

A TIME STUDY OF SCIENTISTS & ENGINEERS (S&Es) IN THE AIR VEHICLES DIRECTORATE

 *JoAnn McCabe and Col John Wissler, USAF*

The Air Vehicles Directorate of the Air Force Research Laboratory, concerned that its scientists and engineers (S&Es) were spending more time on nontechnical duties than on technical duties, developed a Web-based means of gathering data on this issue. After almost 27,000 hours, recorded data showed approximately 19 of 40 hours in an average week were spent on technical taskings. This led the directorate to examine various ways of increasing the share of technical time productivity reported by its S&Es. This article highlights the authors' data gathering results and offers insights on increasing the technical and value-added time of S&Es, thereby resulting in increased productivity for AFRL— an important Air Force resource.

Keywords: *Time Study of Scientists and Engineers, Air Force Research Laboratory (AFRL) Research, Air Force Research Laboratory Time Study, How Scientists and Engineers Spend Their Time, Technology-Focused Research Organizations, Value and Non-Value Added Work in a Government Laboratory, Research Day*

TIME STUDY

27,000	TOTAL
17.64	44%
1.41	4%
3.24	8%
3.87	10%
1.59	4%

The Air Vehicles Directorate, located at Wright-Patterson Air Force Base, is one of the 10 technology-focused research organizations in the Air Force Research Laboratory (AFRL). We employ approximately 600 people, close to one-third of whom are government scientists and engineers (S&Es), and develop advanced flight vehicle technologies in the areas of aerodynamics, control of flight vehicles, and structural sciences. Our work is analytical, computational, and experimental, accomplished in both in-house and external facilities, and involving programs with academia and industry. Although our natural focus is on the long-term future, we also solve shorter-term, more urgent problems for the Air Force.

The Air Vehicles Directorate and its predecessor organizations have a long history, and our technologies can be found in practically every major weapon system in today's U.S. Air Force inventory. In response to budget cuts, drives for efficiency, and numerous reforms, the workforce in the Air Vehicles Directorate has declined 16 percent in the last decade (C. Remillard, personal communication, April 10, 2008). Many of these cuts resulted in the reduction of non-technical personnel, thus often leaving some nontechnical taskings to our S&Es.

Concern regarding the DoD's acquisition workforce capability and competency is increasing (Taubman, 2008). At the organizational level, anecdotal evidence supports the view that our technical workforce does not feel it accomplishes enough technical work. This view is a frequently cited frustration that has been noted in recent cultural surveys and exit interviews, and discussed during formal and informal mentoring sessions. Concerns have been raised at director's calls, overheard in the hallways, and documented by supervisors during feedback sessions. These concerns have continued despite initiatives such as Air Force Smart Operations for the 21st Century (AFSO-21) and business process reengineering, which are directed at reducing non-value-added work, increasing our S&Es' *bench time*, and making the most of AFRL's technical talent. AFSO-21, introduced by former Secretary of the Air Force Michael Wynne in his Secretary of the Air Force Letters to Airmen in December 2005 and March 2006, described it as "a dedicated effort to maximize value and minimize waste in our operations" (Wynne, 2005, p. 1; Wynne, 2006, p. 1) and "AFSO-21 is about working smarter to deliver warfighting capabilities" (Hudson, 2006, p. 5).

According to Lt Gen John L. "Jack" Hudson, USAF, commander of the Aeronautical Systems Center in a Commentary dated September 15, 2006, "Our mission of providing warfighting capabilities has never been more important, and we must continually find ways to do this more efficiently and effectively, despite manpower and budgetary constraints. AFSO-21 will help us do that" (p. 1). According to Jenkins (2009), there is a need for having a framework for workplace satisfaction and organizational commitment. Jenkins states that this framework, "integrates McGregor's Theories X and Y, Maslow's hierarchy of needs, and Meyer and Allen's

three-part organizational commitment theory” (pp. 21–23). Jenkins lists factors related to workplace satisfaction: pay and benefits; growth and development opportunities; relevance or meaning of job; supervision; and feelings towards co-workers. What is not listed as relevant is the fact that many of our S&Es simply want to do what they do best: engineering and science. A key part of that is assessing how much engineering and science they are actually doing.

In general, the feedback from our workforce is that people want to concentrate on their research and technical work, i.e., the *intellectual work* associated with their core duties, *not* the excessive program management and administrative responsibilities required to support that work. So the question was asked: How do S&Es in the Air Vehicles Directorate spend their time?

