A CASE STUDY IN SCIENCE AND TECHNOLOGY DIPLOMACY:
UNDERSTANDING DIPLOMATS’ TECHNICAL COMPETENCY AND
INTERACTION WITH TECHNICAL EXPERTS

by

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Submitted to the Engineering Systems Division
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ABSTRACT

As science and technology are increasingly at the center of global issues, diplomats are less capable of effectively completing their work without heavily relying on scientists and engineers for clarification and insight. This thesis is motivated by a desire to determine if convincing evidence exists that the lack of diplomats’ technical knowledge and/or existing relational difficulties between the diplomat and the technical expert have negative effects on international agreements.

The first required step, the focus of this thesis, is to gain an understanding of the technical expert and the diplomat’s relationship. This thesis has examined, as a case study, the National Aeronautics and Space Administration Office of External Relations’ (OER) diplomats - officially known as international program specialists (IPS). The IPSs were interviewed and the data was analyzed using the grounded theory coding process. Statistics and charts were produced from pre-interview questionnaires and competency data and used as supporting evidence for the interview data. The thesis question is expressed and answered through its three sub-questions: What is the IPS’s working relationship with scientists and engineers? How do IPSs go about writing the technical content of agreements? What is the IPS’s technical competence? The collective answer is that an IPS does not generate the technical content of agreements, but relies heavily on the technical expert for both the content and its clarification. This lack of technical competence is supported by the fact that only 1% of reported OER’s employees’ competencies are technical (hard math and science) and only 4% are technically related.

Additionally, hypotheses were drawn: An evaluation of the current IPS orientation process and OER training procedures may show that, despite perceived difficulties, the practices are the best available; An increased understanding of the IPS’s role, on behalf of the technical experts - especially the field experts, should improve the relationship between the IPS and the technical expert; The technical competence of an IPS is, to some degree, dependent on both (1) the working relationship an IPS has with the technical expert and (2) the IPS’s capability, capacity, and desire to learn. The study largely implies that the lack of understanding of the diplomat’s role may also be apparent in other technical organizations where the method of diplomacy aiding science and technology is practiced.

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BIOGRAPHICAL NOTE

Sherrica Newsome is a native of Franklin, Virginia. She graduated from Virginia Polytechnic Institute and State University in 2007 with a Bachelor of Science in Aerospace Engineering, minor in Mathematics. Soon after, she was hired as the Operations Manager of the 2008 NASA Academy at the NASA Goddard Space Flight Center in Greenbelt, Maryland. Interested in international space policy and engineering systems, she entered as a student at the Massachusetts Institute of Technology the fall of 2008 to study to receive a Master of Science in Technology and Policy.

The summer of 2009, Newsome worked as an intern with in NASA’s Office of External Relations. It was this experience that sparked the motivation for her thesis research. Also, as a member of the MIT Space, Policy, and Society Research Group, Newsome helped in the production of “The Future of Human Space Flight,” a well known report meant to inform the Obama’s Administration of the benefits of humans in space.

A Robert E. McNair Post-Baccalaureate Scholar Alumni and NACME Scholar Alumni, Sherrica has been selected to join a fine group of MIT graduate women as a Graduate Woman of Excellence. Nominated by her peers and faculty, Sherrica has been recognized for taking a proactive and innovative approach toward finding sustainable solutions to research challenges. Sherrica’s hobbies include singing, playing the piano, cooking, traveling, reading, and spending time with loved ones.
ACKNOWLEDGMENTS

I would like to thank my thesis supervisor, Jeffrey Hoffman, for his guidance and support. Without our common interests and your willingness to take me on as a student, this novel research would not have been possible and would have suffered immensely without your insight. I have enjoyed being able to brag about working with such an amazing individual who has flown on the Space Shuttle five times and who performed the unprecedented, highly improvisational first Hubble Space Telescope repair mission.

I must also thank the NASA OER management, who allowed me to interview the international program specialists of the office. Their generosity, willingness to cooperate, and willingness to be open has enabled me to produce this thesis.

