Overcoming Differences in Global Communication in Order to Efficiently Complete Work in the Aerospace Engineering Community

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Introduction

"I am studying to become an aerospace engineer," I told my counselor, parents, friends, and just about anyone who asked me about my future plans. In the past year, it seemed as if parents, friends, and even new people I met were obligated to open conversations by asking what my declared major was instead of asking the simple, "What's up?" Just by repeating my declared major to a multitude of people, I already wanted to change majors to make my response more interesting, or at least different. All exaggerations aside, I realized something by repeating my intended major to a variety of people. What does it really mean to be an aerospace engineer? I mean, sure, the title suggests that I'll be working with flying objects, but a lot of the time people just assume I want to work for NASA. In NASA alone, there are more roles than just simply being an aerospace engineer. For me, the least clear part of this career and community is what actually working in the field looks like. Since I will be entering this community when globalization has almost reached its climax, I am really curious about the various barriers and challenges associated with working and communicating on a global scale. Different people from different cultures, who speak different languages, and who are trained differently, cannot be the ideal mix when it comes to working in a highly specialized industry.

I recently attended the annual Food and Wine Festival at Epcot in Disney World. At this event, I witnessed something rather interesting. Epcot, as some of you may already know, brings in people from countries around the world to work at the different regions of the World Showcase within the theme park to provide a more authentic atmosphere. However, I witnessed a flaw within this system. I was at the food stand in Japan and the manager, a middle-aged white male, was having a hard time explaining to a young lady from Japan how to use the register. This not only held up the line, but even made some guests leave the stand. Having done a little research for this paper before I went to the festival, I realized how difficult it was to accomplish a simple task when individuals from different cultures, who speak different languages, are forced to work together. This was just a simple incident of miscommunication at a festival. Now think about this issue in the engineering field, a community in which communication affects nearly all of the individuals in the

world who use a variety of advanced technologies. As aerospace engineers work more and more on a global scale, the need for proper and efficient communication grows. Products must meet ever stricter safety standards, but also meet certain deadlines. The great pressure caused by such a line of work means all parts of the community must work in a smooth, efficient, and collective manner at all times.

I aspire to become an aerospace engineer because I do not only want to help people, but I also want to be a part of the future of technology. Before I moved to Orlando during my sophomore year of high school, I grew up on the Space Coast only a few miles from NASA and the Kennedy Space Center in Merritt Island and Cape Canaveral. I have a number of family friends who work within the aerospace industry and I have been an active participant in aerospace related clubs and organizations. I also continuously attend space camp and follow all of the recent news and launches, even though I currently live in Orlando, Florida. The school curriculum in Merritt Island even devoted modules to space exploration history and technology. It is safe to say my upbringing has inspired me to go into this community in the future.

Synthesis

Christian Lescher, a doctoral researcher at the Technical University of Munich, and Dr. Susan Morgan, a Fellow of the Advanced Institute of Management Research and currently a senior lecturer at Loughborough University, both recognize the multiple challenges and obstacles associated with communicating in the aerospace engineering field on the global scale. Lescher is quick to point out that "globalization is considered as one of the major research challenges in engineering. Furthermore, communication over distance is key in global engineering and is oftentimes a requirement for effective work (Lescher 277). Not only is it important to ensure effective communication over a long distance, but it is especially crucial to the success of aerospace engineers in the community as there is a "competitive climate" in the contemporary marketplace (Morton et al. 3227). Networking and overcoming cultural and social boundaries give firms a competitive edge over others around the world since social networks are one of the first things a company can utilize to improve performance (Morton et al. 3228). Isabelle Dostaler, who holds a PhD from Cambridge and is a part of the Department of Management at John Molson School of Business, would agree with Morton et al. and Lescher. Dostaler adds another important challenge and even concern to the issue of effective communication on a global scale. As Morton et al. stated, efficiency is important on a competitive level at which the aerospace community constantly operates (Morton et al. 3227). Due to the various deadlines and quotas required to be successful in this community, Dostaler stresses the importance of efficiency within the aerospace industry, as the lack of efficiency results in company reliance on "safety nets" rather than ensuring the product is safe to begin with (Dostaler 5).