The Approach

To answer that question, we first needed a way to gather data about how our S&Es spend their time. One possible approach was to use the organization’s existing timekeeping system. However, this system only tracks the amount of *time* our workforce charges to their projects, not the *type of task performed* in support of those projects. Another challenge was working with a relatively small population. Statistically, in order to attain a 95 percent confidence interval, we would have needed 122 respondents. Given not everyone would take the time to submit data, we instead chose to conduct a census and invite all our S&Es to participate, after which we would accept whatever we could get. Admittedly, we were less concerned about confidence intervals and absolute statistical rigor than we were about identifying issues and trends and taking steps to address them. We would then use the information to help us increase the time each S&E spent in technical activities and increase the value-added aspects of the S&Es’ work.

We developed an intranet Web site that would enable us to collect:

- Number of hours worked in various activity/category types
- Whether the hours worked were considered by S&Es to be value- or non-value-added
- Comments, especially if the S&Es reported the activity to be of no value.

To encourage participation, we ensured the anonymity of each respondent providing the information and designed the site so that it took less than 5 minutes each day to complete.

FIGURE 1. INTRANET WEB SITE FOR RECORDING TIME STUDY INFORMATION

AIR VEHICLES Time Study

Mar		April 2007					May	
Su	Mo	Tu	We	Th	Fr	Sa		
1	2	3	4	5	6	7		
8	9	10	11	12	13	14		
15	16	17	18	19	20	21		
22	23	24	25	26	27	28		
29	30							

Selected Day Today

INSTRUCTIONS

To submit hours simply select a day from the calendar above, enter the number of hours spent working in a particular time area, select whether that time spent added value, and enter any comments that you might have (optional).

SUBMIT HOURS

Friday, April 13, 2007

Hours:

Time Area:

Value Added:

Comments:

Hours Entered

	Hours		Description	Comments
Delete	2	<input type="checkbox"/>	Administration	Meetings
Delete	1	<input type="checkbox"/>	Lunch	

The Web site is shown in Figure 1. To the left is a calendar showing the date and the day for which data was being entered. The right hand side contains a number of items to be filled out, such as the number of hours worked on a particular activity, the activity performed, a value indication, and a text entry box for any comments the submitter cared to make. At the bottom of the site is a table (Hours Entered) that displayed the data as the respondents entered it. Once respondents logged into the Web site, they simply entered the data regarding their activities for that day. The Web site was designed so that if they missed a day, respondents could click on the missed day and enter the data. Only activities in the standard workday (nominally a 40-hour federal work week) were to be logged.

Prior to launching the 2-month Time Study, we ran a 1-week beta test that resulted in the refined categories shown in the Table, which also shows the four major categories into which the data were binned: Technical, Program Management, Administration, and Miscellaneous. Note that Program Management consists of only one subcategory that covers administratively oriented tasks associated with program management, such as putting program budgets into the management information systems. We characterized the intellectual tasks associated with program management as technical (e.g., technical planning).

Then, in July 2007, we had an all-hands meeting with our S&Es, during which we provided them with an overview of the Time Study, including a demonstration of the Web tool. Additionally, we asked the S&Es for their support and stressed that individual identities would be masked.

The data collection period ran for 2 months (July and August 2007). To help our census respondents remember to fill out the questionnaire, our Web Team issued periodic pop-up reminders on the network; we also sent them periodic e-mail reminders. Additionally, the Air Vehicles director would send periodic e-mails asking people to participate. Not unexpectedly, these resulted in increased participation.

Results

In total, over the 2-month period, approximately 27,000 hours of time data were logged by the S&Es in the Air Vehicles Directorate. To make the data more relevant to the average S&E's activities, we normalized the data into the standard 40-hour work week, thus creating the picture of an *average S&E*.

Figure 2 shows the top-level results. Technical activities comprised slightly over 19 hours per week for our average S&E, and Program Management accounted for another 4 hours. Administrative and Miscellaneous activities accounted for the remaining 17 hours. Thus, it appears that the majority of our average S&E's time is spent on either Technical or Program Management, although only by a slim majority.

