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COLLEGIATE AVIATION REVIEW

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The Collegiate Aviation Review (CAR)
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No juried publication can excel, unless experts in the field serve as anonymous reviewers. Indeed, the ultimate guarantors of quality and appropriateness of scholarly materials for a professional journal are the knowledge, integrity, and thoroughness of those who serve in this capacity. The thoughtful, careful, and timely work of the Editorial Board and each of the following professionals added substantively to the quality of the journal, and made the editor's task much easier. Thanks are extended to each reviewer for performing this critically important work. In addition to the members of the Editorial Board, the other reviewers for this issue include:

Tony Adams	Eastern Kentucky University
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Carmen Burrows	Thomas Nelson Community College
Kitty Campbell	Purdue University
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STATEMENT OF OBJECTIVES

The *Collegiate Aviation Review* is published semi-annually by the University Aviation Association. Papers published in this volume were selected from submissions that were subjected to a blind peer review process, for presentation at the 2012 Fall Education Conference of the Association.

The University Aviation Association is the only professional organization representing all levels of the non-engineering/technology element in collegiate aviation education. Working through its officers, trustees, committees and professional staff, the University Aviation Association plays a vital role in collegiate aviation and in the aviation industry.

The University Aviation Association accomplishes its goals through a number of objectives:

> To encourage and promote the attainment of the highest standards in aviation education at the college level.
>
> To provide a means of developing a cadre of aviation experts who make themselves available for such activities as consultation, aviation program evaluation, speaking assignments, and other professional contributions that stimulate and develop aviation education.
>
> To furnish a national vehicle for the dissemination of knowledge relative to aviation among institutions of higher education and governmental and industrial organizations in the aviation/aerospace field.
>
> To foster the interchange of information among institutions that offer non-engineering oriented aviation programs including business technology, transportation, and education.
>
> To actively support aviation/aerospace-oriented teacher education with particular emphasis on the presentation of educational workshops and the development of educational materials in the aviation and aerospace fields.

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Call for Papers

The Collegiate Aviation Review (CAR) is the refereed journal of the University Aviation Association (UAA). Both qualitative and quantitative research manuscripts relevant to aviation are acceptable. The CAR review process incorporates a blind peer review by a panel of individuals who are active in the focus area of each manuscript. Additional recommendations are also provided by the editors of the CAR. A list of all reviewers is published in each edition of the CAR and is available from the CAR editor.

Authors should e-mail their manuscript, in Microsoft Word format, to the editor at CARjournal@uaa.aero no later than June 1 (Fall 2012 issue) or December 1 (Spring 2013 issue).

Previous editions of the CAR should also be consulted for formatting guidance. Manuscripts must conform to the guidelines contained in the Publication Manual of the American Psychological Association, 6th edition. Specifically, this means that submissions should follow the formatting found in the manual, e.g. proper use of the headings, seriation, and in-text citations. The references section must be complete and in proper APA format. Submissions that include tables and figures should use the guidelines outlined in the APA manual. In order to better align the CAR with the general research community, submissions using quantitative analysis should take into account the recommendations of the APA Task Force on Statistical Inference. Papers that do not meet these expectations will be returned to the author for reformatting.

All submissions must be accompanied by a statement that the manuscript has not been previously published and is not under consideration for publication elsewhere. Further, all submissions will be evaluated with plagiarism detection software. Instances of self-plagiarism will be considered the same as traditional plagiarism. Submissions that include plagiarized passages will not be considered for publication.

If the manuscript is accepted for publication, the author(s) will be required to submit a final version of the manuscript via e-mail, in "camera-ready" Microsoft Word format, by the prescribed deadline. All authors will be required to sign a "Transfer of Copyright and Agreement to Present" statement in which (1) the copyright to any submitted paper which is subsequently published in the CAR will be assigned to the UAA and in which (2) the authors agree to present any accepted paper at a UAA conference to be selected by the UAA, if requested. Students are encouraged to submit manuscripts to the CAR. A travel stipend for conference attendance up to $500 may be available for successful student submissions. Please contact the editor or UAA for additional information.

Questions regarding the submission or publication process may be directed to the editor at (727) 403-9903, or may be sent by email to: CARjournal@uaa.aero.

Editor's Commentary

Little did I know how much work would be required in coordinating and producing an academic journal. But the fact that aviation scholarship is truly heading in the right direction made it a pleasure for me to do my part to help in this process. I want to genuinely thank all those who submitted their work to the journal. It takes a special scholar to feel confident enough in their work to subject themselves to the scrutiny of their peers. I also want to thank the reviewers for taking time out of their busy schedules to assist in the peer review process. For those that are interested, the acceptance rate for this issue was 50%.

There is a Chinese proverb that states "a nation's wealth is in its scholars." I would take that step further and say that "aviation's wealth is in its scholars." We must continue to pursue ways to make our industry better. To improve aviation education. And to even create new, competent aviation scholars to keep pushing the boundaries of aviation research.

I am very proud that the *CAR* is now available in major research databases. This disseminates aviation research throughout the globe. A higher standard for statistical reporting, the requirement for compliance with APA format, and the screening for plagiarism insures that the research we present to the world is of high standard. As Johnson, Hamilton, Gibson, and Hanna stated in the volume 24, issue 1 of this journal: "as aviation education establishes itself in academia, it must continue to advance the discipline by creating a rich depository characterized by scholarship and inquiry" (p. 83). Please consider how you can contribute to this goal.

I want all readers to know that writing journal articles does not have to be an intimidating experience. Your research does not need to have endless tables of statistics and results to be successful. The editors of the journal and the UAA publications committee encourage all types of research – quantitative, qualitative, and mixed methods. There truly is no preference. All that is required is a sound research design, clear methodology, and succinctly reported results. I want to challenge you to produce a journal article to submit for the next edition of the *CAR*. Take your place as an aviation scholar and help improve aviation and its growing research literature.

Sincerely,

David C. Ison, PhD

TABLE OF CONTENTS

Twenty-Eight Years of the *Collegiate Aviation Review*: An Exploratory Study of Academic Research in Aviation Education

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Abstract

The author conducted a review of academic journal articles published in the *Collegiate Aviation Review (CAR)*. The study included all 189 articles published in the *CAR* over the past 28 years (1983-2010). The author categorized the *CAR* articles by author's institution/organization affiliation, classification by subject category, and geographical grouping of contributing authors and institutions/organizations. The study indicates that the *CAR* has a broad range of authors and subject matter. Collegiate flight training curriculum and instructional methods, collegiate aviation degree programs, the collegiate aviation student, the airport system, and the commercial airline industry were the top 5 subject areas over the past 28 years. Implications and opportunities are provided for the future and the role of aviation faculty and industry professionals engaged in aviation education research. The findings of this exploratory study provide additional opportunities for research initiatives in the aviation education environment.

Introduction

In 1947, the National Association of University Administrators of Aviation Education (NAUAAE) was organized in Denver, Colorado "to encourage and expand the growth and status of aviation education programs nationwide" (University Aviation Association, 2011a). In 1948, the NAUAAE held their first Annual Meeting in conjunction with Denver Air Congress, when NAUAAE adopted their first mission statement:

> It is believed that the work of the Association, conducted as it will be by leading educators of the United States, will be of basic and permanent benefit to aviation. A new generation of youth, graduating from the high schools and colleges each year, with a thorough grounding in and understanding of the airplane and its social, scientific, political, and economic influences upon living will, through the years, establish an informed public opinion on aviation which will go far toward eliminating many of the present day problems which beset the aviation industry and the national defense (University Aviation Association, 2011a).

In 1949, the National Association of University Administrators of Aviation Education changed their name to the University Aviation Association (UAA) and headquarters were established at United Airlines School and College Service (UASCS) in Chicago, Illinois. Approximately 30 years later, in 1977, UAA moved their headquarters to the Auburn University-owned airport in Auburn, Alabama (University Aviation Association, 2011a).

When the UAA moved to Auburn, association membership totaled 178 individual members and the annual budget for UAA was $5,000 (University Aviation Association, 2011a). In 2010, the UAA had 500 members and an annual organizational budget of $310,500 (C. Williamson, personal communication, November 14, 2011).

According to the *CAR's* Statement of Objectives "the UAA is the only professional organization representing all levels of the non-engineering/technology element in collegiate aviation education" (Fanjoy, 2008, p. 6). The UAA achieves its goals through several objectives:

- Encourage and promote the attainment of the highest standards in aviation education at the college level.
- Provide a means of developing a cadre of aviation experts who make themselves available for such activities as consultation, aviation program evaluation, speaking assignments, and other professional contributions that stimulate and develop aviation education.
- Furnish a national vehicle for the dissemination of knowledge relative to aviation among institutions of higher education and governmental and industrial organizations in the aviation/aerospace field.
- Foster the interchange of information among institutions that offer non-engineering oriented aviation programs including business technology, transportation, and education.
- Support aviation/aerospace-oriented teacher education with particular emphasis on the presentation of educational workshops and the development of educational materials in the aviation and aerospace fields (Fanjoy, 2008, p. 6).

In 1938, the University Aviation Association initiated its first "call for papers" to provide an opportunity for collegiate aviation faculty to gain national recognition through a competitive peer-review process. In the acknowledgments section of the 1983 conference proceedings, Editor James M. Daley stated,

> The papers presented in this volume demonstrate that the members of the Association continue to grow in terms of their knowledge and their research. This reflects well, not only on the members of the University Aviation Association, but serves as a benchmark for future members and old members to surpass; it seems true that, academically, we either grow or we die (p. iii).

From 1983-1990, the scholarly papers were published as University Aviation Association Fall Conference Proceedings; the first *Collegiate Aviation Review (CAR)* was published in 1991 after a call for papers was announced at the UAA conference in 1990 (McCoy, 1991).

The purpose of this study was to review the individual contributions to the *CAR* that have provided growth to the UAA over the past 28 years and to reflect upon what the future may hold for this aviation professional organization and its scholarly journal, the *CAR*. This is important to ensure the UAA and its membership is academically positioned to meet the ever-changing aviation/aerospace industry and address the continuing challenges of the 21st century.

Method

A review of 189 *CAR* articles from 1983 to 2010 was conducted by the author. Specifically, the articles published in the *CAR* were categorized by author's institution/organization affiliation, classification by subject category, and geographical grouping of contributing authors and institutions/organizations. The methodology used in this study to explore the contribution of authors to the *CAR* was very similar to one used by the author to analyze the content and contributions of another peer-reviewed professional journal (Woods et al., 1989). This exploratory study identified and categorized aviation faculty and industry professionals who have led the aviation profession, academically, and what important issues and challenges they have identified in their scholarly writings over the past 28 years.

Results

Table 1 represents the 28-year timeline of *CAR* publications, which was divided into five-year increments (1983-1985 represents only three years) to highlight author and article productivity from 1983-2010. During the 2001-2010 decade, 60% of all *CAR* articles were published. In addition, 118 co-authors contributed to these *CAR* publications. During the period of 2006-2010, there were 73 articles (39% of total articles) published in the *CAR*. Beginning in May 2007, the editors began publishing the *CAR* biannually in the spring and fall resulting in the proliferation of published articles during this five-year span.

Table 1. *Timeline of Published CAR Articles, 1983-2010*

Years	*Journal Articles*	*Percent of Articles*	*Total Article Pages*	*Co-Authors*
1983 - 1985	14	7.40	252	3
1986 - 1990	19	10.05	388	4
1991 - 1995	17	9.00	140	11
1996 - 2000	25	13.23	334	17
2001 - 2005	41	21.70	536	44
2006 - 2010	73	38.62	905	74
Total	189	100.00	2555	154

Authorship by Institution/Organization Affiliation

The *CAR* articles are categorized in Table 2 by author's institution/organization affiliation. Similar to the Woods et al. (1989) article, columns 1, 2 and 3 in Table 2 list institutions/organizations, their rank by number of articles, and total articles per institution/organization, respectively. Every time a lead (first) author and/or co-author represented a specific educational institution or aerospace/aviation organization, that institution or organization was credited with a journal article. As a result, there were 189 articles published with 154 co-authors therefore the total number of *CAR* "author-credited" articles in Table 2 is 343, which is significantly larger than the actual number of articles (189) published in the *CAR* from 1983-2010 (University Aviation Association, 2011c). As shown in Table 2, Southern Illinois University Carbondale was credited with 79 of 343 author-credited articles (lead and/or co-author) and ranked first in total articles published in the *CAR* from 1983-2010.

Columns 4, 5, and 6 (Table 2) ranked contributing institutions/organizations by total number of pages for lead (first) authors only. The author recorded the institution/organization affiliation of the lead author, credited the institution/organization for the entire number of article pages contributed to the *CAR*, and lastly, ranked all institutions/organizations by total page numbers. For example, Embry-Riddle Aeronautical University was credited with 194 total pages and ranked second overall.

The last three columns in Table 2 ranked the institutions/organizations by total article pages for all authors. Each institution/organization was credited with a percentage of total pages when there was more than one contributing author associated with a *CAR* article. Therefore, the total number of *CAR* pages (2,555) was apportioned among all contributing authors. Over the 28-year time period studied by the author, 54 different institutions/organizations and one non-affiliation were represented by the contributing authors publishing in the *CAR.*

All in all, 197 authors contributed to the *CAR* during the 28-year time period, 1983-2010; 131 authors contributed only once, 35 authors contributed twice as senior or co-author, 8 authors contributed three times, 13 authors contributed four times, 1 author contributed six times, 6 authors contributed five times, 1 author contributed seven times, 1 author contributed nine times, and 1 author (David NewMyer from Southern Illinois University Carbondale) contributed 14 times to the *CAR*, ten times as lead author and four times as co-author.