Pinelli et al. and Guruprasad, Nikam, and Vidyadhar, scientists who work in the Knowledge and Technology Management Division at the National Aerospace Laboratory in India, agree that efficiency in global communications and overcoming challenges on the international level can be achieved through academic means. In the aerospace community, writing is used at all levels, whether by the individual, in pairs, or even at the group level (Pinelli et al. 499). While working in this community, oral presentations, information resources, letters, memos, and technical reports are just a few of the most used forms of communication (Pinelli et al. 500). As globalization continues, communication is leaning more towards an electronic format as many scholarly discussions take place on this platform (Guruprasad, Nikam, and Vidyadhar 397). Guruprasad, Nikam, and Vidyadhar are also sure to point out that "scholarly communication is very rapidly evolving" (397). Due to the shift in communication, it is vital that the next generation of engineers learn the implications and challenges associated with today's methods of communication (Holzer et al. 1). Soft skills required in the work field need to be picked up readily and quickly in order to

ensure the best efficiency and productivity from new workers. In order to aid in this effort, soft skills should be taught as early in education as possible (Holzer et al. 1). The role of education and training then, is a "fundamental part of a nation's ability to establish and cultivate absorptive capacity on a national or organization-specific level" says van der Heiden et al. (43). However, it is important to note that education and training are different as education is used over a long period of time while training is more specialized instruction and has a practical emphasis on concepts (van der Heiden et al. 46).

So what is being done to overcome specific communication obstacles in the aerospace engineering community? Wasiak et al. look at the current forms of communication to ensure efficiency at all levels in this community. The aerospace community has "adopted product lifecycle management (PLM) and product data management (PDM) systems to address information management issues associated with concurrent engineering, such as versioning, modification and access" (Wasiak et al. 445). Emails, as Wasiak et al. specifically present, serve "for personal information needs, work needs and problems associated with the work product or in managing the work process and collaboration, and in social and personal needs including relationship building" (445). Furthermore, "software applications are becoming highly critical in aircraft development lifecycle(s?)," say Muñoz et al. (24). Software applications are important as they are required at all stages of this community: design, manufacturing, and support assets (Muñoz et al. 24). While emails and software applications are already used to overcome communication obstacles in the aerospace community, individuals, such as R.E. Deemer, who is a part of the Advanced Engineering Environment Committee in Washington D.C., look at the future of communication in aerospace engineering. Advanced Engineering Environments (AEE) may be the future of communication in aerospace engineering as they help make all aspects of engineering (design, manufacturing, communication, and consumer production) more efficient and productive (Deemer 547). AEEs can "enable teams in widespread locations to collaborate using the newest instruments and computing resources" (Deemer 547).

Based on my research and studies, differences in native, oral, and mathematical language hinder aerospace engineers from accomplishing goals and being productive. As a result, the use of traditional methods of training and communication, along with the integration of new, advanced technologies, and education, help aerospace engineers overcome the differences in global communications that cause inefficiencies in their work.

Methods

I met with Dwayne Waters, an employee at Embraer Air, at the facility in which he works (1111 General Aviation Drive, Melbourne, FL 32935). Mr. Waters is my best friend's father. Their entire family is into aircrafts and, in addition to working in the aerospace industry, Mr. Waters owns a hangar and a biplane at the Merritt Island Airport. I went to observe this community on October 14, 2015 and started to log my observations (in double-entry style) at 4:00 p.m. I chose this particular time to observe this community because it was not only the most convenient time for the particular individual I had connections with, but it was also the best time to see a variety of activities. I was able to go on a tour of the entire facility at this time. I saw what clients and customers saw and got an exclusive behind the scenes look at the work done throughout the community. I saw different offices and work spaces but, most importantly, I got to witness members of the community communicating at all levels (in the office, in the hangar, and with clients). I saw individuals communicating through electronic devices in the office and got to see members with different cultural and linguistic backgrounds work together to fix a private jet. Furthermore, I got to see how salesmen explained the company's products (private luxury jets) to potential and foreign customers.

