "A closed-Form Solution to the Aeroelastic Response of an Elastic Plate in Axial Flow," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 20017, ProQuest Ebrary.
- ^[393] Master of Science M.S., "Performance of Full Coverage Effusion Cooling With Crossflow Supply and Mainstream Pressure Gradient." Institute of Aerospace Thermodynamics, University of Stuttgart, Stuttgart, Germany. in Collaboration with THe University of Alabama in Huntsville, May 2017.
- ^[394] Nedunchezian, K., "A Numerical Analysis of the Effects of Flapping Wing Kinematics on Aeroacoustics in Hovering Flight," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2018, ProQuest Ebrary.
- ^[395] Chow, R., "Exergy Analysis of the Environmental Control and Life Support System," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2018, ProQuest Ebrary.
- ^[396] Arceneaux, H., "High-order Hybrid Roe-WENO Schemes for Interface Advective Flux Reconstruction," Master's Thesis, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2019, ProQuest Ebrary.

American Institute of Aeronautics and Astronautics

- [397] Raghu, Sreyas, "Kinematic Analysis of Gait in An Aquatic Treadmill using Land Based Motion Capture Cameras," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 1999, ProQuest Ebrary.
- ^[398] McCain, J., "Experimental Force and Wing Motion Measurements of A Bioinspired Flapping Wing in A Martian Density Condition," Master's Thesis, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2019, ProQuest Ebrary.

<u>PhD</u>

- ^[399] Hahn, P., "The Influence of a Three-Dimensional Protuberance and Surface Curvature on Wall Pressure Fluctuation in a Supersonic Flow," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2012, ProQuest Ebrary.
- [400] Taylor, T., "Implementing Planetary Meteor Impact Craters as High Gain Radio Frequency Dish Reflector Antennas," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2012, ProQuest Ebrary.
- [401] Brown, Michael, "Numerical Studies of Supersonic Jet Impingement on a Flat Plate,"Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2012, ProQuest Ebrary.
- [402] "Welsch, S., ""Atomic Scale Study of the Influence of Grain Boundary Character on Segregation and Oxidation in Commercially Pure Nickel,"" Ph.D. Dissertation, The Joint Tricampus Materials Science Program of The University of Alabama, The University of Alabama at Birminghan, The University of Alabama in Huntsville, Huntsville, AL, 2014, ProQuest Ebrary."
- [403] Bidadi, S., "Investigation of Numerical Viscosities and Dissipation Rates of Shock-Capturing Schemes for Implicit Large-Eddy Simulation," Ph.D. Dissertation, Department of Mechanical and Aerospace Engineering, The University of Alabama in Huntsville, 2015, ProQuest Ebrary.
- ^[404] Percy, T., "Simplified Population Growth Modeling For Low Earth Orbit," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2015, ProQuest Ebrary.
- [405] Underwood, O., "An Investigation of Grain Boundary Character Evolution in Nickel 200,"" Ph.D. Dissertation, The Joint Tricampus Materials Science Program of The University of Alabama, The University of Alabama at Birminghan, The University of Alabama in Huntsville, Huntsville, AL, 2015, ProQuest Ebrary."
- ^[406] Bluman, J., "The effects of wing flexibility on the flight performance and stability of flapping wing micro air vehicles," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2017, ProQuest Ebrary.
- [407] Ren, Z., "Investigation of Effusion, Impingement, and Cross Flow Cooling Within a Double Wall Cooling Configuration," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2018, ProQuest Ebrary.
- ^[408] Englestad, T., "Study of Effects of Rigid Body Vibrations on External Hypersonic Flow Using Smoothed Particle Hydrodynamics," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2019, ProQuest Ebrary.
- [409] Fisher, A., "Development of Absorption-Coefficient-Based Narrow-Band Model and Its Application to the Calculation of Radiative Heat Transfer in One- and Two-Dimensional Enclosures," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2019, ProQuest Ebrary.
- [410] Kodali, D., "Analytical Aeroelastic Models for Chordwise and Spanwise Flexible Flapping Wings in Forward Flight," Ph.D. Dissertation, Mechanical and Aerospace Engineering Dept., The University of Alabama in Huntsville, Huntsville, AL, 2019, ProQuest Ebrary.

American Institute of Aeronautics and Astronautics