Table 3 lists the institution/organization sources of the 343 *CAR* author-credited articles. Educational institutions (universities and colleges) were first with 332 articles, or 97% of total articles. Non-academic organizations were responsible for a very small percentage of total articles (3 percent) published in the *CAR*. These non-academic

Table 2. *Institution/Organization Affiliation of Collegiate Aviation Review Authors, 1983-2010*

	Journal Articles[1]		Lead Author[2]			All Authors[3]		
Institution/Organization	*Rank*	*Number*	*Rank*	*Pages*	*Percent*	*Rank*	*Pages*	*Percent*
Southern Illinois University	1	79	1	557	21.80	1	553.00	21.64
Middle Tennessee State University	2	31	4	158	6.18	4	160.67	6.29
Purdue University	3	24	5	134	5.24	5	134.00	5.24
Auburn University	4	22	3	175	6.85	3	163.50	6.40
Embry-Riddle Aeronautical University	5	18	2	194	7.59	2	186.34	7.29
University of North Dakota	6	17	7	120	4.70	6	120.00	4.70
University of Nebraska	7	16	6	128	5.01	7	115.50	4.52
Arizona State University	8	15	11	65	2.54	11	66.01	2.58
Oklahoma State University	9	14	10	67	2.62	9	75.33	2.95
St. Cloud State University	10	11	16	42	1.64	17	42.00	1.64
Central Washington University	11	9	12	63	2.47	12	63.00	2.47
Indiana State University	11	9	13	51	2.00	13	51.00	2.00
Bowling Green State University	11	9	8	99	3.87	8	104.00	4.07
Florida Institute of Technology	14	8	15	46	1.80	15	46.00	1.80
Parks College of Saint Louis University	15	5	21	31	1.21	21	31.00	1.21
San Jose State University	16	4	19	38	1.49	16	43.00	1.68
Rocky Mountain College	16	4	9	74	2.90	10	74.00	2.90
Wichita State University	16	4	37	11	0.43	23	26.50	1.04
University of Illinois	19	3	22	30	1.17	22	30.00	1.17
Hampton University	20	2	18	40	1.57	19	40.00	1.57
Western Michigan	20	2	43	8	0.31	38	8.00	0.31

Institution/Organization	Journal Articles[1] Rank	Number	Lead Author[2] Rank	Pages	Percent	All Authors[3] Rank	Pages	Percent
University								
Kent State University	20	2	36	12	0.47	41	7.66	0.30
Hillsborough County Aviation Authority	20	2	17	41	1.60	18	41.00	1.60
Daniel Webster College	20	2	27	17	0.67	27	17.00	0.67
Non-affiliated Author[4]	25	1	23	25	0.98	24	25.00	0.98
Ohio State University	25	1	27	17	0.67	27	17.00	0.67
Harvard University	25	1	24	19	0.74	25	19.00	0.74
Western Oklahoma State College	25	1	43	8	0.31	52	4.00	0.16
Advanced Aviation Concepts	25	1	39	10	0.39	45	5.00	0.20
California State University	25	1	46	6	0.23	44	6.00	0.23
American Airlines	25	1	20	33	1.29	20	33.00	1.29
United States Air Force Academy	25	1	24	19	0.74	35	9.50	0.37
Texas Southern University	25	1	33	14	0.55	32	14.00	0.55
Nova Southeastern University	25	1	29	16	0.63	29	16.00	0.63
Eastern Michigan University	25	1	24	19	0.74	25	19.00	0.74
Sky Views	25	1	41	9	0.35	50	4.50	0.18
University of New Orleans	25	1	39	10	0.39	45	5.00	0.20
Florida State University	25	1	45	7	0.27	42	7.00	0.27
Ohio University	25	1	29	16	0.63	38	8.00	0.31
Delta State University	25	1	29	16	0.63	29	16.00	0.63
Vaughn College of Aeronautics	25	1	37	11	0.43	34	11.00	0.43
Joint Interagency Task Force	25	1	35	13	0.51	43	6.50	0.25
University of Western Ontario	25	1	41	9	0.35	36	9.00	0.35
Miami Dade Community	25	1	14	48	1.88	14	48.00	1.88

	Journal Articles[1]		Lead Author[2]			All Authors[3]		
Institution/Organization	*Rank*	*Number*	*Rank*	*Pages*	*Percent*	*Rank*	*Pages*	*Percent*
College								
Broward County Comm College	25	1	33	14	0.55	32	14.00	0.55
University of South Alabama	25	1	32	15	0.59	31	15.00	0.59
Federal Aviation Administration	25	1				45	5.00	0.20
Utah State University	25	1				52	4.00	0.16
Bryant College	25	1				55	1.66	0.06
United States Air Force	25	1				48	4.67	0.18
University of West Florida	25	1				49	4.66	0.18
Central Missouri State University	25	1				38	8.00	0.31
Concordia University	25	1				51	4.50	0.18
Philadelphia International Airport	25	1				52	4.00	0.16
Texas Tech University	25	1				37	8.50	0.33
Totals		343		2555	100.00		2555.00	100.00

[1]An institution/organization was credited with a *CAR* article each time a lead (first) author and/or a co-author representing that institution/organization contributed to the journal. Therefore, there was double counting each time two or more authors contributed to an article. As a result, the total number of "author-credited" articles (343) is inconsistent with the actual number of *CAR* articles (189) published from 1983-2010 (Woods et al., 1989).

[2]The lead author columns list the pages and percent of contribution by lead (first) author only. The lead author's institution/organization affiliation was recorded and received credit for the entire number of article pages contributed in the *CAR*. Lastly, the institutions/organizations were ranked by total number of article pages contributed by lead author only (Woods et al., 1989).

[3]Each contributing institution/organization listed in the all authors columns was credited with a percentage of total pages in the *CAR* article. Fractional counting occurred each time two or more authors contributed to an article. Final calculations resulted in identical results for the total pages contributed by lead authors and total pages by all authors (2,555) (Woods et al., 1989).

[4]One author contributing to the *CAR* was not affiliated with an institution/organization. This author was grouped alone and represented in this entry.

Table 3. *Institution/Organization Source of Collegiate Aviation Review Articles, 1983 to 2010*

Institution/Organization	*Journal Articles*	*Percent of Total Articles*
Universities and Colleges	332	96.80
U.S. Airport Systems	3	0.88
U.S. Military	2	0.58
U.S. Government	2	0.58
Aviation Companies	2	0.58
U.S. Commercial Airlines	1	0.29
Non-affiliated Author	1	0.29
Total	343	100.00

organizations included airport systems, military, aviation companies, commercial airlines, and the government.

Article Classification by Subject Category

In Table 4, the *CAR* articles are classified in 15 different subject categories. These categories, determined by the author of this study, were based on each *CAR* article's title, abstract, and content. The subject category "collegiate flight training curriculum and instructional methods" accounted for 37 *CAR* articles and 492 pages, or 19% of total pages. The remaining top five subject categories included collegiate aviation degree programs, the collegiate aviation student, the airport system, and the commercial airline industry. These diverse subject categories (Table 4) characterize the research initiatives of the contributing authors to the *CAR* over the past 28 years.

Geographical Grouping of Contributing Author's Institution/Organization

The contributing author's institution/organization is grouped geographically in Figure 1. The nine regions (Alaska, Northwest Mountain, Western Pacific, Great Lakes, Central, Southwest, New England, Eastern, and Southern) identified in Figure 1 are the operational regions used by the Federal Aviation Administration (Federal Aviation Administration, 2011). Authors associated with institutions/organizations located in the Great Lakes region contributed 159 of 343 author-credited *CAR* articles (46%) from 1983-2010; and authors associated with institutions/organizations from the Southern region contributed 90 articles (26%). Smaller contributions came from authors associated with institutions/organizations located in the Central region (8%), Southwest region (6%) and the Western Pacific region (6%).

Only 340 of the 343 *CAR* author-credited articles are grouped geographically in Figure 1 because two *CAR* articles were written by authors associated with international

Table 4. Subject Classification of *Collegiate Aviation Review* Articles, 1983 to 2010.

Category	*CAR Articles*	*Pages*	*Percent of Total Pages*
Collegiate Flight Training Curriculum and Instructional Methods Including Flight Simulation	37	492	19.26
Collegiate Aviation Degree Programs (2-year and 4-year degree programs)	20	284	11.11
The Collegiate Aviation Student (characteristics, accountability, perceptions and learning styles)	20	230	9.00
The Airport System and Air Traffic Control	15	225	8.81
The Commercial Airline Industry	14	154	6.03
The Aviation/Aerospace Industry	13	200	7.83
Academic Internships, Cooperative Programs and Articulation Agreements	12	153	5.99
Assessment & Accreditation	11	143	5.59
Distance Learning and Technology	10	121	4.73
Collegiate Aviation "Non-Flight" Curriculum (aviation and airport management, aviation safety)	9	175	6.85
Employment in the Aviation Industry	7	112	4.38
Women and Minority Aviation Students	7	68	2.67
Aviation Faculty	6	90	3.52
U.S. Government & Military	5	71	2.78
International Aviation Issues	3	37	1.45
Total	189	2555	100.00

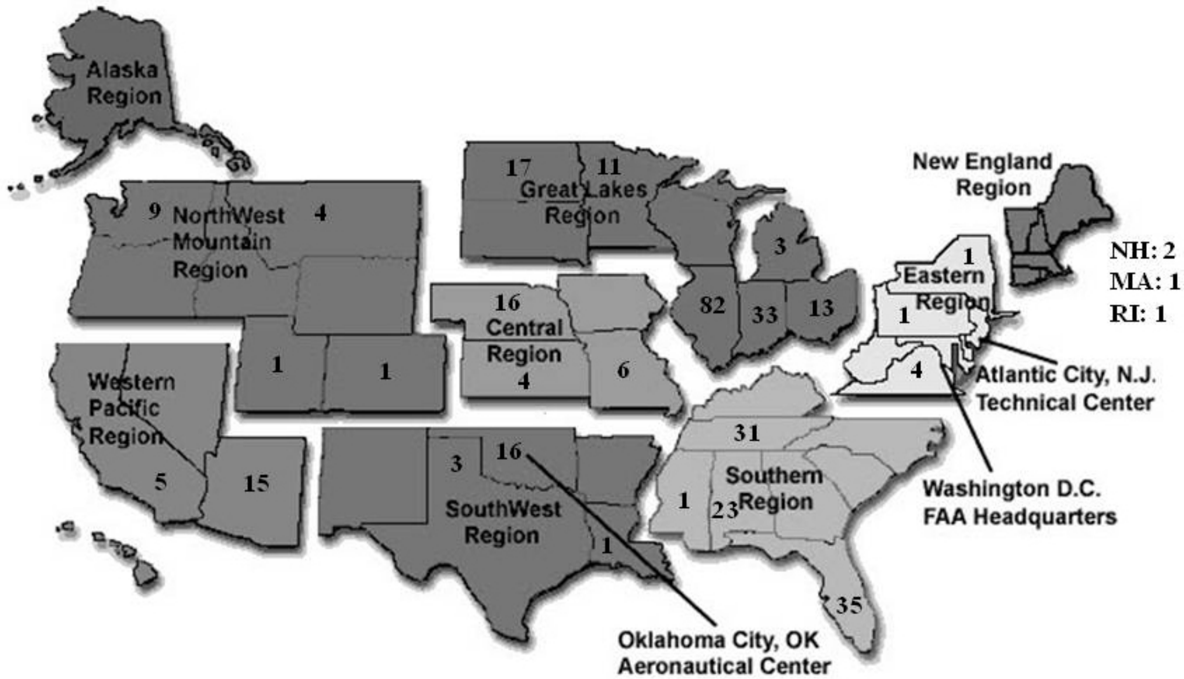

Figure 1. Geographical Grouping of CAR Author's Institution/Organization 1983-2010

institutions/organizations and the one remaining *CAR* article was written by an author not affiliated with an institution/organization.

The institution/organization membership of the University Aviation Association is grouped in geographical regions in Table 5. There were 98 institution/organization memberships listed in the 2010 UAA membership directory; and 94 (96%) of these institutions/organizations were located in the United States (University Aviation Association, 2011b). Twenty-two of these U.S. institution/organization memberships (22%) are located in the Great Lakes region (North Dakota, South Dakota, Minnesota, Wisconsin, Michigan, Illinois, Indiana, and Ohio) and 17 institution/organization memberships (17%) come from the Southern region (Kentucky, Tennessee, North Carolina, South Carolina, Mississippi, Alabama, Georgia, and Florida). As shown in Table 5, authorship of total *CAR* publications was heavily representative of these same regions. Lastly, there is very little international representation of institutional membership; only four percent.

Summary of Results

The blind peer-reviewed *Collegiate Aviation Review* has been published for 28 years with the first seven years being published as blind peer-reviewed conference proceedings.

Table 5. *Geographical Grouping of UAA Institution/Organization Memberships, 2010*

Geographical Region	*UAA Memberships*	*Percent of Total UAA Membership*	*Percent of CAR Articles*
Great Lakes	22	22.45	46.49
Southern	17	17.35	26.32
Southwest	14	14.29	5.86
Eastern	13	13.26	1.76
Northwest Mountain	10	10.20	4.38
Central	7	7.15	7.58
Western Pacific	6	6.12	5.86
New England	4	4.08	1.17
Alaska	1	1.02	0.00
Non-US	4	4.08	0.58
Total	98	100.00	100.00

A review of contributions from all of those years revealed many interesting findings:

1. Institutional/organizational affiliation of contributing authors.
    - Authors representing 54 different institutions/organizations and 1 non-affiliation were identified as *CAR* contributors
    - The top ten contributors, all educational institutions, accounted for 72% of total *CAR* articles
    - Universities and colleges accounted for 97% of the *CAR* article contributions
    - Very few non-academic organizations have published in the *CAR* during its 28-year history
2. Contributors and subject matter of *CAR* articles.
    - There were 35 co-authors contributing to 75 total *CAR* articles published between 1983 and 2000. During the last 10 years (2001-2010), there have been 118 co-authors contributing to 114 total *CAR* articles
    - The top five institutions (Southern Illinois, Middle Tennessee State, Purdue, Auburn, and Embry-Riddle), ranked by total number of *CAR* author-credited articles (174), contributed to 51% of total *CAR* articles published from 1983-2010
    - The subject matter contributions were diverse, but heavily concentrated in the areas of collegiate flight training, collegiate aviation degree programs, the collegiate aviation student, the airport system (including air traffic control), and the commercial airline industry
3. Geographic grouping of *CAR* article authorship.
    - Authors associated with institutions/organizations located in the Great Lakes region have contributed significantly to the *CAR* over the years, primarily due to

Southern Illinois University’s domination of total author-credited articles (79 articles or 23%)

- Authors associated with institutions/organizations located in the Southern region have also contributed a large percentage of *CAR* articles (26%)
- Only two international authors/institutions (both from Canada) have contributed to the *CAR* over the past 28 years

Discussion

Regarding the next 28 years of the *Collegiate Aviation Review* and the University Aviation Association, several conclusions can be made based on the outcome of this study:

1. The large participation by the Great Lakes and Southern regions, in terms of both UAA membership and *CAR* authorship, is likely to continue. The collegiate aviation programs at educational institutions located in these two regions are well-established and possess large numbers of degree programs, aviation student populations, and faculty members. All three of these factors contribute favorably to increases in UAA membership numbers as well as contributing authors to the *CAR*.
2. Academia, university, and college faculty will continue to lead the way in author contributions to the *CAR*, primarily because the spirit of academia is to encourage and reward faculty to engage in scholarly activity (tenure and promotion). Many aviation professionals and practitioners outside of the educational institutions have less of an incentive to devote quality time required to research, write, and publish a *CAR* article.
3. Given the collegiate nature and aviation expertise of the UAA's membership; collegiate flight training curriculum and instructional methods, the collegiate aviation student, collegiate aviation degree programs, the airport system, and the commercial airline industry will continue to be the subjects of choice by the universities and colleges. However; as indicated in the past 28 years, the contributing authors to the *CAR* will continue to research the current challenges and issues occurring every day in the aviation industry, as well as the collegiate flight environment.
4. Forty-seven percent, 89 of 189, of total *CAR* articles had contributing authors. However, only 20% of these articles (18) had contributing authors from different institution/organization affiliations. All in all, less than 10% of all *CAR* articles (189) were co-authored by different institutions/organizations; suggesting that very few aviation faculty members are collaboratively engaging in research initiatives with colleagues from other educational institutions and aviation/aerospace organizations.
5. There is very little international influence in the *Collegiate Aviation Review*. Over the 28-year history of the journal, only two authors representing two international educational institutions have contributed their aviation knowledge and experiences. As a result, only a minute number of *CAR* articles (1.7%) have focused on international aviation issues. However; in regards to the UAA institutional

membership directory for 2010, only 4% of membership were from international institutions/organizations.

6. In 1983, the first year that conference proceedings were published, the UAA had 36 institutional memberships and 188 individual members (C. Williamson, personal communication, November 16, 2011). There were a total of 5 articles (79 pages) published in the 1983 proceedings. By 2010, the UAA had 98 institutional memberships and 500 individual members; and 14 articles (201 pages) were published in the 2010 CAR (spring and fall issues). In addition, from 2006-2010, 39% of the total 189 articles were published in the *CAR*. Therefore, the growth in UAA membership since 1983 correlates with the increase in published *CAR* articles during the past 28 years; supporting the UAA goal of "furnishing a national vehicle (the *CAR*) for the dissemination of knowledge relative to aviation among institutions of higher education and governmental and industrial organizations in the aviation/aerospace field" (Fanjoy, 2008, p. 6).