For my face-to-face interview, I met with Hank Liu who has known me since I came to the United States when I was nine months old. He is an aerospace and structural engineer who just recently retired from Boeing. The interview was conducted in the afternoon of October 21, 2015 in the comfort of his home for his convenience. I used my laptop's built in recording software and the voice recording app on my iPhone 6 to ensure that I had multiple copies of the interview. I chose to interview Hank Liu because he has extensive experience in the community I am studying. He has worked with Boeing for approximately 35 years and has been trained through both the Taiwanese and American education systems. He holds PhDs in structural and aerospace engineering. He has worked for an international company that is also one of the most renowned aerospace companies in the world, and he was there long enough to work on a variety of projects, communicate with a multitude of individuals, and see how modern technology has become an integral part of the aerospace community. The interview was used to gain further knowledge about the aerospace community that I could not find through articles and journals. Furthermore, the interview helped me get a firsthand look into the entire process, from entering the community to becoming an established member. I was able to find answers to all of my pre-planned questions and was able to gain further knowledge from various discussions that stemmed from this interview.

I found my online interview through a YouTube video. TheCareerZoo.com conducted the online interview to help students, like me, understand what it's like to be an aerospace engineer. A variety of questions were asked to get the most information possible to provide people with an understanding of what it means to be and work as an aerospace engineer. Trevor Jones, an aerospace engineer at the NASA Glenn Research Center, was interviewed. He was young, but also had plenty of experience working on the shuttle and on various other launch vehicles during his time with NASA, where he primarily tested vehicle components on a shake table. The interviewer and interviewee mostly talked about what it was like working as an aerospace engineer and how to become one. A lot of the content focused on the required courses and education as well as real world applications and real world experiences. I chose this online interview to gain another example of a specialized member in this community. The interview outlined basic aspects of aerospace engineering and also provided information about the proper education and communication skills needed to become successful in this community

Most of my research was done through the University of Central Florida's library databases. I went to the databases tab and then selected the engineering tab to begin narrowing down my search results. I mostly used the *IEEE Xplore*, *ProQuest*, and *JSTOR* databases. I used the same search terms on each database: "aerospace engineer AND global AND communications." When I began this process in my research, I did not expect to find any scholarly, peer-reviewed journals or articles that covered my community, and, more specifically, answered my research question. However, I was pleasantly surprised by the number of results I obtained. The articles and journals were specific to all aspects of the community I am studying and provided various perspectives to support my thesis.

I was able to obtain an email, letter, and text message conversation for my genres. All genres were provided during my face-to-face interview. It is important to include that I could not attach or present the original copies of the genres I obtained within the context of my paper due to security reasons from both Dr. Liu and Boeing. I was allowed to observe and take notes from the original documents without revealing any specific content. I chose the email because I had found an article about the use of emails in the aerospace community; I wanted to see a firsthand example of it being used in the community. I chose the letter because I found it interesting that this genre was still used, despite our growing reliance on technology as a means of communication. I learned why this genre was still used and got to see its important role in communication within this community. I chose the text message conversation because it showed how simple day-to-day communication methods used by many individuals could be used in this community. It was difficult to obtain various genres due to the sensitive nature of most of the content. While these genres had relatively

informal content, they still provided me with valuable examples of communication in the aerospace engineering community.

I think the most successful part of my data collection was the interview. I got to ask all of my pre-planned questions and even got the opportunity to ask more questions I came up with on the spot. Dr. Liu's answers were detailed and fit really well into my research question. I was very pleased with the interview and will be using many sound bites from the interview in this paper. The most successful thing about how I collected my data would have to be the effective scheduling and pre-planning. Whether it was for the interview or the observation, planning ahead made obtaining information easier and the entire process stress-free. By going into the interview with pre-planned questions and by showing up to the aerospace facility with my double-entry style notebook ready, I was able to focus on actually getting data to support the claims in my paper. I think the online interview may have been the least useful. While it still provided information I didn't know, I could have benefited from even more information about collaborations and work on a global scale. This information was really difficult to find in an online interview and I think my scholarly sources cover this topic thoroughly.

Discussion

More About My Interviewee

Hank Liu inspired me to do a lot of the things I enjoy doing today. In his downtime, he enjoys playing and watching basketball. In fact, he was the first person to get me interested in the sport, and I still remember the first time I went to the gym with him to play basketball. I had never played before that particular occasion. I showed up to play basketball from swim practice, in flip-flops and bright orange swim trunks. However, after that day at the gym, I realized I had a newfound interest. Similarly, Hank Liu has also inspired me to become a part of the community I am currently studying. I always found his work to be inspiring and one of the coolest jobs in the world. He is a very close family friend, but more importantly, he is a mentor to me. I chose him as an interview subject because he is a very knowledgeable man who has had many experiences in his lifetime. He continues to encourage me and give me advice on how to go about my education and training experiences in order to be a part of the community to which he belongs.