Figure 3 shows the same data, now accounting for the value-added versus non-value-added time. It shows that our S&Es reported non-value-added activities in all categories. However, nearly one-third of

FIGURE 2. TOP-LEVEL RESULTS—SCALED TO A 40-HOUR WORK WEEK

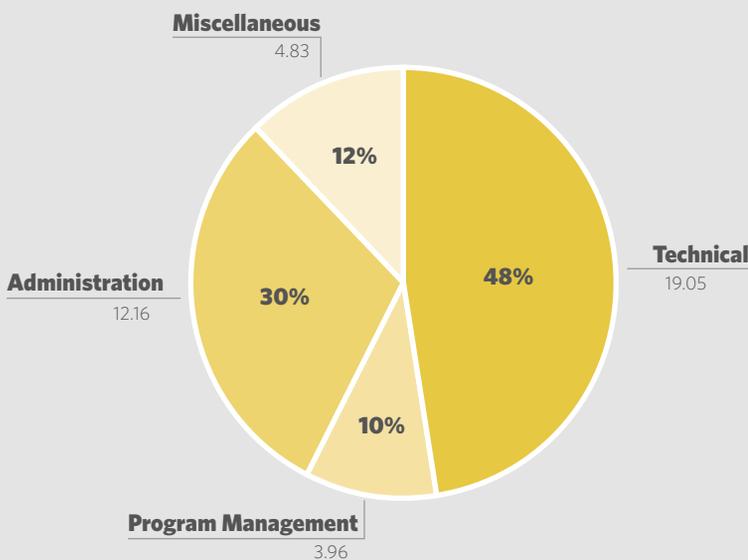


FIGURE 3. TOP-LEVEL RESULTS—VALUE ADDED VS. NON-VALUE-ADDED

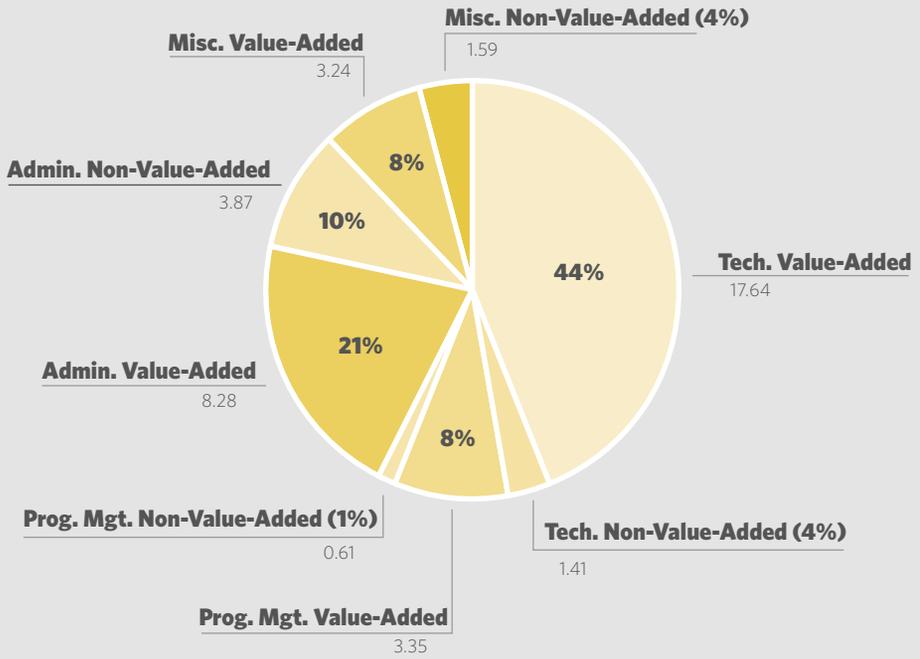


FIGURE 4. COMPARISON OF VALUE-ADDED TIME—MILITARY S&Es VS. CIVILIAN S&Es

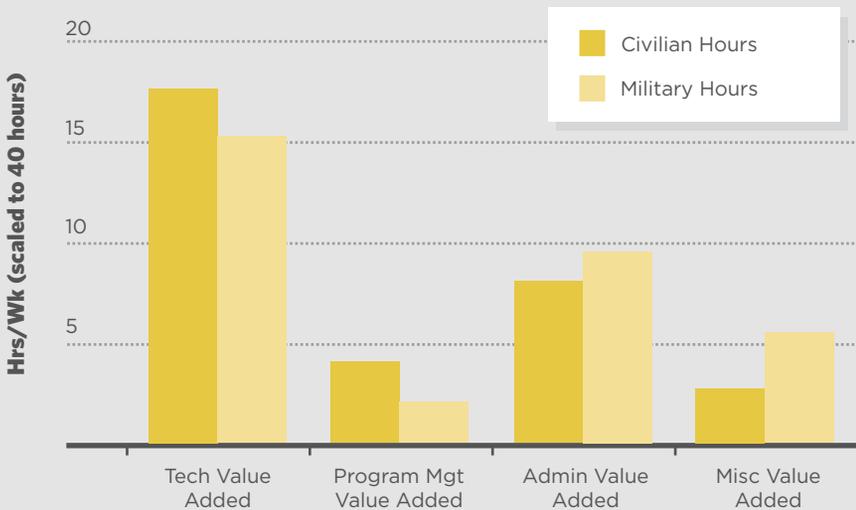
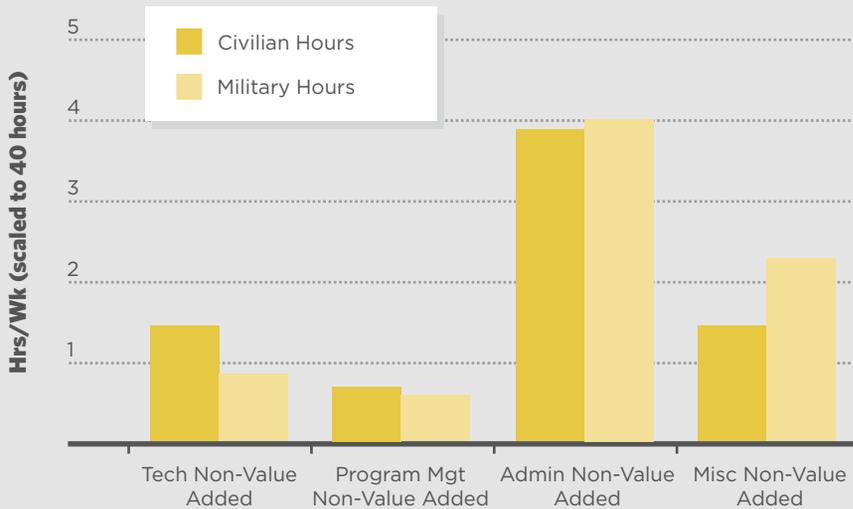


FIGURE 5. COMPARISON OF NON-VALUE-ADDED TIME—MILITARY S&Es VS. CIVILIAN S&Es



the administrative activities accounted for were viewed as non-value-added—the largest percentage among all four categories. The program management category showed the lowest absolute amount of non-value-added activities, but on a percentage basis within a category, our S&Es felt that technical activities had the largest value (as one would expect).

Figure 4 shows how our military S&Es, mostly junior officers (second lieutenants through captains), compare to our civilian S&Es, who fall within a broad spectrum of grades, from GS-11 to GS-14 equivalent. It shows that civilian S&Es reported a slightly greater share of value-added hours for Technical and Program Management activities, while military S&Es reported a slightly higher value-added share for Administrative and Miscellaneous tasks.

Figure 5 shows the same data for non-value-added activities. It shows that the military perception of non-value-added activities is slightly higher overall, with the biggest difference between civilian and military being in the miscellaneous category.

Discussion