Recommendations

In summary, this exploratory study presented as many questions as it hopefully answered. Examples of questions and subsequent recommendations related to further study include:

1. *Over the past 28 years, what has been the acceptance rate versus the rejection rate of academic manuscripts submitted to the CAR for review?* One method of evaluating the rank of an academic journal is to review the acceptance rate and rejection rate percentages to determine how competitive that journal is relative to the other journals within the same academic discipline (St. John's University, 2004).
2. *Are UAA members consistently submitting their research manuscripts to other aviation scholarly journals? If so, what are the various reasons for not submitting to the CAR?* Perhaps the research orientation at certain UAA educational institutions or an individual faculty member's line of inquiry precludes them from submitting their research to the *CAR*. Should there be changes made to the *CAR* to better fulfill the goals and desires of the UAA and its existing membership, as well as prospective scholars and members?
3. *Why are very few UAA members collaboratively engaging in research initiatives with colleagues from other educational institutions and/or aviation organizations?* Perhaps this can be attributed to the fact that some educational institutions do not promote peer collaboration from other institutions or that some educational institutions' tenure/promotion documents prefer single authorship research initiatives.
4. *How can the UAA effectively expand its reach into the global aviation education marketplace?* Educational institutions in the U.S. and the international communities will need to increase their collaborative effort in order to reach common solutions that respond to everyone's needs associated with the aviation industry. Even though different perspectives and different disciplines may exist;

an interdisciplinary approach of working together must be fostered to find feasible solutions to the numerous issues facing aviation in a global world.

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Exploring the Experiences of Pilots within Canadian General Aviation Flight Operations

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Abstract

Pilots track flight hours as a quantitative measure of expertise. This linear development of expertise may apply to technical skills; however, it has been suggested that the development of nontechnical expertise is associated with operational exposure to threats and errors (Thomas, 2004). Within this framework, nontechnical skills may develop at different rates depending upon exposure to different threats and errors within specific types of flight operations. The present investigation examined the threats, errors, and nontechnical skills of pilots within Canadian general aviation operations. One hundred thirty narratives describing real-world scenarios were gathered from pilots with an online self-report Hangar Talk Survey (HTS). Several threats, errors, and nontechnical skills were significantly associated with specific types of operations. This suggests that the rate of nontechnical skill development may additionally be linked to the type of operation a pilot is involved in, rather than to the number of flight hours alone.

Introduction

Canada offers pilots great diversity in geographic terrain, climate, and aviation operations, coupled with unparalleled access to uncontrolled airspace. In 2008, there were 37,944 recreational and 24,598 professional licensed pilots in Canada (Transport Canada, 2010). An important component of Canada's aviation industry is general aviation (GA), which includes all operations outside of scheduled airline or military operations, including commercial operations such as charters, helicopter operations, bush flying, recreational flying, and flight instruction. GA is the largest aviation sector in Canada, with more aircraft and pilots than in the airlines and military combined (Kearns, 2009).

Within the broader aviation industry, it is accepted that all pilots require a combination of technical and nontechnical skills. Technical skills are those required to safely complete standard operating procedures, including psychomotor (hands-and-feet) and cognitive (operational knowledge) skills. Nontechnical skills are less specific, referring to broad cognitive and interpersonal skills. Nontechnical skills are often considered supplementary safety skills that are beyond the scope of what is included in traditional pilot training such as situation awareness, communication, workload management, and decision making. Safety skills are a significant concern in GA, as 98% of aviation accidents in Canada in 2010 occurred within GA (Tranportation Safety Board, 2011). Unfortunately, GA pilots have little access to nontechincal training to improve safety. Instead, the industry relies on pilots developing crucial nontechincal skills through the naturalistic process of building real-world flying experience.

This method of building expertise through experience is addressed by the threat and error management (TEM) perspective on nontechnical skill development. TEM suggests that nontechnical skills develop as a result of a pilot being exposed to threats and committing errors (Helmreich, Merritt, & Wilhelm, 1999; Thomas, 2004). A threat is defined as a condition that has the potential to negatively impact flight safety, such as bad weather or an incorrect instruction from Air Traffic Control (ATC), while an error is defined as a response, or lack of a response, commited by the flight crew that diverges a flight from its intended course (Thomas, 2004). Errors can include a pilot intentionally breaking a regulation or may result from lack of proficiency in a particular skill or maneuver.

Nontechnical skill development is especially important in GA, since a large proportion of pilots within this sector are in an “hours-building” phase of their career. Typically, new commercial pilots in Canada work in this sector for a period of time as a means to build sufficient hours of flight experience to apply for a flying career in the airline industry. From a hiring perspective, the emphasis is on the pilots’ number of hours, with little consideration given to the type of operation in which the hours were conducted (G. Priestley, personal communication, October 20, 2011). That is, the industry typically assumes that all hours-of-experience on a similar aircraft are equal, regardless of how those hours were spent. However, a similar type of aircraft may be used for flight instructing, a small charter, mountain flying, or a recreational trip. These different operations likely result in pilots encountering different threats and errors, meaning that pilots with the same number of hours in a particular aircraft may have meaningful variations in experience. Based on the TEM concept of skill development, therefore, the varying experience with threats and errors may lead to different levels of nontechnical expertise.

Expertise is important for pilots across all sectors of aviation, as experts demonstrate unique characteristics that result in improved performance over novices, including improved decision making, the ability to accurately predict future flight states, and compensation for cognitive and psychomotor declines that naturally occur with age on flight-related tasks (Doane, Sohn, & Jodlowski, 2004; Morrow et al., 2009; Taylor, Kennedy, Noda, & Yesavage, 2007). Expertise is characterized by an individual’s progression from understanding problems in a literal and superficial sense, to the ability to understand in a principled, articulated, and conceptual manner (Chi, 2006). Contrary to popular opinion, expertise is not developed through the passing of time or individual maturation. The key to developing expertise is accumulating skill through deliberate practice and/or experience, such as operational exposure to threats and errors (Ericsson, 2004). Based on the “craft guilds” terminology of the Middle Ages, Hoffman (1996) presented the following framework to describe the stages of expertise: naiveté, novice, initiate, apprentice, journeyman, expert, and master. Pilot technical expertise, based on a pilot’s number of hours, can be mapped over Hoffman’s stages in a linear fashion, as presented in Table 1. However, if threats or errors vary depending upon categories of flight operation, it is expected that nontechnical expertise may develop with operational specificity. For example, a master who operates primarily within ab initio flight instruction would not be expected to demonstrate expert attributes within a charter environment, even if operating the same type of aircraft and possessing the same number of hours.

Table 1. *The Stages of Expertise Within a Professional Pilot Career*

Stage	Application to professional pilot career	Approximation of experience in each stage
Naiveté	A person who is ignorant of flying	No flight training experience
Novice	A person with minimal exposure to piloting	Begun flight training but has not yet completed a solo flight
Initiate	A person with introductory flight instruction	Has completed a solo flight but does not hold a license or rating
Apprentice	A person undergoing a course of instruction (either from a flight instructor or by working with and observing senior pilots)	After completing a private pilot license but with less than 1000 hours total time (Durso and Dattel, 2006)
Journeyman	Someone who can competently perform the professional duties of a pilot unsupervised	After completing 1000 hours total time but before completing 5 years or 4000 hours flight experience – however, some professionals may remain at this level throughout their careers
Expert	A pilot who reliably demonstrates accuracy in piloting, who can respond to situations automatically with little cognitive effort, and who can competently deal with unexpected challenging situations	More than 4000 hours flight experience, who demonstrates expert attributes (accuracy, automatic reactions, competency in challenging situations)
Master	Any expert or journeyman who possesses the qualifications to teach those at a lower level of expertise; the judgments of masters establish standard procedures within their domain	A journeyman or expert who is a qualified chief flight instructor

While some data exist on the threats and errors encountered by airline pilots (Thomas, 2004), little empirical evidence exists describing the threats and errors pilots encounter within GA. The variety of GA operations in Canada means that while pilots keep track of their number of flight hours as a measure of their expertise, flight hours alone may not precisely gauge pilot skill. Therefore, the purpose of the current investigation was to begin to characterize the experiences of pilots in Canadian GA by examining the threats and errors that occur in different operations, and the nontechnical skills that are used in those operations. Pilots self-reported significant flying events that occurred during the hours-building phase of their career. The scenarios were analyzed for descriptions of threats, errors, and the use of nontechnical skills in the type of operation described. If particular operations, including single versus multi-crew situations, are differentially associated with certain threats, errors, and nontechnical skills, hiring practices may need to be modified to look not only at the number of hours a pilot possesses but to also consider the type of operation within which those hours were conducted. Therefore, the current study sought to determine whether, within events that pilots deemed significant, the threats, errors, and nontechnical skills reported differed according to the type of operation.

Method

Participants

The present investigation used an Internet-based self-report survey (the Hangar Talk Survey, HTS) to solicit data on threats, errors, and nontechnical skills. The survey was published online for a period of 10 months. Participants were recruited through pilot groups, professional aviation organizations, flying schools, and a pilot magazine, as well as participant-to-participant through social media utilities.

A total of 849 people visited the survey website. Of those, 704 agreed to the consent form and gained access to the survey. The total number of people who completed the survey was 143, for an overall completion rate of 20%. Thirteen responses were excluded from the current analysis due to incomplete or incorrect responses and responses that did not describe Canadian operations, resulting in a total of 130 valid responses. The respondents' hours of flying experience were categorized in several ways. The mean number of hours when encountering the scenario described in the survey was 1028 (*SD* = 1090), while the mean hours in the aircraft described in the scenario was 320 (*SD* = 375) and the mean hours in the type of operation at the time of the scenario was 488 (*SD* = 5484).

The study was approved by the Research Ethics Board of Seneca College, Markham, Ontario, where the web survey was hosted.

Procedure

Materials. The HTS was a self-report survey created to gather narrative descriptions of scenarios pilots had encountered, including the type of operation they were involved in at the time, the impact of the event on their career, and whether they would react differently if encountering the same scenario in the future. Data on the impact of the event reported in the scenario on the pilot, and the effect of the scenario on future decision making, were addressed in Kearns and Sutton (2011); therefore, the current analysis is focused on the associations of operation type and crew type with threats, errors, and nontechnical skill utilization in the reported scenarios. The survey was written in English and included an open-ended narrative question and closed-ended multiple-choice questions. It took approximately 20 to 25 minutes to complete the survey. Anonymity was guaranteed.

The relevant survey items for the current investigation were as follows:

- *Based on your real-world flying experiences, after achieving a commercial pilot's license but before being employed with a major airline, please think of a situation you have encountered that was outside the limits of standard performance and required you to think creatively to maintain safe flight. The scenario should describe a situation where you were challenged as a pilot and ultimately learned a valuable lesson.*
- *Approximately how many hours did you have when you encountered this scenario?*
- *Approximately how many hours did you have in the aircraft type when you encountered the scenario?*
- *Approximately how many hours did you have in the type of operation (medevac, instructing, charter, etc.) when you encountered the scenario?*
- *Approximately how many hours do you have now?*
- *Were you in a single-crew or multi-crew operation when you encountered the scenario?*

Identification of Threats, Errors, and Nontechnical Skills. The narrative description of each scenario was subjected to a data cleaning process. Valid survey responses were distributed to three professional pilots who acted as reviewers. Reviewers were given instructions on how to identify threats, errors, and nontechnical skills within the narrative responses. Reviewers also identified the type of operation described within the scenario. Each survey response was reviewed by all three pilots. If a consensus was not reached, the reviewers worked with the first author to determine the most appropriate response in a data cleaning roundtable.

As an example, the following is an excerpt from one of the Hangar Talk Survey narratives (identifying details have been removed):

> It was my leg to fly and we were operating in IFR although not down to approach minimums. We were behind schedule from the start of the flight. During descent, I briefed the approach.
>
> When I finished, I asked the captain, who had a bit of a reputation, if he had any questions. He looked right at me and said "That's (expletive) stupid. The weather isn't that bad. Just go a couple hundred feet lower out here and you'll get below the cloud and it will save us 5 minutes." I explained that I couldn't legally get to that altitude

without busting a few limits. He pressed his point by saying that it was flat and there were no mountains or towers for me to hit.

> I flat out refused to bust any limits and told the captain that this was the only legal way we could get down below the cloud and that if he didn't like it that he could take control from me and that I would be forced to follow it up with management. He didn't take control and he never again asked me to bust another limit. I was new with the company and was intimidated by this captain. What I should have done was to follow it up with Management and document the situation.

This narrative was tagged with the threats of "operational pressure" and "weather," as the pilot had to deal with an over-authoritative captain along with poor weather conditions. In addition, it was determined that the pilot utilized the nontechnical skills of "decision making" and "communication," as he or she was challenged to choose the right course of action, despite the insistence of the captain to continue, and had to communicate that decision effectively.

Results

Descriptive Analysis

Operations. The types of operation identified by reviewers are presented in Table 2. Of the 130 survey responses, 77% described scenarios flown by a single pilot, while 23% described multi-crew operations.

Table 2. *Operations Reported in the Scenarios*

Type of operation	Frequency	Percentage
Recreational flight	42	32%
Charter	23	18%
Flight instruction	20	15%
Bush flying	11	9%
Commuter	4	3%
Medical evacuation	3	2%
Ferry flight	3	2%
Cargo	2	2%
Helicopter	2	2%
Survey flight	1	1%
Sightseeing	1	1%
Fire patrol	1	1%
Search and rescue	1	1%
Regional airline	1	1%
Not identifiable	15	12%
Total	130	

Threats. Threats and errors were identified based on the narrative description of the scenario and were separated for analysis purposes. The frequencies and percentages of threats identified within the HTS are presented in Table 3.

Errors. Table 4 describes the frequency and percentage of identified errors identified within HTS responses.

Table 3. *Threats Identified in Survey Responses*

Threat	Frequency[a]	Percentage
Weather	45	34%
Aircraft malfunction	39	29%
Operational pressure	11	8%
Traffic	6	5%
ATC Command	7	5%
Terrain	6	5%
Student pilot error during instruction	7	5%
Passenger event	5	4%
Ground handling event	3	2%
Airport condition	2	1%
Communication threat	1	1%
Inappropriate SOP	1	1%
Pilot incapacitation	1	1%
Total	134	

[a] Threat data from narratives describing Canada-specific operations in Kearns and Sutton (2011).

Table 4. *Errors Identified in Survey Responses*

Error	Frequency[a]	Percentage
Decision making error	41	47%
Procedural	17	19%
Proficiency	16	18%
Intentional noncompliance	7	8%
Communication error	7	8%
Total	88	

[a] Error data from narratives describing Canada-specific operations in Kearns and Sutton (2011).

Nontechnical Skills. The nontechnical skills (NTS) identified within HTS responses are presented in Table 5.

Table 5. *Nontechnical Skills Identified in Survey Responses*

Nontechnical skill	Frequency[a]	Percentage
Decision making	113	39%
Communication	76	26%
Situation awareness	58	20%
Task management	43	15%
Total	290	

[a] Error data from narratives describing Canada-specific operations in Kearns and Sutton (2011).

Associations Between Type of Operation and Threats, Errors, and Nontechnical Skills

Since some operation types were reported infrequently, broader categories were created for analysis purposes. The Charter Flight category was expanded to include sightseeing, cargo, ferry flights, and regional airline operations. An “Other” category was created to include operational types with few instances, including bush flying, helicopter, medical evacuation, fire patrol, and search and rescue operations. Therefore, four main categories of operations were used in the analysis: Charter Flights, Recreational Flights, Flight Instruction, and Other. Associations between type of operation and threats, errors, and nontechnical skills were evaluated using chi-square tests or, for tests where at least one cell had an expected count less than 5, Fisher’s exact test.

Threats. Chi-square analyses revealed that Operation Type was significantly associated with the presence of Operational Pressure, $\chi^2(3) = 10.48$, $p = .01$, but associations with Weather, $\chi^2(3) = 7.31$, $p = .06$, and Aircraft Malfunction, $\chi^2(3) = 4.90$, $p = .18$, were not significant. Fisher’s exact tests showed a significant association between Operation Type and Airport Condition, $p = .02$, and Student Pilot Error, $p < .001$. Associations between Operation Type and Traffic, Air Traffic Control, Terrain, Passenger Events, Communication, violations of Standard Operating Procedure, Pilot Incapacitation, and Ground Events were not significant, all p values were greater than .05. Contingency tables for the significant associations of Operation Type with Operational Pressure, Airport condition, and Student Pilot Error are shown in Tables 6, 7, and 8, respectively.