Current Communication Challenges in the Aerospace Community

In the present day, many businesses outsource and work with other countries and companies around the world to more efficiently accomplish a task and produce a product. With advancing technologies throughout the past century, communication across the globe has become easier than ever. However, upon recent evaluations, "globalization is considered as one of the major research challenges in engineering" (Lescher 278). There are a number of hurdles the world must overcome as it grows closer to complete globalization. Cultural and linguistic challenges continue to exist and many industries and communities continue to feel the effects of such problems. When asked about working with individuals in and from other countries, Dr. Liu was quick to point out that while working with Japan on the International Space Station, members from Boeing did not want to "accidently step on anybody's toes" because they simply did not understand their culture. Challenges in global communication during engineering projects include "incompatible environments and cultural differences" (Lescher 278). While these issues may seem common and understandable at the pace and level at which the world is connecting, they present major dilemmas and complications within the aerospace community.

At present, negotiation, organization, and the establishment of frameworks are important for globally distributed projects (Lescher 278). Communication over distance is key in global engineering and is oftentimes a requirement for effective work (Lescher 277). To further

emphasize this point, deadlines continuously become shorter, forcing industries and personnel to work in a seemingly flawless manner. Inefficiencies do not only prevent production deadlines from being met, but they also lead to safety concerns. Aircraft design and development is "a complex and highly regulated activity" that presents a variety of challenges related to global communications (Dostaler 5). Aerospace machinery and vehicles must go through many detailed inspections and pass rigorous tests in order to ensure the safety of individuals who use them. A major concern within the aerospace industry is the lack of efficiency, which results in company reliance on "safety nets" rather than ensuring the product is safe to begin with (Dostaler 5). Similar to construction workers finding shortcuts in building a skyscraper by using fewer and cheaper materials, relying on "safety nets" in the aerospace community does not only lead to safety concerns, but also causes companies to have to go back and figure out the original issue, which consumes even more time.

Along with safety concerns and pressing deadlines, there is the issue of competition. Like any business, the key to progress and victory is staying on top of your rivals and being the most productive and successful. In the competitive climate of the contemporary marketplace, organizations "will need to differentiate themselves from competitors" (Morton et al. 3227). Class-leading development is the major key to success and serves as a competitive advantage at the global level. The increasing competition in the global marketplace "necessitates the strengthening of organizational product development capabilities" (Morton et al. 3228). As a business minor, I have also learned that having connections and friends in all the right places leads to a successful business. When design work is divided among various organizations located in different regions, "effective partner integration is another key success factor" in ensuring productivity and efficiency (Dostaler 19). Networking and overcoming cultural and social boundaries give firms a competitive edge over others around the world since social networks are one of the first things a company can take advantage of to improve performance (Morton et al. 3228). Trust, while having many interpretations and varying levels, is crucial in determining the success of global industries. Relationships must be strong between companies in order to ensure they can be successful together.

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The Importance of Education and Training

Education and training may be commonly seen as focusing on major subject areas pertaining to one's particular field of study. For example, someone would likely expect the aerospace engineering career track to consist of a multitude of calculus and physics courses. As a current student at the University of Central Florida, I—along with my fretting and regretting peers—can tell you my current educational track does consist of a plethora of courses related to calculus and physics. However, as we are looking at the importance of communication in aerospace engineering, it is important to observe the value of education and training in terms of its use in the professional community. The role of education and training in aerospace engineering in establishing sufficient levels of "absorptive capacity in newly industrialized countries is substantial and forms a fundamental part of a nation's ability to establish and cultivate absorptive capacity on a national or organization-specific level" (van der Heiden et al. 43).

As reiterated before, communicating effectively "is crucial for career success" (Pinelli et al. 501). This is why it is important for the next generation of engineers to learn the implications and challenges associated with current methods of communication. When asked about communicating in the aerospace community, Dr. Liu felt that "dealing with people has a lot of very important parts

for communication." Dr. Liu went on to state that effective communication and dealing with others was "stressed in his training." Soft skills required in the field need to be picked up readily and quickly in order to ensure the best efficiency and productivity from new workers. In order to aid in this effort, soft skills should be taught as early as possible (Holzer et al. 1).