Surprisingly, the results countered to a certain extent the anecdotal evidence that our S&Es spent little or no time on technical activities, painting a good news/bad news picture. Clearly, close to one-half of a 40-hour work week was spent on technical work (good news; after all, our S&Es perceived they did little or no technical work!). However, the bad

news was that technical work comprised *only* 19 hours a week. It indicated we can use our employees' time more wisely.

Although the non-value-added component was lower than we originally expected, it nonetheless comprised almost a full day out of a 5-day week. Again, it was a good news/bad news story. The good news was that it was only a day and not 2 or 3 days. The bad news was that it was a day and not a half day or less. We assume it is impossible to drive it to zero (after all, we *are* part of the federal government!). But, we should be able to drive it to less than a day. We recognize that different people in different jobs have different perceptions of value; most of our S&Es view the major share of the administrative work they do as having little or no value.

One area of concern is the data that shows our military junior officers doing more administrative and miscellaneous work as compared to their civilian counterparts. To a certain extent, this makes sense; many of our additional duties tend to be administrative in nature and tend to fall into the laps of our officers. However, given that we are theoretically preparing our young officers for increased responsibility, one has to ask whether placing the administrative and miscellaneous burden on them is the best use of their talents and the best way to develop them. Certainly, their academic background and officer training could be better utilized, especially given the fact that our S&E workforce has declined in number.