Table 6. *Contingency Table for the Association of Operation Type and Operational Pressure*

	Operational Pressure		
Operation Type	No	Yes	Total
Recreational Flight	42	0	42
Charter Flight	27	7	34
Flight Instruction	19	1	20
Other	17	2	19
Total	105	10	115

Table 7. *Contingency Table for the Association of Operation Type and Airport Condition*

	Airport Condition		
Operation Type	No	Yes	Total
Recreational Flight	42	0	42
Charter Flight	33	1	34
Flight Instruction	20	0	20
Other	16	3	19
Total	111	4	115

Table 8. *Contingency Table for the Association of Operation Type and Student Pilot Error*

	Airport Condition		
Operation Type	No	Yes	Total
Recreational Flight	41	1	42
Charter Flight	34	0	34
Flight Instruction	14	6	20
Other	19	0	19
Total	108	7	115

Errors. Chi-Square tests showed that Operation Type was significantly associated with Intentional Noncompliance, $\chi^2(3) = 8.60$, $p = .04$, but not Decision Error, $\chi^2(3) = 6.16$, $p = .10$. Fisher's exact tests showed a significant association of Operation Type with Proficiency Errors, $p = .02$, but not with Procedural or Communication Errors, both p values were greater than .05. Contingency tables for the significant associations of Operation Type with Intentional Noncompliance and Proficiency Errors are presented in Tables 9 and 10, respectively.

Table 9. *Contingency Table for the Association of Operation Type and Intentional Noncompliance Errors*

	Intentional Noncompliance		
Operation Type	No	Yes	Total
Recreational Flight	42	0	42
Charter Flight	31	3	34
Flight Instruction	20	0	20
Other	16	3	19
Total	109	6	115

Table 10. *Contingency Table for the Association of Operation Type and Proficiency Errors*

	Proficiency Errors		
Operation Type	No	Yes	Total
Recreational Flight	35	7	42
Charter Flight	32	2	34
Flight Instruction	14	6	20
Other	19	0	19
Total	100	5	115

Nontechnical Skills. Chi-square tests showed a significant association of Operation Type and Communication skills, $\chi^2(3) = 15.65$, $p = .001$, but not Situation Awareness, $\chi^2(3) = 0.36$, $p = .94$, Task Management, $\chi^2(3) = 0.48$, $p = .92$, or Decision Making, $\chi^2(3) = 2.97$, $p = .40$. A contingency table for the association of Operation Type and Communication Skills is presented in Table 11.

Table 11. *Contingency Table for the Association of Operation Type and Communication Skills*

	Communication Skills Utilized		
Operation Type	No	Yes	Total
Recreational Flight	30	12	42
Charter Flight	10	24	34
Flight Instruction	9	11	20
Other	13	6	19
Total	62	53	115

Associations Between Flight Crew Type and Threats, Errors, and Nontechnical Skills

As with Operation Type, associations between type of flight crew (single or multi-crew) and threats, errors, and nontechnical skills were evaluated using chi-square tests or, for tests where at least one cell had an expected count less than 5, Fisher's exact test.

Threats. Fisher's exact test showed a significant association between Crew Type and Operational Pressure, $p = .02$, but no association between Crew Type and Traffic, Air Traffic Control, Airport conditions, Terrain, Passenger Events, Communication Events, Student Pilot Errors, Inappropriate SOP, Pilot Incapacitation, or Ground Events, all *p* values were greater than .05. Also, chi-square tests showed no significant associations between Crew Type and Weather, $\chi^2(1) = .0004$, $p = .98$, or Crew Type and Malfunction, $\chi^2(1) = 0.54$, $p = .46$. The contingency table for the significant association of Crew Type and Operational Pressure is shown in Table 12.

Table 12. *Contingency Table for the Association of Crew Type and Operational Pressure*

	Operational Pressure		
Crew Type	No	Yes	Total
Single pilot	81	4	85
Multi-Crew	24	6	30
Total	105	10	115

Errors. Fisher's exact tests showed Crew Type was not significantly associated with Intentional Noncompliance, Procedural Errors, Communication Error, or Proficiency Errors, all *p* values were greater than .05, and a chi-square test showed no significant association between Crew Type and Decision Error, $\chi^2(1) = 0.57$, $p = .45$.

Nontechnical Skills. Chi-square tests revealed a significant association between Crew Type and the use of Communication skills, $\chi^2(1) = 23.42$, $p < .001$, and an association with Situation Awareness that approached significance, $\chi^2(1) = 3.79$, $p = .051$. Crew Type was not significantly associated with Task Management skills, $\chi^2(1) = 1.73$, $p = .19$, or Decision Making skills, $\chi^2(1) = 1.58$, $p = .21$. The contingency table for Crew Type and Communication Skills is shown in Table 13, and the contingency table for Crew Type and Situation Awareness is presented in Table 14.

Table 13. *Contingency Table for the Association of Crew Type and Usage of Communication Skills*

	Communication Skills Utilized		
Crew Type	No	Yes	Total
Single pilot	55	30	85
Multi-Crew	4	26	30
Total	59	56	115

Table 14. *Contingency Table for the Association of Crew Type and Situation Awareness*

	Situation Awareness		
Crew Type	No	Yes	Total
Single pilot	42	43	85
Multi-crew	21	9	30
Total	63	52	115

Discussion

The current investigation used an online Hangar Talk Survey (HTS) to gather narrative descriptions of flying events encountered by pilots within Canadian GA operations. Within the narratives, three pilot reviewers identified threats, errors, and nontechnical skills. Analyses revealed that the threats of operational pressure, airport condition, and student pilot error were significantly associated with the type of operation. In addition, a significant association with operation type was identified for the errors of intentional noncompliance and proficiency, as well as the nontechnical skill of communication. The analysis also revealed that the type of crew, whether single-pilot or multi-crew, was associated with the threat of operational pressure and the nontechnical skill of communication.

A number of threats were differentially associated with operation type in the scenarios reported by pilots. The threat of airport condition refers to environmental challenges during takeoff, landing, or taxi, and was most often reported within the Other category, which included bush flying, helicopter, medical evacuation, fire patrol, and search and rescue operations. Within Canada, these activities may be conducted in rural areas, on floats that allow takeoffs and landings on water, or into confined areas that are not registered aerodromes. Although pilots within these operations receive specialized training to deal with such conditions, pilots within other types of operations would be unlikely to face these challenges. Moreover, if nontechnical skills are related to the experience of particular threats, pilots with experience in these sectors should be better able to deal with airport challenges than pilots in other sectors.

It is perhaps unsurprising that another threat, student pilot error, was more commonly encountered during flight instruction than other operations. A student pilot error during flight instruction refers to a mistake made by a student pilot that threatens the safety of the flight while the responding pilot is acting as a flight instructor. Flight instructors are trained in how to teach students, but little attention is paid to how to manage the threat of a student pilot error. This represents a significant risk for new pilots who choose flight instruction as a means to build skills and experience, as most instructors are still apprentices themselves yet must deal with student pilot errors—often combined with the stress of a panicked student.

The threat of operational pressure was significantly associated with operational type, most identified within charter flight operations. As charter operations are more likely than other GA operations to be operated by a multi-crew, it follows that the crew type in the reported scenarios was also associated with the threat of operational pressure. Multi-pilot flight crews appeared more likely to be affected by operational pressure than single-pilot crews. It is unclear why multi-pilot crews would be more susceptible to this threat, but it could be due to the presence of an over-authoritative senior crewmate, which would only impact multi-pilot crews. Future investigations may explore whether human factors instruction, focusing on communication, personal limitations, team-working, leadership, and decision making skills, can mitigate the risk associated with this type of threat (Mearns, Flin, & O'Connor, 2001).

As with threats, the scenarios pilots reported included errors that were significantly more frequent in some operations than others. For instance, the error of intentional noncompliance refers to a pilot deliberately disobeying an aviation regulation or air traffic control instruction. This error occurred most commonly in scenarios involving charter operations and operations in the Other category. Within the current investigation, these two categories included several types of operations. Intentional noncompliance may be the result of a sense of personal invulnerability among pilots (Helmreich, 2000). However, it is unclear why this error would be more prevalent among these operational categories. Additional research, with a larger sample size, is required to piece apart the activities and levels of experience within the Charter and Other category to further explore this issue.

Proficiency errors were also significantly associated with the type of operation and were reported most frequently in flight instruction scenarios. As these errors refer to those of the responding pilot, this indicates a mistake on behalf of the instructor rather than the student. This finding may reflect a lack of technical expertise among many flight instructors, which is understandable as most instructors are apprentices or journeymen themselves. Unfortunately, proficiency errors may lead to risky situations when combined with the threat of student pilot error discussed previously. This finding suggests the need for investigation of flight instructor proficiency and for the identification of instructional methods that may be used to improve technical and nontechnical flight instructor skills.

In scenarios where a specific nontechnical skill was identified, communication skills were reported more frequently in charter operations and, correspondingly, multi-crew situations. This is an intuitive finding, as although single pilots use communication skills with company personnel, air traffic control, and passengers, in a challenging scenario communication skills would have a more significant impact on multi-crews. Interestingly, as multi-crews were more likely to use communication skills in challenging situations, data indicated a slight tendency for single pilots to use situation awareness skills more often to maintain flight safety (a finding that approached significance, $p = .051$). These data therefore suggest a benefit for nontechnical skill training that is customized to the type of operation a pilot is involved in, with an emphasis on communication skills for multi-crews and situation awareness skills for single-pilot operations.

Overall, this investigation revealed some of the different threats, errors, and nontechnical skills within scenarios perceived as important by pilots within GA. Given that different operation and crew types were associated with specific threats, errors, and nontechnical skills, it is logical to suggest that the rate of development of specific types of nontechnical skills may vary depending upon the operations within which relevant experience was gained. This is contrary to the widely-held aviation industry assumption that expertise is accurately measured by a pilot's hours. The current study asked pilots to report on only one event from the hours-building phase of their career, and future studies will need to gauge pilot experience in a more objective fashion to more precisely determine how expertise is shaped by flight operations. Nonetheless, the current data suggest that flight hours alone may be an insufficient method of mapping nontechnical expertise development, as it potentially overlooks important skill differences between pilots associated with their operational experience.

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Promotion and Tenure Perceptions of University Aviation Association (UAA) Collegiate Aviation Administrators and Faculty

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Abstract

The promotion and tenure process is often viewed as one of the most highly scrutinized and demanding periods in a faculty member's career. This study reports collegiate aviation administration and faculty perceptions toward promotion and tenure workload components; including, the importance, or value of specific workload components considered during the promotion and tenure process for probationary faculty members. The study made use of an online survey. The online survey instrument was composed of 20 multiple-choice questions with space for additional comments. Two-hundred-twenty professional members of the University Aviation Association (UAA) formed the study population. Eighty-seven responded for a response rate of 39.5%. The results of this quantitative/descriptive research study re-affirm the notion that perceptions of workload items used to determine fitness for promotion and tenure are not uniform throughout collegiate aviation. One perception reported as a constant was the belief that all "three pillars," scholarship, teaching and service possessed some degree of importance in the promotion and tenure process. A future research study comparing the perceptions of administrators versus that of faculty on the topic of promotion and tenure should be explored.

Introduction

The intent of this study was to report the collective perceptions of collegiate aviation faculty and administrators regarding the importance, or value of specific faculty workload components typically considered in the promotion and tenure process for probationary faculty members. The promotion and tenure process is often viewed as one of the most highly scrutinized and demanding periods in a faculty member's career. "The tenure and promotion process may be the most challenging and frightening time in a faculty member's life" (Gelmon & Agre-Kippenhan, 2002, p. 7). However, policies used to communicate suitability for promotion and tenure can be highly subjective and often vary among different institutions. For example, listed below are promotion and tenure policy excerpts from four different collegiate aviation institutions. Promotion guidelines employed by the Provost of Purdue University (2011) state:

> The tasks of University faculty members are to acquire, discover, appraise and disseminate knowledge. They should communicate this knowledge and the manner of its acquisition or discovery to their immediate community of students and scholars, to their profession, and to society at large. Service to the institution, the community, the state, the nation and the world constitutes an important mission of University faculty members. As an institution of higher education with a commitment to excellence and a diversity of missions, Purdue University values creative endeavor, research, and scholarship; teaching and learning in its many forms; and engagement in its many forms, including extension and outreach for example. To be considered for promotion, a faculty member should have demonstrated excellence and scholarly productivity in at least one of these areas: discovery, learning and engagement. Ordinarily, strength should be manifest in more than one of these areas (para. 2).

Embry-Riddle Aeronautical University (2010) stated:

> Consideration for promotion and tenure of faculty will recognize the importance of teaching, service, and scholarship, viewed as a continuum of activity over time. Therefore, our colleges will develop and administer multiple pathways to tenure and promotion reflecting different combinations of teaching, research, and service (p. 8).

Further, The Ohio State University (2011) stated:

> The awarding of tenure and promotion to the rank of associate professor must be based on convincing evidence that the faculty member has achieved excellence as a teacher, as a scholar, and as one who provides effective service; and can be expected to continue a program of high quality teaching, scholarship, and service relevant to the mission of the academic unit(s) to which the faculty member is assigned and to the university. Promotion to the rank of professor must be based on convincing evidence that the faculty member has a sustained record of excellence in teaching; has produced a significant body of scholarship that is recognized nationally or internationally; and has demonstrated leadership in service (para. 5).

Additionally, Southern Illinois University (SIUC, 1996) stated:

> …therefore, it is essential that its faculty be dedicated to achieving

> excellence in teaching, research/creative activity, and professional contributions to preserve and strengthen the vitality of the university. Academic promotion is awarded to those faculty making continuing contributions in these areas. The preservation of quality requires that all persons recommended for promotion clearly satisfy the general criteria presented herein. Fairness requires that these criteria be applied as uniformly as possible (p. 1).

One common theme appears to emerge among the mentioned policies; teaching, scholarship and service play an important role in the promotion and tenure process.

Teaching, Scholarship and Service Defined

The literature review uncovered a number of varied definitions, used by different academic institutions, for the terms: teaching, scholarship and service. It would appear that universal definitions for teaching, scholarship and service do not exist. However, definitions used by the University of North Carolina Greensboro (UNCG, 2009) employed a large number of terms and activities used in definitions common throughout the literature review and were adopted for the purposes of this study.

Teaching. "Teaching embraces activities related to instruction and learning that occur both inside and outside the classroom, including community-engaged teaching, international experiences, and other diverse modalities and settings" (UNCG, 2009, p. 3).

Scholarship. "Research and creative activities include all forms of discovery and integration of knowledge; the solution of practical problems; critical analyses; the organization, creation, analysis and dissemination of knowledge resources" (UNCG, 2009, p. 3).

Service. Lastly, the service component was defined by UNCG (2009) as such:

> Service embraces activities that sustain the University and enable it to carry out its mission, contributes to the function and effectiveness of the faculty member's profession and discipline, and reaches out to external communities and constituencies, such as government agencies, business, private for-profit and not-for-profit organizations, and arts communities, where academic knowledge intersects with practical affairs and problem solving (p. 3).

Problem Statement

How are specific faculty workload components perceived and valued by collegiate aviation administrators and faculty during the promotion and tenure process? The promotion and tenure process can be difficult to negotiate (Gelmon & Agre-Kippenhan, 2002). Exploring the manner in which collegiate aviation administrators and faculty weigh the importance and/or value of specific workload components during the promotion and tenure process may aid tenure-track faculty in its successful completion.