Before further discussion about education and training in the aerospace community, it is important to note the rather distinguishable differences between the two concepts. Education and training are different, as education occurs over a long timeframe and evolves. As more information is obtained through research, the content taught through education is altered so that basic skills and understandings are consistent throughout a large group of individuals preparing to enter the professional field. Training is a more specialized instruction and has a practical emphasis on concepts (van der Heiden et al. 46). As a result, training is shorter and focuses on the more specific aspects of a particular concept. It is important to distinguish between these two methods because communication skills are taught differently in both. When asked about the use of information he learned and how he applied it to the professional community, Dr. Liu reported that he used "a lot and applied much of his academic learning to his field." However, as you may recall from the previous paragraph, Dr. Liu was also quick to point out it was through the *training* from his company that he learned how to specifically communicate and work with people and different cultures.

So how effective is education and training in terms of ensuring effective and efficient production and communication in the aerospace community? The answer is rather ambiguous and subjective. Results may vary, but Dr. Liu pointed out that during his academic career, "instructors never really talked too much about what it would be like in the field." Instead, it was not until he got into the professional field that he picked up the specific skills required by his company through training. Dr. Liu noted that he does not believe "they actually teach you how to adapt and apply what you've learned in the field." Furthermore, Dr. Liu pointed out that much of the content he learned while studying to obtain his PhDs was more theoretical, and did not have any real practical application at Boeing.

Throughout my personal education, teachers have often stressed that I would one day apply all the knowledge I learned in school towards my future career. While I can see how mastering mathematics and physics are essential towards my future career in aerospace engineering, it is sometimes difficult to see how education can prepare me for the more social aspect of working in the aerospace community. I have taken preparatory and life skills classes such as Speech and College Success. However, I do not see how the education system is preparing me for the use of soft skills in my future community. Education does a rather excellent, if not excessive, job of building up "book smarts." I am more interested though, in the "street smarts" that I will have to use along with the knowledge gained from my education in order to be successful in the aerospace community. I anticipate my acquisition and development of useful soft skills to come through internships and, as Dr. Liu stated, training from my future employer. Upon further observation, it is now more coherent and understandable as to why companies view internships as such a high résumé-builder and even a requirement to be hired. Internships better prepare individuals for work in the professional community by not only immersing individuals in the actual community, but by also displaying and developing soft skills simultaneously.

The Use of Technology to Ensure Efficiency in the Aerospace Community

Engineering "demands intensive communication and knowledge sharing within projects that can employ up to tens of thousands of engineers" (Wasiak et al. 445). Communicating effectively and efficiently across a large group of individuals is crucial in the success of a company. The engineering community has "adopted product lifecycle management (PLM) and product data management (PDM) systems to address information management issues associated with concurrent engineering" (Wasiak et al. 445). Emails are a traditional and still widely used method

of communication today. With advancements in other technological areas, emails are becoming more of a seemingly outdated method of communication. According to Wasiak et al., the use of emails in engineering projects, responds to three needs:

> 1) Personal information needs for resolution of the sender's problems relating to the work product or work process.
> 2) Work needs and problems associated with the work product or in managing the work process and collaboration.
> 3) Social and personal needs including relationship building. (445)

Many people view emails as a means of personal communication. However, managers need to realize the use of email as a group communication tool will help improve efficiency and widen awareness of information during an engineering project. Emails are used for a variety of reasons and contain more than a single type of information. Managers may include a policy about the use of work emails, but, even then, ensuring every individual reads the information is not possible (Wasiak et al. 450).

Emails are just one of many methods to improve efficiency within the aerospace community. Software applications are also important as they are required at all stages of an engineer's work, including design, manufacturing, and support assets (Muñoz et al. 24). Currently, "software is increasing its weight in aerospace industry activities, providing unique features and capabilities during aircraft development as well as during its operational life cycle" (Muñoz et al. 24). However, current software is inefficient because it relies on various parts of itself. If software can be set to work on its own and complete various assigned tasks, then networking on a global scale will be much easier no matter where the company or engineers are located. Advanced Engineering Environments (AEE's) help make all aspects of engineering (design, manufacturing, communication, and consumer production) more efficient and productive (Deemer 547). AEE's can also "enable teams in widespread locations to collaborate using the newest instruments and computing resources" (Deemer 547). Design, manufacturing, and maintenance often occur internationally, so this large mass of data must be accessible and movable over long distances and at a high speed. AEE's can help improve the accuracy and efficiency of engineering systems and processes. Barriers to incorporating AEE's include efficient integration and management of information (Deemer 551). Barriers can be overcome with aid from government agencies and other organizations in the production and development of such systems (Deemer 551).