Before we took on the challenge of reducing the number of non-value-added tasks in an S&E's work week, we checked out our concerns with Air Force pilots and leaders from industry. We asked several Air Force rated officers: Would it be acceptable if line pilots spent only half their time thinking about, preparing for, or actually flying? The consensus was that it would not be acceptable. The obvious question for the Air Force is, if spending less than half one's time on core duties is unacceptable for the flying community, then why should it be acceptable for the technical community?

We then asked several of our industry counterparts how their engineers spent their time. Their responses left us with the sense that although they probably spent more than half their time on technical work, a large portion of their time was also spent on marketing and business development. Our industry colleagues also said that most companies try to get the most out of their highly trained and well-paid technical workforce and do this partly by offloading as much administrative work as they can to nontechnical personnel.

The next question is: Now what? We want to make the most of the technical talent we have in the Air Vehicles Directorate. We want to look at *non-value-added* efforts, and we want to increase bench time for S&Es because we believe it represents better value for the American taxpayer; and it is clearly a morale, motivation, and recruiting issue.

The directorate's leadership identified three possible initiatives we anticipate will increase the bench time of our S&Es. The first initiative, The First Three Years Program, is an Air Force Research Laboratory-wide program. The second initiative is the hiring of technical business specialists to assist the S&Es, and the third initiative is the implementation of Research/Focus Day.

THE FIRST THREE YEARS PROGRAM

In a move to ensure every newly hired federal civilian service S&E and lieutenant can become a successful technology leader (i.e., researcher, program manager, or supervisor), AFRL implemented The First Three Years Program. The program's goal is to allow young S&Es to become comfortable with the laboratory environment from a bench-level perspective before taking on more complex program management functions. The program requires supervisors to assign technical mentors to oversee the technical training of our S&Es during their first three years of employment (Fast, 2009). Its basis is the belief that the primary function of bench-level military and civilian S&Es is to perform mission-focused science and technology work for their first three years, as well as reviews of management literature concerned with the career management of scientific personnel (Clarke, 1996; Farris & Cordero, 2002). The mentors oversee the technical training of our new S&Es, with both on-the-job training (OJT) and formal training. A formal Individual Development Plan (IDP), required for each employee within the first 60 to 90 days of assignment and outlining both formal and OJT assignments, helps the employee and the supervisor map out a strategy to help new S&Es contribute quickly and effectively.

TECHNICAL BUSINESS SPECIALISTS

Based on this study's results, we determined that decreasing administrative workload on S&Es is clearly a necessity. Hiring additional government S&Es to perform this duty, however, is not a practical option because the Air Force places limits on manpower authorizations. This solution is also completely counter to increasing the technical content of what our S&Es do.

A different option is to hire a small number of government business specialists to perform basic program management tasks. Specifically, we decided to hire six technical business specialists, two of which would be assigned to each of the three technical divisions to become part of the program manager support team. S&Es will remain assigned as program managers, and the new specialists will augment any personnel currently doing similar duties within the division. The administrative burden that the technical business specialists remove from the S&Es will free a significant

portion of the S&Es' work week, allowing them to focus on core technical activities, reduce the program management workload, and increase the time spent performing research. Our S&Es have reacted positively to this new practice, which has acted as an unexpected motivator. The S&Es accurately interpreted the proposed practice that management values their research and development time. As pointed out by Ralph Katz (1997), if technical employees believe their work is challenging and innovative, and if they have the freedom to do what they do best, they will work to meet the demands the research calls for.

A potential argument against filling these positions is that they increase the number of administrative personnel relative to the S&Es, thereby reducing the "tooth-to-tail" ratio. However, we would submit that tooth-to-tail is more than just a body count. It is also the kind of functions that people in those positions actually perform. Having an expensive and technically trained S&E perform functions that could easily be done by a nontechnical and less expensive business specialist in effect makes the tooth-to-tail ratio worse, not better. This is especially true if several S&Es perform work on a part-time basis, thus doing that work inefficiently while the per hour cost is higher. Having the technical business specialists perform some of the critical nontechnical functions will increase the efficiency with which those functions are accomplished, enable the S&Es to spend more time on the technical intellectual content of what they do, and also increase morale, recruiting, and retention.

RESEARCH/FOCUS DAY

Probably the most controversial idea we implemented may prove to be the most beneficial. The directorate has designated every Thursday as a day in which each employee is asked to spend their time working only on their *core* function, whether it be technical or nontechnical. One of our employees said it best when he responded to the question: What should we be working on? His response was: "On Research Day, do what you would do if you had to come in on a Saturday to get done what you couldn't get done during the week. That's what you should be working on" (T. C. Hummel, personal communication, August 30, 2007).