Purpose Statement

The purpose of this quantitative/descriptive study was to report the collective perceptions of collegiate aviation faculty and administrators regarding the importance, or value of specific faculty workload components typically considered in the promotion and tenure process.

Research Questions

1. How do collegiate aviation faculty and administrators perceive the importance of teaching, scholarship and service in determining an individual's fitness for promotion and tenure?
2. How do collegiate aviation faculty and administrators perceive the value of specific scholarly activities toward successfully completing the promotion and tenure process?

This article will address these and other issues associated with the promotion and tenure process within collegiate aviation.

Literature Review

"[T]enure and promotion decisions are critical to young professionals seeking their first faculty position, continuing faculty members contemplating alternative positions, and students seeking particular emphases in their graduate educations. These criteria (*scholarship, teaching, and service*) define the uniqueness of faculty work…." (Green, 2008, p. 117), thus emphasizing the significance for clarifying these measures in the academic promotion and tenure process.

Examining the Roots of the Tenure and Promotion Process

In 1940, the American Association of University Professors (AAUP) in collaboration with the Association of American Colleges (*now, the Association of American Colleges and Universities*) developed a joint statement of principles with reference to the previous year's academia conference information, which is now known as the *1940 Statement of Principles on Academic Freedom and Tenure* (AAUP, 2006). Further specific revisions to the "statement" were completed in 1990.

Particular to the requirements of tenure, the AAUP *Statement of Principles on Academic Freedom and Tenure* stipulates that:

> After the expiration of a probationary period, teachers or investigators should have permanent or continuous tenure, and their service should be terminated only for adequate cause…Frequently, young faculty members have had no training or experience in teaching, and their first major research endeavor may still be uncompleted at the time they start their careers as college teachers. Under these circumstances, it is particularly important that there be a probationary period - a maximum of seven years under the *1940 Statement of Principles on Academic Freedom and Tenure* - before tenure is granted. Such a period gives probationary faculty members time to prove themselves, and their colleagues time to observe and evaluate them on the basis of their performance in the position rather than on the basis only of their education, training, and recommendations (p. 16).

In 1990, Boyer published *Scholarship reconsidered: Priorities of the professoriate*. His approach to redefining the status-quo in measuring promotion and tenure through the traditional merits of scholarship, teaching, and service has gained support as well as raised questions in trying to further define the specific criteria for a new promotion and tenure process. Boyer's (1990) expansion of the definitions of "scholarship" included: a) scholarship of discovery, b) scholarship of integration, c) scholarship of application, and d) the scholarship of teaching.

Boyer further provided six measures/standards related to this new definition of scholarship. A summary of these standards were reported by Glassick's (2000) review below:

- Clear goals: does the scholar state basic objectives, define the objectives as achievable and realistic, and does the scholar identify important questions for the field?
- Adequate preparation: does the scholar have the understanding, resources, and skills necessary to move an assignment forward?
- Appropriate methods: does the scholar apply effective methods or modify those methods to achieve appropriate goals?
- Significant results: does the scholar's work open avenues for additional research or add to the field of research by obtaining goals in their research?
- Effective presentation: does the scholar effectively and with clarity and integrity, present their own work?
- Reflective critique: does the scholar use appropriate methods to critically evaluate and improve on their own work? (p. 879).

Of all the expanded definitions of scholarship provided by Boyer (1990), the definition of *scholarship of teaching* has been difficult for faculty to distinguish between effective teachings vs. the scholarship of teaching. Glassick (1999) further stated that the former president of the Carnegie Foundation, Lee Shulman, provided the following criteria in order to clarify what scholarship of teaching should include: "a) the work must be made public, b) the work must be available for peer review and critique according to accepted standards, and c) the work must be able to be reproduced and built on by other scholars" (p. 879).

Perceptions of the Workload Components in the Promotion and Tenure Process

In 1997, Emmert and Rollman performed a national study on tenure and promotion standards within the discipline of Communication Arts and Sciences. This study surveyed 169 departments across a variety and range of academic institutions. The initial purpose of this survey was to determine the weighting of scholarship, teaching, service, and evaluation of activities in the tenure and promotion process; secondly, the author's hoped the results of this study would also lead to providing a baseline for faculty planning and assisting administrators in the development of standards for the tenure and promotion process. Responses to workload requirements were based on an academic year.

The results of the study found that teaching loads differed among institutions based on the level of degree offered and ranking of the faculty member. For institutions that only offered bachelor's degrees, departments required faculty members to teach an average of 6.89 courses per academic year. Those with master's programs required faculty to teach an average of 6.41 courses and doctorate programs 5.10 courses per academic year, respectively. Additionally, when evaluating percent time assigned to teaching, scholarship, and service, the authors found that for bachelor degree programs, faculty time assigned to teaching varied from 62-64%, scholarship ranged from 20-22%, and time assigned to service varied between 15-17%. For those institutions responding with master's programs, faculty time assigned to teaching ranged from 52-57%, scholarship 29-31%, and service 15-18%. Further, for responding doctorate degree granting institutions, faculty time assigned to teach varied between 41-43%, scholarship 40-45%, and service 12-18% (Emmert & Rollman, 1997).

Additionally, the study provided a Likert-type scale for rating the importance of activities related to teaching, scholarship, and service. Results for teaching identified the activities that would most likely add credit to the promotion and tenure process include: a) positive teaching evaluations from students and/or peers, b) curriculum development, and c) supervising independent projects or student internships. Activities identified in the scholarship category included: a) publishing articles in regional and national journals, b) serving as an editor or editorial board member on a regional or national journal, c) publishing books, and d) presenting papers at a regional or national conference. Service activities ranked from this study include: a) regularly serving and/or chairing department, college and/or university committees, b) development of on-campus programs that contribute to the enrichment of the department, college, or university, and c) holding office in regional and national organizations.

The authors conclude that based on the results of this study, scholarship, in the form ofpublications and presentations is a significant part of the promotion and tenure process for every faculty member. Another conclusion drawn from this study identified "those department expectations for scholarly output and service activities comparative to teaching loads were not adjusted as much as they should have been. A MANOVA showed no significant effect of teaching load on the expectations for publications, presentations, or service. The author's additionally conducted a one-way analysis of variance in which differences in teaching load showed significance between degree programs, suggesting that teaching load may have contributed to the result on scholarship expectations detected in the MANOVA" (Emmert & Rollman, 1997, p. 16).

In 2007, the Modern Language Association of America (MLA) performed an extensive review of literature covering the evaluation and measure of scholarship under the tenure and promotion process. This study identified 20 recommendations under their charter pertaining to scholarship and the promotion and tenure process. Although most recommendations from this review are discipline specific to the MLA profession, a number of their recommendations apply across all academic professions. A portion of the recommendations include that:

- departments and institutions should practice and promote transparency throughout the tenuring process.
- departments and institutions should calibrate expectations for achieving tenure and promotion with institutional values, mission, and practice.
- departments and institutions should recognize the legitimacy of scholarship produced in new media, whether by individuals or in collaboration, and create procedures for evaluating these forms of scholarship.
- departments should devise a letter of understanding that makes the expectations for new faculty members explicit. The letter should state what previous scholarship will count toward tenure and how evaluation of joint appointments will take place between departments or programs.
- departments and institutions should provide support commensurate with expectations for achieving tenure and promotion (start-up funds, subventions, research leaves, and so forth).
- departments and institutions should establish mentoring structures that provide guidance to new faculty members on scholarship and on the optimal balance of publication, teaching, and service.
- scholarship, teaching, and service should be the three criteria for tenure. Those responsible for tenure reviews should not include "collegiality" as an additional criterion for tenure (MLA, 2007, pp. 63-64).

In support of the last recommendation point provided from this study, the authors state: “the task force agrees with AUUP’s argument on faculty evaluations during the tenure process; in that a ‘fourth’ criterion of inclusion of collegiality, beyond scholarship, teaching and service should not be invoked” (p. 52).

Method

Population

The population for this study was composed of the 232 “professional members” listed on the August, 2010 University Aviation Association (UAA) online Membership Directory (UAA, 2010). The UAA is a professional organization representing the interests of collegiate aviation. UAA membership is composed of 105 collegiate aviation institutions and over 525 individual members (UAA, 2011). Twelve e-mail messages were returned as undeliverable, or the e-mail addresses were invalid. Two-hundred-twenty professional members with valid e-mail addresses were identified as the sample in this study.

Online Survey Instrument

The literature review did not reveal a survey instrument specific to the perceptions of promotion and tenure issues in a collegiate aviation environment. As such, another survey questionnaire addressing perceptions within collegiate aviation developed by Ruiz (2009) was used as a general guide. The study made use of an online survey questionnaire. The online survey instrument was composed of 20 multiple-choice questions with space for additional comments.

A survey validation panel composed of 15 collegiate aviation administrators and tenured/tenure-track faculty members participated in a pilot study used to provide suggestions for improving the construct, accuracy and clarity of the survey questionnaire. The survey instrument was also approved by the Southern Illinois University Carbondale (SIUC) Human Subjects Committee. A copy of the final draft of the survey used in this study can be found in the appendix.

Data Collection

Two-hundred-twenty UAA professional members with valid e-mail addresses were contacted via e-mail and invited to participate in the research study. The survey data collection period spanned six months. Two survey reminder e-mail messages were sent in three-month intervals to all 220 study participants. Eighty-seven complete, useable survey responses were used to gather research data. The survey response rate was 39.5%. Given the size of the population, a 39.5% response rate allows for a 95% degree of certainty (with a +/- 10% margin of error) that responses are accurately representing the population (GreatBrook, 2007).

Data Analysis

Quantitative descriptive research methods were used to analyze and report data collected in this study. "*Quantitative descriptive research* uses quantitative methods to describe *what is*, describing, recording, analyzing, and interpreting conditions that exist**"** (Best & Kahn, 1993, p. 26). Means, frequencies and standard deviations were calculated and used to analyze aggregate data.

Results

Demographics

The survey respondents represent a cross-section of 4-year collegiate aviation institutions and faculty. Seventy-eight of the survey respondents were faculty members of all ranks (assistant, associate, and full), and twenty-two percent of the survey respondents were in an administrative position such as a department chairperson or similar position. The faculty rank of the chairpersons was not identified in the survey. Sixty percent of the survey respondents were tenured at their institution.

Only survey respondents from 4-year institutions are included in this report. Eighty-four percent of the survey institutions have a graduate program. Over one-third of the institutions (39%) were doctoral granting with a Carnegie Foundation classification as "high" or "very high" research activity. Eighteen percent were doctorate/research universities. Approximately, one quarter of the institutions (27%) were non-research intensive and 16% of the respondents did not know their institution's Carnegie Foundation classification.

Survey responses were grouped in five categories based on the number of students in the institution of the survey respondents, and then an aggregate of all responses. The groupings are: Less than 10,000; Between 10,000 and 20,000; Between 20,000 and 30,000; Between 30,000 and 40,000; Greater than 40,000. Slightly less than one-half survey respondents are at institutions that have student populations of 20,000 or less. One-fifth of the survey respondents are at institutions that have more than 30,000 students. The largest group of survey respondents were from institutions with less than 10,000 students or between 30,000 and 40,000 students, each representing 29% of the total.

Scholarship, Teaching, Service

Survey respondents were asked to rank their perceived value of the three pillars of promotion and tenure – Scholarship, Teaching, Service – on the following scale: Not Important = 1; Minimally Important = 2; Somewhat Important = 3; Important = 4; Very Important = 5.

When it comes to the perception of scholarship and teaching - size matters. Scholarship is perceived as the most important pillar in institutions greater than 30,000 students, while teaching is perceived as the most valuable pillar in institutions with less than 10,000 students. Service is perceived as the least important of the three pillars in all groups (see Table 1). The next several sections break down each pillar in more detail based on *size of institution* (number of students reported/enrolled/attending).

Scholarship. Each institutional size group had responses rating scholarship as "Very Important." However, *every* survey respondent from institutions with greater than 40,000 students rated scholarship as "Very Important." In the Between 30,000 and 40,000 groups, *no* survey respondent rated scholarship less than "Somewhat Important," and 80% rated scholarship as "Very Important." The average rating for scholarship by the two groups was 5.00 and 4.70 respectively.

Less than 25% of the survey respondents from institutions with less than 10,000 students rated scholarship as "Very Important." The average rating was 3.36. The average rating for the Between 10,000 to 20,000 groups increased significantly to 4.53, but still lower than the average of the largest groups.

Table 1. *Perceived Importance of the Three Standard Pillars of Promotion and tenure*

	Scholarship	Teaching	Service
Size of Institution by Enrollment	*M (SD)*	*M (SD)*	*M (SD)*
Less than 10,000	3.36 (1.32)	4.44 (1.23)	3.68 (1.14)
Between 10,000 and less than 20,000	4.53 (1.07)	3.88 (1.41)	2.88 (1.11)
Between 20,000 and less than 30,000	4.36 (0.99)	4.48 (0.82)	3.44 (1.16)
Between 30,000 and less than 40,000	4.70 (0.67)	3.60 (0.84)	2.80 (0.63)
Greater than 40,000	5.00 (0.00)	4.00 (1.41)	3.44 (1.51)
All Responses	4.18 (1.19)	4.22 (1.16)	3.33 (1.17)

When asked if scholarship is a critical gauge in determining an individual's fitness for promotion and tenure 61% of the survey respondents either agreed or strongly agreed. However, 26% of survey respondents disagreed or strongly disagreed. Survey respondents from the smaller institutions had a higher percentage of disagree and strongly disagree responses (see Table 2).

Table 2. *Scholarship is a Critical Gauge in Determining an Individual's Fitness for Promotion and tenure*

Size of Institution by Enrollment	Strongly Agree	Agree	Disagree	Strongly Disagree	Neither
Less than 10,000	3	8	4	2	8
Between 10,000 and less than 20,000	5	6	6	0	0
Between 20,000 and less than 30,000	4	10	4	5	2
Between 30,000 and less than 40,000	3	5	1	0	1
Greater than 40,000	3	4	1	0	0
All Responses	19	34	16	7	11

The perceived value of each scholarly activity in each size category was fairly uniform throughout size groupings. The highest ranked scholarly activity was a peer-reviewed journal article with an average ranking of 4.60. Publishing a book was ranked second highest with an average ranking of 4.55. The only other scholarly activity that was ranked above "Valued" was an externally funded grant with an average ranking of 4.41. Publishing a chapter in a book was ranked slightly below "Valued," however only two of the five groups ranked it above 4.0 and then by only a small amount.

Survey respondents were asked to assign a value to a variety of scholarly activities using the following scale: Not valuable = 1; Very Little Value = 2; Somewhat of Value = 3; Valued = 4; Most Valued = 5. Peer-reviewed abstract, conference proceedings, etc. (M = 3.61), conference/professional presentation (M = 3.54), member of peer-reviewed journal panel (M = 3.45), and internally funded grant (M = 3.34) were all ranked in the middle of "Somewhat of Value" and "Valued" (3.00 and 4.00). The lowest ranked scholarly activities were consultantship (M = 2.73), research posters (M = 2.68), book review (*M* = 2.62), non-peer reviewed abstract, conference proceedings, etc. (*M* = 2.54), and non-peer reviewed journal article (*M* = 2.45). All were ranked lower than "Somewhat of Value" (3.00).

Publication Venues. Survey respondents were asked to rank specific publication venues using the following scale: Not Valuable = 1; Very Little Value = 2; Somewhat of Value = 3; Valued = 4; Most Valued = 5.

There were four publication venues that had an average ranking in every size group of greater than "Valued" (4.0). The highest ranked publication venue was the *Collegiate Aviation Review* (CAR) with an average ranking of 4.36, although the survey respondents from the largest institutions preferred the *Journal of Aviation/Aerospace Education and Research* (JAAER), the *International Journal of Applied Aviation Studies* (IJAAS), and the *Journal of Air Transportation* (JAT). The *Journal of Aviation Management and Education* (JAME) was the only other publishing venue with an average ranking of 4.0 or greater from all size groups. The *International Journal of Professional Aviation Training and Testing Research* (IJPATTR) had one size group rank it below 4.0, but the journal's overall average ranking was 4.14.