Examples and Analysis of Genres Used in the Aerospace Community

The email I analyzed (which I received from Dr. Liu) further reiterated the effectiveness and use of emails noted earlier. The purpose of the email I obtained was to inform members in this community about the proper uses of the Internet. The particular email I obtained from Dr. Liu is intended to keep this community in line and focused on the task at hand as well as teach individuals how to use all resources efficiently to be completely productive. Individuals in management positions maintain and update this specific genre. This genre is primarily distributed by individuals in higher positions within this community. As seen in the particular email I obtained, the ethics advisor and senior manager sent out the email to the entire staff. This genre is also used among workers to pass on information. Both of the latter scenarios are portrayed in the specific email I obtained. At the top and bottom of the email, I can see it has been forwarded multiple times and has been requested to be passed on to more members in the company. Using emails is an effective method of sharing information across the entire community without having to meet in person. From the comfort of someone's computer or electronic device, the entire community can know detailed information and read it on their own time and at their own pace to fully grasp the message management wants everyone to understand. This genre could be improved by suggesting feedback from everyone who received the message. With technology, a lot of face-to-face interaction is lost. This reduces human interaction, which may be necessary for some people to understand and

communicate more successfully.

The purpose of the letter I looked at is to formally communicate (and, in this case, congratulate) individuals in this community. Today, individuals rely heavily on technology to communicate. Due to this, old forms of communication such as letters are used primarily in very formal and serious situations. Since this genre is a letter, it serves to convey a serious message in a professional manner. Due to the method of communication, the individual receiving the message in this genre will understand the severity and gravity of the message. In the letter I was allowed to analyze, Dr. Liu was congratulated on receiving the title of Engineer of the Year. Individuals who hold positions of authority will usually send this type of genre. In order to convey a serious message to an individual, managers and those who hold higher positions may choose to send letters. In global communications, letters may be used to formally send a message, since technological means of communication are readily used. In this particular genre, the individual may not have used formal vocabulary, but the structure and form of the message was one that called for attention. In this specific example, the person in charge of contracts and pricing sent this important message to the individual. This genre is effective in getting the attention of the audience and conveying a distinguished message. Since it is apart from other forms of communication, this letter not only signifies a different type of information being presented, but also a sincere message. The level of sincerity is seen in the way the company chose to recognize this achievement.

The purpose of the text message feed I obtained is to work out an official meeting time. There was an original proposed meeting time, but one member of the team could not make it due to another appointment. Through text messaging, this issue was handled in a rather simple and personal way. Since the meeting consisted of only a few individuals, the issue could be resolved at this more informal level. This genre makes simple communication and personal communication easier in this community. There was no need for corporate or managers to get involved since this team resolved the issue and still met the deadline. Individuals at all levels of this community update and maintain this genre. Everyone has access to it and it has become a popular form of simple, fast communication between individuals in this community. I can tell that it is accessible and maintained by all members of this community because everyone had a say in this conversation. No particular formal language was used and responses were short and to the point, similar to how everyone communicates with friends and peers. This genre is effective in helping every member of a team communicate quickly and efficiently. By creating a group text, team members can view information and include their opinion on a situation and offer solutions to problems. Some shortcuts could be improved in this genre such as replacing the word “morning” for “a.m.” Other members could also voice their acknowledgement of receiving the information so there is no discrepancy pertaining to the retrieval of information.

Communication in the Aerospace Community: A Well-Oiled Machine

Upon my visit to Embraer Air, I expected a hangar full of different people from around the world working under the same roof. I also expected an office space with cubicles and plenty of typing and page flipping. Both of these visions were true. I also expected to see a lot of airplanes like a car dealership, which I found in the hangar facility in the back. I was, however, surprised by the entire facility itself. The luxurious finish and details made for a different atmosphere, making me feel out of place. Even the workplace was very organized and well-decorated. I never knew a hangar could be so clean! I was also expecting a loud level of talking, but it seemed as if most communication was done over the phone or through emails on computers. The most surprising aspect of my observations, however, was the way that individuals from different countries and cultures communicated with ease.