To help personnel concentrate on these core tasks, the directorate refrains from issuing new administrative taskings on Thursdays, and requests that non-core training and meetings be deferred to another day. Employees are also encouraged to minimize e-mails. Directorate leaders (branch chiefs and above) are expected to walk around and ensure that personnel are following the rules of Research/Focus Day. Surprisingly, the hardest part of implementing it has been getting people to think about their core duties and then have the discipline to focus on them. This may be a symptom of the fragmented nature in which we have operated. In any

case, we are continuing to emphasize the use of Thursdays and the need to use them to concentrate, not fragment.

Conclusions

Clearly, the Time Study was a first attempt to define and break down how Air Vehicles Directorate S&Es spend their time. We are considering repeating the Time Study in fall 2009. We will compare the results of the original study and look at other assessments directed at our workplace environment.

As we continue to develop our personnel and provide them with meaningful work, increasing the time spent by our military and civilian technical personnel on technical tasks must remain a priority. Increasing the amount of time spent on technical tasks represents a best-value proposition for the Air Force because it maximizes the payoff associated with hiring S&Es. Additionally, the working environment is also improved because through the conduct of this Time Study and responsive follow-up actions, our workforce understands that we listen to them, we hear them, and we are taking their best interests to heart.

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Author Biographies

Ms. JoAnn McCabe is the corporate development officer for the Air Vehicles Directorate, Air Force Research Laboratory, Wright-Patterson Air Force Base, Ohio. She is responsible for the career development of approximately 600 civilian, military, and contractor employees. Ms. McCabe is Level III certified in Financial Management and Level I certified in Program Management; and holds a master's certificate in Leadership from the University of Dayton and a certification in Organizational Development from Linkage, Inc.

(E-mail address: joann.mccabe@wpafb.af.mil)



Col John B. Wissler, USAF, is currently director of the Air Vehicles Directorate, Air Force Research Laboratory, and commander of the Wright Research Site. He leads the \$195 million science and technology development of air vehicles for the U.S. Air Force. His career includes assignments in test and evaluation, labs, academia, and at the Pentagon. Col Wissler is Level III certified in Program Management and Systems Planning, Research, Development, and Engineering.

(E-mail address: john.wissler@wpafb.af.mil)

REFERENCES

- Clarke, T. E. (1996, February). *Review of the R&D management literature concerned with career management of scientific personnel* (Revised February 1997). Retrieved June 5, 2009, from <http://www.stargate-consultants.ca/artcaree.htm>
- Farris, G. F., & Cordero, R. (2002). *What do we know about managing scientists and engineers: A review of recent literature*. Retrieved September 11, 2008, from http://cims.ncsu.edu/downloads/Research/67_Farris%20%20Cordero-%20Managing%20Scientists%20%20Engineers.pdf
- Fast, W. R. (2009, April). What ever happened to certification? *Defense Acquisition Review Journal*, 16(1), 3-17.
- Hudson, J. (2006, September). *AFSO21: It's time for everyone to get on board* (Commentary). Retrieved July 6, 2009, from <http://www.afmc.af.mil/news/story.asp?id=123027376>
- Jenkins, A. K. (2009, April). Keeping the talent: Understanding the needs of engineers and scientists in the defense acquisition workforce. *Defense Acquisition Review Journal*, 16(1), 1-19.
- Katz, R. (2005, November). Motivating technical professionals today: To thrive, scientists and engineers need an ambidextrous environment that can support motivational dualism. *Research-Technology Management*. Retrieved Oct 7, 2008, from <http://www.allbusiness.com/management/611570-1.html>
- Taubman, P. (2008, June). High-technology brain drain takes heavy toll on U.S. military projects. *International Herald Tribune*. Retrieved June 5, 2009, from http://www.nytimes.com/2008/06/24/world/americas/24iht-engineer.4.13957565.html?_r=1
- Wynne, M. W. (2005, December). Letter to Airmen. Retrieved July 6, 2009, from <https://acc.dau.mil/GetAttachment.aspx?id=32633&pname=file&aid=6198&lang=en-US>
- Wynne, M. W. (2006, March). SECAF letter to airmen: Air Force Smart Operations 21. Retrieved July 6, 2009, from <http://www.highbeam.com/doc/1P3-1018357351.html>