Three publication venues had an average ranking below 4.0, but greater than 3.00. The *International Journal of Safety Across High-Consequence Industries* had two size groups give it an average ranking about 4.0, but the overall average ranking was 3.81. The *Academic and Business Research Institution* (AABRI) and the *American Technical Education Association* (ATEA) were ranked below 3.0 by the Greater than 40,000 group; however their overall average ranking was 3.40 and 3.35 respectively.

The lowest ranked publication venues were an aviation trade magazine article and a non- peer reviewed journal publication with average rankings of below 3.0. Their rankings were 2.85 and 2.45 respectively.

Single versus multi-authored publications. Less than 50% of survey respondents indicated that a single-author publication is more valuable for achieving promotion and tenure than a multi-author publication; although 41% of the survey respondents indicated that single and multi-author publication are weighted equally in the promotion and tenure decision.

In the case of a multi-author publication 60% of the survey respondents agreed that being identified as the first author is more valuable in the promotion and tenure process.

When a publication is multi-authored, over 60% of the survey respondents indicated that the authors do not need to identify what percentage each author contributed to the publication. Less than 20% of the survey respondents said that identifying the contribution percentage was required.

Geographical location of a scholarly venue. Survey respondents were asked to rank the geographical location of a scholarly venue using the following scale: Not Valuable = 1; Very Little Value = 2; Somewhat of Value = 3; Valued = 4; Most Valued = 5.

There is agreement between all size classes that scholarship activity in the National and International arena is the most important geographical venue toward successfully achieving promotion and tenure. The overall average ranking for each venue was greater than “Valued” (4.0) with average rankings of 4.41 and 4.32 respectively. The Regional venue average ranking was slightly lower than “Valued” (M = 3.82). The least valuable venue from scholarship activity was the local venue, with an average ranking of 3.06. However, the survey respondents from smaller institutions placed a higher value on the local venue than did survey respondents from larger institutions. Survey respondents from institutions of less than 30,000 students ranked the local venue, on average, about 3.00, or “Somewhat of Value.” While survey respondents from institutions greater than 30,000 students ranked the local venue, on average, midway between “Very Little Value” and “Somewhat of Value.”

Teaching. The perception of the importance of teaching to the promotion and tenure process was the inverse of the perception of scholarship, although the difference in averages was less. Smaller schools perceived teaching as more important than did the larger schools. Over 75% of the survey respondents from institutions with less than 10,000 students rated teaching as “Very Important.” The average rating for this group was 4.44. Only 27% of the survey respondents from the largest institutions rated teaching as “Very Important.” The group that valued teaching the most was the survey respondents from institutions with between 20,000 and 30,000 students, with an average of rating 4.48.

Most institutions base teaching evaluation either wholly or in-part on an evaluation of classroom instruction (Phillips, 1997). Student evaluation is the most common method of evaluating classroom instruction. Ninety percent of the survey respondents listed that classroom instruction is evaluated by students. Classroom instruction evaluated by other faculty members or peers was listed in slightly over half of the survey responses. Evaluation performed by Chairpersons of the department/program was indicated as the least common method of classroom instruction evaluation.

Although most of the evaluation of teaching ability was based on classroom instruction evaluation, the perception of the fairness and accuracy of the evaluation is questioned. Of the survey responses either agreeing or disagreeing that the statement that the methods of evaluation classroom instruction at their institution are fair and accurate, 41% of the survey respondents either agreed or strongly agreed and 41% disagreed or strongly disagreed. Regardless of the perceived fairness and accuracy of the classroom evaluation methods, and thus the evaluation of teaching, 86% of the survey respondents agreed or strongly agreed with the statement that teaching performance is a critical gauge in determining an individual’s fitness for promotion and tenure (see Table 3).

Service. The perception of service to promotion and tenure was the lowest rated pillar in all size groupings. Overall service was only rated as "Somewhat Important" with a M = 3.33. Even with the low ranking service was still perceived as critical in the promotion and tenure process (see Table 1 above).

The survey differentiated service into three areas: Professional, University/Institutional, and Community. Professional service was perceived as critical for promotion and tenure by 68% of the survey respondents. Only 11% of the survey respondents disagreed or strongly disagreed with the statement that professional service is a critical gauge in determining an individual's fitness for promotion and tenure (see Table 4).

The perception of university/institutional service is also perceived as critical for promotion and tenure, but not quite as strong as professional service. Sixty-five percent of those who responded to this element indicated that university/institutional service was critical. Seventeen percent either disagreed or strongly disagreed with the statement that university/institutional service is a critical gauge in determining an individual's fitness for promotion and tenure.

Community service was perceived as the least valuable type of service for promotion and tenure. Forty-three percent of those who responded to this element either agreed or strongly agreed with the statement that community service is a critical gauge in

Table 3. *Teaching Performance is a Critical Gauge in Determining an Individual's Fitness for Promotion and tenure*

Size of Institution by Enrollment	Strongly Agree	Agree	Disagree	Strongly Disagree	Neither
Less than 10,000	14	9	0	1	0
10,000 to less than 20,000	10	6	0	1	0
20,000 to less than 30,000	12	9	1	2	1
30,000 to less than 40,000	4	5	0	0	1
Greater than 40,000	1	4	1	1	1
All Responses	42	33	2	5	3

determining an individual's fitness for promotion and tenure. Thirty-one percent disagreed or strongly disagreed with the statement.

Annual promotion and tenure progress and/or review

The final element of the survey asked respondents if annual promotion and tenure progress and/or reports were done at their institutions. Most survey respondents who responded to this element, 66%, indicated that their institutions did an annual evaluation of probationary (tenure track) faculty. However, 26% of those who responded to this element said their institution did not evaluate probationary faculty.

Discussion

Respondents indicated that Teaching (M = 4.22) was slightly more "important" than Scholarship (M = 4.18) toward successfully achieving promotion and tenure at their institution. Respondents also reported that Service was viewed as "somewhat important" (M = 3.33) in the pursuit of promotion and tenure. Additional results will be discussed by category in the following three sections: Scholarship, Teaching and Service.

Table 4. *Professional Service is a Critical Gauge in Determining an Individual's Fitness for Promotion and tenure*

	Strongly Agree	Agree	Disagree	Strongly Disagree	Neither
Size of Institution by Enrollment					
Less than 10,000	3	17	1	2	2
10,000 to less than 20,000	2	10	2	0	3
20,000 to less than 30,000	1	14	3	1	6
30,000 to less than 40,000	0	7	0	0	3
Greater than 40,000	2	1	1	0	4
All Responses	8	51	7	3	18

Scholarship

Scholarship was viewed as an important component toward successfully achieving promotion and tenure. However, it was viewed as "important" (*M* = 4.64) among larger institutions (greater than 10,000), and appears to carry less weight among smaller institutions (*M* = 3.36).

In many cases, scholarship was considered a critical gauge in determining an individual's fitness for promotion and tenure. Sixty-one percent of respondents "strongly agreed" (22%) or "agreed" (39%) with the statement, "Scholarship is a critical gauge in determining an individual's fitness for promotion and tenure." Twenty-six percent of respondents "strongly disagreed" (8%) or "disagreed" (18%) with the statement. Thirteen percent of respondents were neutral on the topic.

All scholarly activities were viewed as possessing some level of value. However, three scholarship activities were viewed as having greater "value" toward successfully achieving promotion and tenure requirements: a "Peer-Reviewed Journal Article" (*M* = 4.60), "Publishing a Book" (*M* = 4.55) and an "Externally Funded Grant" (*M* = 4.41). Other research activities were viewed as having "very little value" or being "somewhat of value".

All mentioned publishing venues were perceived as possessing some level of value. However, six publications were identified as having the most "value" toward successfully achieving promotion and tenure requirements: *Collegiate Aviation Review* (CAR) (*M* = 4.36), *Journal of Aviation/Aerospace Education and Research* (JAAER) (*M* = 4.33), *International Journal of Applied Aviation Studies* (IJAAS) (*M* = 4.32), *Journal of Air Transportation* (JAT) (*M* = 4.31), *Journal of Aviation Management and Education* (JAME) (*M* = 4.20) and *International Journal of Professional Aviation Training and Testing Research* (IJPATTR) (*M* = 4.14).

Based on the data, a definitive conclusion regarding the value of a single-author publication versus a multi-author publication in achieving promotion and tenure could not be determined. Slightly less than 50% of respondents considered a single-author publication more valuable than a multi-author publication. Eight percent of respondents did not believe that was the case; 41% of respondents felt that single-author and multi-author publications were weighed equally and 1% of respondents indicated that they did not know.

Being identified as first author in a multi-author publication was considered more valuable than other authorships toward achieving promotion and tenure. Sixty percent of respondents believed that being identified as the first author in a multi-author publication was more valuable than other authorships. Thirteen percent of respondents did not agree with that view; 22% of respondents felt that all authorships in a multi-author publication possessed equal value. Five percent of respondents indicated that they did not know.

Respondents indicated that they were not required to report percentages of effort/contribution made in the development of a multi-author publication. Sixty-two percent of respondents indicated that they were not required to report percentages of effort/contribution made in the development of a multi-author publication. Twenty percent of respondents indicated that authors in a multi-author publication were required to report percentages of individual effort/contribution; and 18% reported that they did not know.

All geographical venues are viewed as possessing some level of value toward successfully achieving promotion and tenure. However, respondents indicated that a scholarship activity conducted in a National (M= 4.41) or International (M= 4.32) venue had greater value in achieving promotion and tenure. Regional (M= 3.82), state (M= 3.51), and local (M= 3.06) venues were perceived as being “somewhat of value.”

Teaching

The majority of respondents viewed Teaching as a critical gauge in determining an individual’s fitness for promotion and tenure. Eighty-eight percent of respondents “strongly agreed” (49%) or “agreed” (39%) with the statement, “Teaching performance is a critical gauge in determining an individual’s fitness for promotion and tenure.” Eight percent of respondents “strongly disagreed” (6%) or “disagreed” (2%) with the statement. Four percent of respondents were neutral on the topic.

Seventy-eight respondents indicated that students played the largest role in classroom instructional evaluation. Respondents also reported that Peers/Faculty (44) and Chairpersons (27) were perceived as playing a significant, but smaller role in instructional evaluation.

Base on the data, a definitive conclusion regarding the fairness and accuracy of classroom instructional evaluation could not be conducted. Forty-one percent of respondents “strongly agreed” (2%) or “agreed” (39%) with the statement, “The methods used for evaluating classroom instruction at my institution are fair and accurate.” Forty-one percent of respondents “strongly disagreed” (12%) or “disagreed” (29%) with the statement. Eighteen percent of respondents were neutral on the topic.

Service

The majority of respondents viewed all three categories of service (Professional, University and Community) as a critical gauge in determining an individual’s fitness for promotion and tenure. However, the value placed on community service was somewhat mixed.

Sixty-eight percent of respondents "strongly agreed" (9%) or "agreed" (59%) with the statement, "Professional service is a critical gauge in determining an individual's fitness for promotion and tenure." Eleven percent of respondents "strongly disagreed" (3%) or "disagreed" (8%) with the statement. Twenty-one percent of respondents were neutral on the topic.

Slightly more than 65% of respondents "strongly agreed" (8%) or "agreed" (58%) with the statement, "University/institutional service is a critical gauge in determining an individual's fitness for promotion and tenure." Seventeen percent of respondents "strongly disagreed" (4%) or "disagreed" (13%) with the statement. Seventeen percent of respondents were neutral on the topic.

Forty-three percent of respondents "strongly agreed" (5%) or "agreed" (38%) with the statement, "Community service is a critical gauge in determining an individual's fitness for promotion and tenure." Thirty-one percent of respondents "strongly disagreed" (7%) or "disagreed" (24%) with the statement. Twenty-six percent of respondents were neutral on the topic.

The results of this quantitative descriptive research study re-affirm the notion that perceptions of faculty workload items used to determine fitness for promotion and tenure are not uniform throughout collegiate aviation. One perception reported as a constant was the belief that all "three pillars," scholarship, teaching and service, possessed some degree of importance in the promotion and tenure process. Respondents indicated that Teaching (M = 4.22) was slightly more "important" than Scholarship (M = 4.18) toward successfully achieving promotion and tenure at their institution. Respondents also reported that Service was viewed as "somewhat important" (M = 3.33) in the pursuit of promotion and tenure.

Respondents reported that all scholarly activities were perceived as possessing some level of value. However, three scholarly activities were viewed as having greater "value" toward successfully achieving promotion and tenure requirements: a "Peer-Reviewed Journal Article" (M = 4.60), "Publishing a Book" (M = 4.55) and an "Externally Funded Grant" (M = 4.41). Other research activities were viewed as having "very little value" or being "somewhat of value". This study determined that collegiate aviation administrators and faculty perceive specific workload components and scholarly activities as possessing greater value than others in successfully completing the promotion and tenure process. This knowledge can serve to guide probationary faculty members in the conduct of their scholarly effort.

Recommendations

The following recommendations for future research are provided:

- Conduct a research study comparing the perceptions of administrators versus faculty on the topic of promotion and tenure.
- Conduct a research study that compares the promotion and tenure perceptions of administrators and faculty from non-aviation institutions with that of like individuals from "aviation specific" institutions.
- Conduct a research study that reports the perceptions of administrators and faculty on the topic of promotion and tenure at two-year collegiate aviation institutions.

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Appendix

Promotion and/or Tenure Perceptions at Collegiate Aviation Institutions

The purpose of this survey is to examine the perceptions of aviation faculty and chairpersons regarding components of the tenure and/or promotion process at collegiate aviation institutions.

Instructions

Response to this survey should be based on YOUR opinions/perceptions - not the opinions/perceptions of others. This survey <u>does not require</u> short narrative responses; however, space has been provided on several questions, if needed. The survey should require no more than 15 minutes of your time. Your assistance is greatly appreciated!

Questions 1 through 5 address survey participant's demographic information.

1. My current position in the aviation academic field is:

Choose one of the following answers:

- ○ Department Chairperson (or similar position)
- ○ (Full) Professor (faculty)
- ○ Associate Professor (faculty)
- ○ Assistant Professor (faculty)
- ○ Other

2. I am considered in my aviation academic institution as:

Choose one of the following answers:

- ○ Tenured
- ○ Not Tenured

3. My collegiate aviation academic institution is categorized under the Carnegie Foundation as a:

Choose one of the following answers:

- ○ Doctorate-granting Research University ("very high" research activity)
- ○ Doctorate-granting Research University ("high" research activity)
- ○ Doctoral/Research University
- ○ Non-research intensive institution
- ○ I do not know

4. My collegiate aviation academic institution is a:

Choose one of the following answers:

- ◯ 4-year institution with a graduate program
- ◯ 4-year institution without a graduate program
- ◯ 2-year institution
- ◯ I do not know
- ◯ Other

5. Approximately, how many students attend your collegiate institution?

Choose one of the following answers:

- ◯ Less than 10,000
- ◯ Between 10,000 and up to 20,000
- ◯ Between 20,000 and up to 30,000
- ◯ Between 30,000 and up to 40,000
- ◯ Greater than 40,000 students
- ◯ I do not know

Questions 6 through 20 address your perceptions of Scholarship, Teaching and Service in the Promotion and Tenure Process.

Survey Definitions

Scholarship **is defined as the advancement of the aviation discipline body of knowledge through the performance of research and creative activities in the field of aviation.**

Teaching **is defined as any instruction or instruction-related activity.**

Service **is defined as voluntary activity that serves to assist and promote the institution, profession, and local community.**

6. Identify the importance of each of the following workload components toward successfully achieving promotion and/or tenure requirements at your institution.