When you go back to the previous observation presented while I was at Epcot, it is hard to believe any load of work is completed within a short span of time when people from varying cultures work together. Dr. Liu even informed me that it was a commonality to work with several

foreign employees as "people go to Europe, Italy, and Japan." During my observation, I witnessed something rather unexpected from the community: Brazilians and Americans were seamlessly communicating and repairing an engine taken apart from a small private jet. At my best friend's house, Mr. Waters often talks to us about his days at work. Embraer Air works closely with individuals and clients in Brazil; so closely, in fact, that they even have the Brazilian flag flying right under the American flag at their facility. Mr. Waters once told me it was a rarity to have a company party or barbeque without a soccer game starting among co-workers. By no means am I trying to say that individuals from varying countries are completely alien to one another; rather, I am just shocked at how well the Embraier Air works and communicates, despite all of the global communication challenges and cultural barriers posed in the present day.

From what I saw at Embraer Air, communication in the aerospace community can be a really well-oiled machine. I am careful in my statement because communication in the aerospace community is not completely flawless. Cultural boundaries are still a factor and sometimes English does not come as easily to some individuals in the community, even though it is a requirement among almost all individuals. This is why I say global communication is like a machine; it will not always run well but with maintenance and proper care, it runs rather smoothly. As for the well-oiled aspect, I was most surprised to learn that linguistic and mathematical differences show very little hindrance on the overall production and efficiency in the aerospace community. Similar to the Olympics and other international sporting events, the common language is English. Especially in corporate, international projects such as the International Space Station, as Dr. Liu says, "[T]he common language is still English no matter where you go, be it Japan or Germany." When asked about the issue of working with individuals who only spoke broken English, Dr. Liu simply pointed out that "it's your schedule. You have to work overtime if it means reaching the deadline." The linguistic challenges seem to have a simple solution that has been working for decades now. What about mathematics? The United States uses customary units while the rest of the world uses the metric system. Surely challenges exist, especially with the number of decimal places an individual gets when converting between both units of measurement. However, Dr. Liu, once again, simply stated that "the unit does not really matter as long as all the pieces fit together." Aerospace engineers are expected to acknowledge and know the units in which a particular diagram is drawn.

Working on a global scale produces issues involving oral language, mathematical language, and cultural differences.

Conclusion

From my observations, I realize individuals from around the world can work simultaneously in the same facility while maintaining a level of efficiency and professionalism. Working on a global scale produces issues involving oral language, mathematical language, and cultural differences. While working on an international scale produces issues within this community, the solutions to various problems are as simple and as readily available as globalization itself. English is, quite simply, the solution to the linguistic challenge, as stated at the beginning of this study. Just as the Olympics and other international committees and events have adopted it as their official language, the aerospace community also requires it as the primary language for this community. Furthermore, while communication is not always as smooth across different cultures and individuals, extra time is taken out and scheduled to ensure a seamless production process. As observed, more time was allotted to ensure all individuals (regardless of their ethnicity and first language) understood the task at hand.

For future studies, I think individuals would benefit from more observations. I only went to a single, highly specialized facility. I would be interested in going to other aerospace facilities to make more observations. I may read one thing about a topic, but actually being there, taking notes, and asking questions makes a noticeable difference in my research and data collection. I also think more observations would add more detail and real-world experiences to my paper. For example, I could show that I have seen firsthand how aerospace engineers work collaboratively. It would also add diversity to the observations I currently have by providing me with other real-world examples of communication in aerospace engineering. Furthermore, studying how particular countries work to match the global level of competition could be an area of more detailed focus. Looking at the major effects of a changing world and how it affects the aerospace industry could be another possible future study. While increasing challenges arise in a rapidly advancing world, how long can the aerospace community rely on traditional methods of communication to ensure efficiency and timely production? Will new technology be able to halt the progressive growth in global communication issues? As a student who will be entering the aerospace community in the future, I believe the traditional methods used throughout aerospace engineering will continue to be used. However, I also think with a flawless and harmonious integration of new technology, the aerospace community could become even more efficient on a global scale through advanced, efficient communication.

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