(Not Important =1, Minimally Important-2, Somewhat Important=3, Important=4, Very Important=5)

Please choose the appropriate response for each item:

	1	2	3	4	5
Scholarship	◯	◯	◯	◯	◯
Teaching	◯	◯	◯	◯	◯
Service	◯	◯	◯	◯	◯

7. Assign a value to each of the following scholarship activities provided below.

How valuable are each of the following scholarly activities weighted toward successfully achieving promotion and/or tenure requirements at your institution?

(Not Valuable=1, Very Little Value=2, Somewhat of Value=3, Valued=4, Most Valued=5)

Please choose the appropriate response for each item:

	1	2	3	4	5
Aviation trade magazine article	○	○	○	○	○
Book review	○	○	○	○	○
Conference/Professional presentation	○	○	○	○	○
Consultantship	○	○	○	○	○
Externally funded grant	○	○	○	○	○
Internally funded grant	○	○	○	○	○
Research posters	○	○	○	○	○
Member of peer-reviewed journal panel	○	○	○	○	○
Non-peer reviewed abstract, conference proceedings, etc.	○	○	○	○	○
Non-peer reviewed journal article	○	○	○	○	○
Peer-reviewed abstract, conference proceedings, etc.	○	○	○	○	○
Peer-reviewed journal article	○	○	○	○	○
Publishing a book	○	○	○	○	○
Publishing a chapter in a book	○	○	○	○	○

7a. If there are additional scholarship activities that you feel should be added to the list in question 7 above, please provide those activities and rank them in accordance with question 7 above.

Please write your answer here:

8. Assign a value to each publication venue provided below.

How valuable is an article published in one of the following publication venues weighted toward successfully achieving promotion and/or tenure requirements at your institution?

(Not Valuable=1, Very Little Value=2, Somewhat of Value=3, Valued=4, Most Valued=5)

Please choose the appropriate response for each item:

	1	2	3	4	5
Academic and Business Research Institution (AABRI)	○	○	○	○	○
American Technical Education Association (ATEA)	○	○	○	○	○
Aviation trade magazine article	○	○	○	○	○
Collegiate Aviation Review (CAR)	○	○	○	○	○
International Journal of Applied Aviation Studies (UAAS)	○	○	○	○	○
International Journal of Professional Aviation Training and Testing Research (UPATTR)	○	○	○	○	○
The International Journal of Safety across High-Consequence Industries	○	○	○	○	○
Journal of Air Transportation (JAT)	○	○	○	○	○
Journal of Aviation/Aerospace Education and Research (JAAER)	○	○	○	○	○
Journal of Aviation Management and Education (JAME)	○	○	○	○	○
Non-peer reviewed journal publications	○	○	○	○	○
Other	○	○	○	○	○

8a. If there are additional publication venues that you feel should be added to the list in question 8 above, please provide those venues and rank them in accordance with question 8 above.

Please write your answer here:

9. Do you consider a single-author publication more valuable than a multi-author publication in achieving promotion and/or tenure at your institution?

Choose one of the following answers:

○ Yes
○ No
○ A single-author publication and a multi-author publication possess the same value
○ I do not know

10. Do you believe that being identified as the first-author in a multi-author publication is more valuable than other authorships in achieving promotion and/or tenure at your institution?

Choose one of the following answers:

- ◯ Yes
- ◯ No
- ◯ All authorships possess equal value
- ◯ I do not know

11. Are authors in multi-author publications required to report percentages of individual effort/contribution made in the development of the publication during the promotion and/or tenure process at your institution?

Choose one of the following answers:

- ◯ Yes
- ◯ No
- ◯ I do not know

12. Assign a value to each scholarship venue provided below.

How valuable is a scholarship activity in one of the following venues toward successfully achieving promotion and/or tenure requirements at your institution?

(Not Valuable=1, Very Little Value=2, Somewhat of Value=3, Valued=4, Most Valued=5)

Please choose the appropriate response for each item:

	1	2	3	4	5
International	◯	◯	◯	◯	◯
Local	◯	◯	◯	◯	◯
National	◯	◯	◯	◯	◯
Regional	◯	◯	◯	◯	◯
State	◯	◯	◯	◯	◯

13. Do you agree or disagree with the following statement?

"Scholarship is a critical gauge in determining an individual's fitness for promotion and/or tenure."

Choose one of the following answers:

- Strongly Disagree
- Disagree
- Neither
- Agree
- Strongly Agree

13a. Please provide any comments you may have relating to question 13 above.

Please write your answer here:

14. Do you agree or disagree with the following statement in the promotion and/or tenure process?

"The methods used for evaluating classroom instruction at my institution are fair and accurate."

Choose one of the following answers:

- Strongly Disagree
- Disagree
- Neither
- Agree
- Strongly Agree

14a. Please provide any comments you may have relating to question 14 above.

Please write your answer here:

15. How is classroom instruction evaluated at your institution?

Check any that apply:

- ☐ Instructional evaluation (performed by students)
- ☐ Instructional evaluation (performed by peers/faculty)
- ☐ Instructional evaluation (performed by chairperson)
- ☐ I do not know

15a. Please provide any comments you may have relating to question 15 above.

Please write your answer here:

16. Do you agree or disagree with the following statement?

"Teaching performance is a critical gauge in determining an individual's fitness for promotion and/or tenure."

Choose one of the following answers:

- ○ Strongly Disagree
- ○ Disagree
- ○ Neither
- ○ Agree
- ○ Strongly Agree

16a. Please provide any comments you may have relating to question 16 above.

Please write your answer here:

17. Do you agree or disagree with the following statement?

"Professional service is a critical gauge in determining an individual's fitness for promotion and/or tenure."

Choose one of the following answers:

- ○ Strongly Disagree
- ○ Disagree
- ○ Neither
- ○ Agree
- ○ Strongly Agree

17a. Please provide any comments you may have relating to question 17 above.

Please write your answer here:

18. Do you agree or disagree with the following statement?

"University/institution service is a critical gauge in determining an individual's fitness for promotion and/or tenure."

Choose one of the following answers:

- ○ Strongly Disagree
- ○ Disagree
- ○ Neither
- ○ Agree
- ○ Strongly Agree

18a. Please provide any comments you may have relating to question 18 above.

Please write your answer here:

19. Do you agree or disagree with the following statement?

"Community service is a critical gauge in determining an individual's fitness for promotion and/or tenure."

Choose one of the following answers:

- ○ Strongly Disagree
- ○ Disagree
- ○ Neither
- ○ Agree
- ○ Strongly Agree

19a. Please provide any comments you may have relating to question 19 above.

Please write your answer here:

20. Do you agree or disagree with the following statement?

"Probationary (tenure track) faculty members at my institution receive annual promotion and tenure progress and/or reviews."

Choose one of the following answers:

- ○ Yes
- ○ No
- ○ I do not know

20a. Please provide any comments you may have relating to question 20 above.

Please write your answer here:

Thank you for completing this survey.

That Used to Be Us: Through the Eyes of the Aviation Industry

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Abstract

The U.S. economic success was rooted in an industrial policy which had five pillars of a prosperity formula that served as a catalyst for development and growth: 1) public/private cooperation on education, 2) immigration policy, 3) infrastructure, 4) risk/capital management, and 5) government-funded scientific research. In this paper, the development and growth of the aviation industry is viewed in the framework of such a prosperity formula in order to face the four areas that the entire economy will need to face in the current market in order to be competitive in the global market in the 21st century. Since the aerospace and aviation industry is an integral part of the US economy, it stands that those elements will also challenge the aviation industry's future. Considering the economic history of the industry and the prosperity formula, the industry has opportunities for not only normal growth but potentially can be used as a catalyst for industry health, significance and renewal in the future as well as the indirect aviation-related industries. It is clear that further research and thought are needed to provide pathways to meet the four economic challenges in the aviation sector identified in this paper. It is hoped that this paper will serve as a foundation for that research.

Introduction

Thomas Friedman is an award winning American Pulitzer Prize foreign policy journalist who spent a large portion of his career since 2000 writing about globalization and economic growth. Friedman's 2011 book with co-author Michael Mandelbaum, *That Used To Be Us*, presents a five-part formula for success derived from U.S. economic history and advocates this formula as a vehicle for future economic growth against current challenges (Friedman & Mandelbaum, 2011).

According to Friedman and Mandelbaum (2011), U.S. economic success was rooted in an industrial policy which had five pillars of a prosperity formula that served as a catalyst for development and growth: 1) public/private cooperation on education, 2) immigration policy, 3) infrastructure, 4) risk/capital management, and 5) government-funded scientific research. The authors argue that collectively, the five pillars are at a cross roads and current trends do not bode well for U.S.'s economic future. Worse, no one pillar had reached a point of criticality that would spur immediate action and reversal (Issacson, 2011).

In this paper, the development and growth of the aviation industry is viewed in the framework of Friedman and Mandelbaum's (2011) prosperity formula and also presents four areas that the entire economy, and certainly the aviation industry will need to face in the current market in order to be competitive in the global market in the 21st century.

Quantifying the Aerospace and Aviation Industry

Customarily the entire aviation industry is divided into two major subcategories, aerospace and aviation. The aerospace industry is defined as the manufacture of general, commercial, and military aircraft, and related products such as spacecraft and missiles. Aviation is a shorthanded way of referring to air transportation that includes the operation of scheduled commercial airlines, freight operations, and nonscheduled passenger and freight air transportation (Aerospace Industries Association of America, 2011; Bureau of Economic Analysis, 2011).

It is safe to say that the aviation industry did not have a large place in the U.S. economy before the Wright Brothers flew at Kitty Hawk in 1903. The industry was not really an industry at all but a collection of enthusiasts and scientists. The Bureau of Economic Analysis (BEA) accounts of economic output began breaking out data by industry in 1947. In 1947, aerospace manufacturing was lumped into the aggregate manufacturing accounts and air transportation did not even exist as a subaccount. The distinctions and importance of separate economic data between aerospace and aviation industries probably began during the industrial military buildup from the Cold War, which also coincided with a maturing air transportation industry. Air transportation output was specifically broken out from the transportation accounts in the BEA for the first time in 1977. In 1977, aerospace and aviation accounted for only 1.5% of the US economy. By 2010, the US aerospace and aviation industry was 0.8% of the total U.S. employment and contains one of the last remaining strong manufacturing sectors of the US economy; however, recent trends in this industry show that the industry is declining (Aerospace Industries Association of America, 2011; United States Department of the Labor, 2011).

Evidence of the Five Pillars in the Industry’s Development

Public/Private Cooperation on Education. When World War I ended, the future aviation industry was highly uncertain as many government contracts were cancelled and companies liquidated to leave the industry operating at only 10% of its wartime peak. The industry needed to refocus away from a military product to develop a commercial product demanded in the ensuing peacetime. The Manufacturers Aircraft Association, headed by Samuel S. Bradley, embarked on the 1919 version of the modern day “Got Milk” campaign by publishing the Aircraft Year Book, in order to educate the public and promote flying.

By the time Mingos (1930) wrote a historical commentary on the birth of the aviation industry, he noted that a great industry had grown from aviation enthusiasts. Since industry output breakdown was not available, the only way to estimate what portion of the economy was devoted to aviation production was by the number of workers employed in the industry. At the end of World War I, 175,000 workers or 0.4% of the U.S. labor force was directly employed by the aviation industry (Mingos, 1930; United States Department of the Labor, 2011). Aviation had gone from a cottage industry to an identifiable industry of 24 aircraft companies representing a $23 million capital investment that was intertwined with 75 different industries within 21 months during World War I. The initial push for the organization of the industry, technological cooperation, patent royalty sharing agreement, and product demand came via the US Government as a direct involvement in World War I, but was buoyed by the private industrial association's education and promotional campaign of aviation.

Formal flying schools were also established in the 1920s, but it was the experience of World War II that drastically expanded not only the military pilot training programs but also the private schools that were contracted by the government. This educational push strengthened the advancement and development of the industry. When World War II was over, military pilots came home and helped fuel the general aviation expansion to five times what it was prior to the war (McCurry, 2000).

Numerous isolated aviation educational experiences began at the University level before the Wright Brother's first flight. The early beginnings of formal aerospace education programs began before 1920 with the first master's degree awarded at Massachusetts Institute of Technology (MIT) in aeronautical engineering and the first Department of Aeronautics was established at the University of Michigan. Others soon followed. Beginning in 1925, the Guggenheim Foundation, a private institution, also contributed much to the development of early programs in aeronautical engineering. In the 1940s, the number of aerospace engineering programs rapidly expanded as a result of World War II and these programs were substantially subsidized by the government. (American Institute of Aeronautics and Astronautics, 2009; McCormick, 2004).

Many argue that the achievement of manned flight would have occurred sooner with better communication between the practitioners' experiments and the theoreticians (Kiernan, 2011b; McCormick, 2004) . It is difficult to determine which came first, education or industry. Air transportation had just begun to take-off as more respected aerospace educational programs became established. This formalized transfer of knowledge, research results and educational discovery with industry began to take place with the establishment of formal aeronautical educational programs and helped fuel the development of the industry. As more aerospace technology was created, a myriad of aviation uses became available which were not considered before. But just as important, as necessity presented itself, academic researchers rose to the occasion to solve the aeronautical technological challenges that were discovered by practice.

Current aerospace and aviation educational programs are available within academic institutions, military institutions, and institutions that evolved from proprietary schools.

The proprietary schools are a mix of public and private providers and given the nature of government supported financial programs, many times they overlap. The discipline of engineering (all fields) conferred 7.7% of the total bachelor's and 8.5% of all master's degrees awarded in the U.S. in 2009 (National Center for Education Statistics, 2010). Aeronautical engineering graduates grew 44% in 2009 and the field remains one of the top paying industries for master's degree graduates (National Center for Education Statistics, 2010).

Immigration Policy. It is difficult to trace the specific contribution of the nation's immigration policy to the development of the aviation industry. The United States is from origin, an immigrant country and had a relatively open-door policy until the surge of immigrants after World War I. At that time, the numbers of immigrants allowed into the country was managed by the government (United States, Senate Congressional Budget Office, 2006). One would expect the aviation industry to exhibit a stamp of notable immigrants. Fry (2003) claims the Scots have placed their mark on the aviation and aerospace industry. Notable aviation pioneers with Scottish decent including Samuel Pierpont Langley; Allan and Malcolm Loughead (founders of Lockheed Inc.); Donald Wills Douglas, Sr. (first commercial airplane in 1921 and others later); James Smith McDonnell (founder of McDonnell, manufacturer of military aircraft); and Dr. John Watret (Chief Academic Officer and Executive Vice President of Embry Riddle Aeronautical University) (Embry Riddle Aeronautical University, 2011; Fry, 2003).

The aerospace industry also benefitted from a national security immigration policy after World War II. The War Department, circumventing State Department regulations, brought in numerous German scientists while the U.S. was still at war with Japan. After the War, the State Department allowed limited immigration of critical scientists who met certain criteria. Initially, immigrant scientists could not be members of the Nazi party, but later it was decided that this criterion was too restrictive. Many felt the only reparations the U.S. was likely to receive were the intellectual reparations of Germany's "rare minds". Additionally, it soon became a mixture of wanting the knowledge and wanting to deny the knowledge to the Soviets as the U.S. entered the Cold War and the aerospace industry experienced great expansion. This intellectual immigration had a huge impact on space and rocketry. The German team dominated rocketry until they basically died or retired. A large percentage of the space scientists who were German fanned out into indirect aerospace fields such as ceramics, aerodynamics, propulsion, etc. (Keinon, 1990; Kiernan, 2011a).

Infrastructure. Clement Keys, the chief executive officer of Curtiss Aeroplane and Motor Company, remarked that 10% of aviation was actually in the air while 90% of it was on the ground, as the logistical dance between the air and ground facility is what allowed the industry to be developed and maintain an ongoing business (Komons, 1989). Barnstorming had not left the public with the impression that flying was a safe form of transportation. Unless reversed, this attitude would not allow the industry to develop.

The airmail system, arguably the beginning of the air transportation sector, developed through a loose collection of air fields that aided night flying by the lighting of bonfires. It was only in 1920 that the Post Office Department ordered installations of radios at each field that was not already provided a radio by the Navy Department stations. The radio stations and then beacons that replaced bonfires became the early pilot guidance system for air transportation, allowing for the expansion of the system into the night and adverse weather conditions. In 1927, the transcontinental system of the airway and radio service, 43 pilots and 600 ground and office employees were transferred out of the Post Office Department to the Department of Commerce and private companies took over these operations. The establishment of the infrastructure and the air mail experience gave stimulus for the establishment of commercial aviation in the U.S. (Lipsner & Hilts, 1951). Clement Keys comment was certainly as pertinent in the 1920s as it is today.

Throughout the 1930s, aviation experienced technological advances in aircraft equipment and public infrastructure that boosted airlines into a vast system of national transportation services that yielded profits for private operators. As the nascent air industry was beginning to grow, the Air Commerce Act of 1926 and the establishment of the Civil Aviation Authority (CAA) in 1938 was created to regulate routes, mergers and airfares becoming the cornerstone of the nation's aviation policy fostering future development of the air transportation industry (Komons, 1989).

During the 1940 - 1960's, aviation diverged into military production and commercial production. Government involvement and funding incited the growth and development of aviation and its services for military purposes while commercial aviation adopted various technologies for their own domestic use. The military sought to develop equipment to not only develop the theory of superior airpower as a strategy on a battlefield, but also the development of long range cargo transport aircraft. Not only was equipment developed and produced, the related indirect aviation services, equipment and educational pipelines experienced development and expansion. (Connolly, 2000). General aviation or private aviation, along with the support facilities and training industry, also began to emerge as a separate industry in the 1940s, following the war, and throughout the 1970s (McCurry, 2000).

By 1958, the government passed the Federal Aviation Act which ultimately led to the establishment of the Federal Aviation Authority (FAA) and the Department of Transportation (DOT). It was clear that the government organization, administration, and regulation of the public domain of airspace was needed for the continuing expansion of the non-military sector of the aviation industry and the public's continued integration of aviation into their daily lives. This step was very similar to the initial regulations the government enacted with the Air Commerce Act of 1926 as a way to promote aviation and aviation safety (Brady, 2000b; Saini, 2011). The standardization of aviation facility requirements was a must to instill a sense of stability and safety in the minds of consumers.

By the 1970s, military aviation was a completely separate industry from commercial aviation even though some manufacturing providers operated in both sectors. Whereas before, aviation technology was typically advanced from a military need in origination, and it later had spillover effects into the private sector. However, during the 1960s and 70s, commercial aviation began to expand independent of the military aviation complex. By the end of the 1970s, commercial aviation could be thought of as a separate system (Leher, 2000).

By 1978, the airline industry was no longer an infant industry needing regulation for protection in order to continue to grow and become stable. Starting in 1978 and ending in 1984, the airline industry was deregulated. After deregulation, economic indicators for the airlines improved in aggregate. Since deregulation, the airline industry has experienced expanded routes, mergers, entrants, recessions, oil price shocks and then restructurings. The cost of travel dropped almost 50% for the consumer and the average cost of production due to increased carriage has decreased by 28%. Today, consumers have more money to spend on more travel or other goods and the airlines are providing more of their services (May, 2008; Wilson, 2008).

The gradual removal of operating and economic controls in the air transportation industry spurred the rapid expansion of services through the greater development of the hub and spoke system of the airlines. The prior economic structure imposed on the market had been an economic deadweight loss or a drag to the growth of the industry. General aviation also experienced significant growth in demand and was faced with increased regulation and market pressures from the expansion of the commercial airlines into their customer base (McCurry, 2000).

The growth and success of aviation's movement of goods and services through its air transportation system is largely due to the expansion of its system of airfields and then airports in the nation. In the 1920s, the military had a hand in selecting the sites. Geographic location, topography, present structures and land prices were considered when selecting sites for airfields. In the 1930s, many areas used funds from the Works Progress Administration (WPA) to improve aviation facilities. In 1940 the Civil Aeronautics Administration (CAA) duties included air traffic control, certifying airman and aircraft, safety enforcement and airway development. Financial aid aimed exclusively at the continued development of the nation's airports was established by President Truman in 1946. The Federal Aviation Act of 1958 created the Federal Aviation Agency that later evolved into the Federation Aviation Administration (FAA) that continued to provide support to the nation's airway infrastructure required for the development of the air transportation industry and responsibility for air traffic control services. The invention of the jet engine, modern airport construction with extended runways, and expanded passenger facilities exploded in the 1960s. The Airport and Airway Development Act of 1970 established the Aviation Trust Fund to provide revenues for airport and airway modernization (The beginning of an adventure, 2003).

Airport ownership is a complex relationship. Airports are owned and invested in by local governments and the private sector which can make it difficult to determine whose needs are primary, local, national, or system-wide issues. According to the American Society of Civil Engineers, in 2009, the National Planned Integrated Airport System (NPIAS) was comprised of 3,356 existing publicly owned, public-use airports in the U. S., with an additional 55 proposed. There are also 522 commercial service airports, and of these, 383 had more than 10,000 annual enplanements and were classified as primary airports. (American Society of Civil Engineers, 2010).

From the early 1900s to World War II, the aviation industry was in its knowledge discovery period, registering many historical firsts and developing innovation. This is not meant to minimize the continued innovation in the aviation industry that still continues to this day, but the early innovations laid the foundation for the development of the industry. From the mid-1920s up through the 1960s a systems-thinking perspective began to develop around the airline industry. A series of government acts created a more structured environment and the industry began to separate into three distinct industries with some crossover between military, commercial, and general aviation (Ferreira, 2001). The aviation industry matured into a major system that included infrastructure in the air as well as the ground.

Risk/Capital Management. Risk and capital management is essentially the legal and financial framework of the nation that supports a functioning economy. Risk and capital management within the U.S. is regulated to guard against financial abuse, the protection of intellectual property, and to provide an amenable business climate across all industries (American Institute for Aeronautics and Astronautics, 2005). With a friendly capitalistic business climate that is relatively politically-interference free, entrepreneurs risk their energy and talent in the pursuit of making themselves richer, as well as the development of the U.S.'s aviation industry along the way. The government creates the foundations for risk taking and innovation that the private sector fulfills and the U.S. is a model for attracting capitalists looking to succeed.

As of 1917, the aviation industry was a formal association comprised of 12 manufacturing companies operating under a cross-licensing agreement that allowed its members use of all the aviation patents and was charged by the U.S. government with manufacturing 25,000 planes for the war effort. The cross-licensing agreement remained in place until the viable expansion of the commercial side of the industry developed in the next decade and allowed all in the industry to work on and take advantage of technological advances in the industry (Mingos, 1930; Whealan George, 2011). This is one example of the legal financial structure provided in the U.S. that acted as incentive for entrepreneurs to strategically invest capital in various businesses with the intent to profit.

The expansion of the air mail program as the first practical commercial application of aircraft with passenger carriage followed soon. There were some private companies such as the St. Petersburg-Tampa Airboat line or Chalk's International Airlines operating without government support, but the overall push for the organization of these services was government originated with private partners. Walter Brown came to office as the Assistant Secretary of Commerce under President Hoover with an intention to develop the fledgling air transportation system into a fully functioning industry (Brady, 2000b; Komons, 1989). Brown's research led to a number of conclusions that did not bode well for an air transportation system on the cusp of bursting forth with growth and maturity under their own devices. Transportation companies that sought to carry passengers instead of mail experienced, at a minimum, an 83% drop in revenue given the market prices for tickets; therefore, there was no business market incentive to expand into the passenger line of business (Arnold, 2011; Brady, 2000b). The air transportation industry was not a profitable industry and did not incentivize investing and using the most technologically advanced equipment available (Fredrick, 1961). Brown concluded that the government needed to provide structure and subsidies within the system as well as incentives and risk mitigation to develop his and Hoover's vision of a passenger carrying air transportation system from within the existing 44 small airlines in operation in 1928 (Freeman, 2003).

Between 1927 and 1934, the air mail and passenger carriage system was organized into a highly regulated competitive industry. When Brown left office, the country was in the midst of a severe depression but aviation was an industry that not only showed promise but was expanding and air mail costs had decreased by 51%. From 1929 to 1934, airline employment jumped 250% at a time when the aggregate unemployment rate in the U.S. went from 3% to 24% (Brady, 2002). While Brown's means eventually were deemed illegal and the government contracts were re-competed, it was the organizational structure that was set up under Brown that yielded the initial regulated marketplace for the air transportation industry.

During the time frame of the late 1920s to early 1930s, another major characteristic on the supply side holding back the expansion of the industry was lack of coordinated aviation infrastructure and foreigners dumping their cheap, lower quality products into the market. The government interceded with default regulations that stipulated the quality of the aircraft imported into the U.S. that insulated the domestic producers from producing a product that would be a financial loser.

At the same time, the Aeronautical Chamber of Commerce was organized with a mission to advance an integrated plan to develop all aspects in trade of the commercial aviation industry. The demand for commercial aviation services drove the regulatory organization and the building of the supporting infrastructure described in the previous section. With the demand, regulations and facilities plans in place for a comprehensive national industrial policy, capital financing followed. But one factor should be reiterated, it was through the work of the chamber of commerce – the private sector – combined with the regulatory environment that led to the proper combination for the development of the national industrial policy that drew capitalists to the development of the modern aviation industry (Mingos, 1930). The cornerstone of the modern aviation industry was set with the passing of the national air law in 1926, placing commercial aviation under the responsibility of the Department of Commerce and giving commercial aviation a place at the table within the Executive branch of the government. As Dr. John Johnson, president of Embry Riddle Aeronautical University claimed, “If you want to shape the agenda, make sure you have a seat at the table” (Johnson, 2010). Aviation had just received a seat at the table.

Fast forward to deregulation of the industry in 1978 when Congress agreed that the industry no longer needed protection. Airlines had to respond to a more businesslike environment subject to the prevailing economic conditions. They were also free to innovate as a core characteristic of a business in a competitive environment. Competition in any industry is beneficial, not destructive, because it yields efficiency and lower prices for consumers, as well as industry innovation. Competition is only destructive if the airline in question is the one that refuses to innovate or become more efficient. In fact, competition pushed airlines to innovative efficiencies in their reaction to macroeconomic shocks, which in turn benefitted the consumers through lower prices and more traveling options (Tom, 2009). Innovations that may not have been realized under a regulated system included hedging fuel costs (Southwest Airlines), more efficient equipment (Boeing 787), increasing capacity utilization by shrinking fleet structures, and scrutinizing the weight of airplanes to maximize fuel consumption (American Airlines). By allowing the market to operate freely under the existing legal structure, especially when faced with low margins, the industry is induced to be creative to find new sources of revenue and new ways to operate efficiently.

Government-funded Scientific Research. In the period before the Wright Brother’s successful flight in 1903, aviation could only be deemed as an emerging science, but it was not without government-funded research. Langley was coaxed out of retirement into what is now referred to as the acquisition world by the US government with the Great Aerodrome project. Langley, with an award of $50,000, was likely the first defense contractor; or, as referred to in D.C., a beltway bandit, pursuing the development of an airplane (Brady, 2000a; Shulman, 2003; United States Senate, 1907). This $50,000 contract, awarded in 1898, was valued at $1,180,000 in 2010 dollars and was arguably the earliest version of the development of an airplane that was possibly capable of launching off an aircraft carrier (U.S. Department of Commerce, 2011). Given the current price tag of the newest carrier aircraft, the $200 million F-35, this investment by the Department of Defense (DoD) was a bargain (Tierney, 2011). Langley believed his work chasing mechanical flight should not be the property of a single benefactor and he ignored private funding options for the continuation of the discovery of flight (U.S. Department of Commerce, 2011).

From 1903 to 1917, interest in the continued development of the airplane was spurred by government contracts, competitions for announced prizes, and air meets. The first government contract for an airplane was between the U.S. Army and the Wright Brothers in 1907, for a cost of $25,000 per plane, or $577,374 in 2010 dollars (Brady & Crehan, 2000; Bureau of Economic Analysis, 2011). At this point in time, it is safe to say that the foremost interest in developing the aviation industry would be for military uses (World rivalry in flying machines and motor boats, 1908). These competitions also highlighted the indirect industry that would need to be developed along with the direct aviation manufacturing and transportation sectors of the economy.

From 1915 to 1958, the National Advisory Committee for Aeronautics (NACA) was the predominant government body supporting aviation research and development. NACA also published its technical documents and was recognized as an authority on aeronautical engineering research. Research from World War II military aviation spun off into private sector advancements. Foremost in the NACA and later National Aeronautics and Space Administration (NASA) roles in research was the focus on broad-based research applications of aviation that could then be taken by the private sector and leveraged to be further advanced. Applications of research were not the focus or concern of the scientists as that was to be determined later by the private market by the difference of supply and demand. This foundation served across a wide spectrum for research and for the transfer of technical information and expertise (Committee on Science, Engineering, and Public Policy (U.S.) Panel on the Government Role in Civilian Technology, 1992).

The Defense Advanced Research Projects Agency (DARPA), established in 1958, is just one example of a government sponsored agency supporting research in development of high-risk, advanced technologies that have applications to the military sector and commercial industries. DARPA acts as a talent agent for the government, outsourcing research to private sector, academia, and military branches for the collective benefit to the U.S. Since 1989, DARPA has also been tasked with the responsibility to advise and manage the transfer of the results of research with commercial applications to industry (Committee on Science, Engineering, and Public Policy (U.S.) Panel on the Government Role in Civilian Technology, 1992).

The American Institute of Aeronautics and Astronautics reported in 2005 that the benefits of government sponsored aeronautics research can be witnessed from the absolute level of the industry within the nation’s GDP, but also the future competitiveness of the entire nation’s workforce and the nation’s ability to provide the public good, the air transportation system (American Institute for Aeronautics and Astronautics, 2005). The AIAA reported that government funded research was partly responsible for the trade surplus of $31 billion dollars in 2005 while most other sectors showed deficits. Government funded or partnered research has been vitally important to the development of the aviation industry in and of itself, and in its importance to the nation’s economy.

Looking to the Future

Friedman and Mandelbaum (2011) presented four major economic challenges that the future U.S. economy depends upon: 1) globalization, 2) revolution of information technology, 3) nation's chronic deficits, and 4) the pattern of the nation's energy consumption. They argue that to meet those challenges, the nation needs to work through their five pillars of the prosperity formula that worked in history to develop our competitive economy. Those challenges were constructed with a view of the macroeconomic economy. Since the aerospace and aviation industry is an integral part of the US economy, it stands that those elements will also challenge the industry's future. Considering the economic history of the industry and the prosperity formula, the industry has opportunities for not only normal growth but potentially can be used as a catalyst for industry health, significance and renewal in the future as well as the indirect aviation-related industries.

Using the lens of the prosperity formula: 1) public/private cooperation on education, 2) immigration policy, 3) infrastructure, 4) risk/capital management, and 5) government-funded scientific research: one can trace how the aviation industry grew to be such an important sector of the U.S. economy. It follows that this formula can be harnessed by the government and the private sector to marshal in future prosperity for the industry. Through the five pillars of Friedman and Mandelbaum's (2011) prosperity formula, the aviation industry can meet the current market challenge in order to be competitive in the global market in the 21st century. It is clear that further research and thought are needed to provide pathways to meet Friedman and Mandelbaum's (2011) identified four economic challenges in the aviation sector identified in this paper. It is hoped that this paper will serve as a foundation for that research.

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