Special thanks to members of the Technology and Policy Program’s staff and faculty: Dava Newman, Sydney Miller, and Ed Ballo, along with Dean Blanche Staton of the Office for Graduate Education, whose support, advice, and extra care kept me financially stable so that I could perform my duties as a student worry-free. Also, I would like to thank my fellow Technology and Policy Program cohorts who have provided the environment for academic scholarship, friendship and support.

Last but not least, I would like to thank my family, friends and loved ones for their undying love and support. A special thanks is owed to Justin. Thank you for all of your support during this process; it has meant so much. Your support includes, but is not limited to, allowing me to use your computer to aid this research and write this thesis! I would also like to extend another special thanks to my parents, Ray and Katherine. There has been no important moment in my life that you both were not present, eagerly and proudly supporting me. My achievements and my development as a woman are a reflection of your choice to raise me in a God-centered, God-fearing environment. For this, I am forever grateful.
This thesis is dedicated to the loving memory of my maternal grandmother, Catherine E. Goodwin. Losing her during this process was difficult. She will forever be loved and missed.
Disclaimer – Unless otherwise noted, the views expressed in this thesis are those of the author and
do not reflect the official policy or position of the United States Government or the National
Aeronautics and Space Administration.
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Nomenclature

CAETS The Council of Academies of Engineering and Technological Sciences
CMS Competency Management System
COUHES Committee on the Use of Humans as Experimental Subjects
DOA United States Department of Agriculture
DOE United States Department of Energy
DOS United States Department of State
EPA United States Environmental Protection Agency
Euro-CASE The European Council of Applied Sciences and Engineering
IAC The InterAcademy Council
IPS International Program Specialist
ISS International Space Station
NASA, HQ National Aeronautics and Space Administration, Headquarters
NIH National Institute of Health
NRC National Research Council
NSF National Science Foundation
NSTC National Science and Technology Council
OER Office of External Relations
OHCM Office of Human Capital Management
OSTP Office of Science and Technology Policy
TWAS The Third World Academy of Sciences
UKRAE The UK Royal Academy of Engineering
UN United Nations
CHAPTER 1: INTRODUCTION

The American Science and Technology Diplomacy Workforce

In the early years after the founding of the United States, science and technology were closely tied to American diplomacy. The first Secretary of State, Thomas Jefferson, administered the Nation’s first patent law and helped to establish a bureau of weights and measures that was associated with the Department of State. Eventually this close relationship between diplomats and scientists would diminish, but science and technology would regain a prominent role in the State Department during World War II [1].

Today, in addition to the United States Department of State (DOS), the American S&T diplomacy workforce is comprised of the White House, a number of cabinet-level and independent federal agencies, and congressional committees. The White House has advisory groups that help guide the President on science and technology issues. The Office of Science and Technology Policy (OSTP), established by the National Science and Technology Policy, Organization, and Priorities Act of 1976, was created to advise the President on domestic and international S&T issues, policies, and cooperation. Two other advisory groups, both administered by OSTP, are the National Science and Technology Council (NSTC) and the President’s Council of Advisors on Science and Technology (PCAST). NSTC is the principal Cabinet-level means to coordinate science and technology policy across the diverse entities that make up the federal research and development enterprise. PCAST is an advisory group of the nation’s leading scientists and engineers who directly advise the President and the Executive Office of the President by making policy recommendations in the many areas where understanding of science, technology, and innovation is key to strengthening the U.S. economy and forming policy that works for the American people [2].

The DOS sets the overall policy direction for diplomacy and is the lead federal agency in developing S&T agreements. The DOS sets its policy direction using the diplomatic perspective of American leadership in science and technology as used to enhance another country’s development and to improve understanding by other nationals of U.S. values and ways of doing business. The DOS Bureau of Bureau of Oceans and International Environmental and Scientific Affairs, Office of Science and Technology Cooperation (OES/STC), coordinates international S&T cooperative
activities throughout the federal government [3].

A number of independent federal agencies are also involved in international S&T policy. About 40 U.S. government departments and agencies have bilateral and regional programs involving developing countries, and S&T are prominent themes in many of these programs [4]. These include, but are not limited to, National Aeronautics and Space Administration (NASA), National Science Foundation (NSF), National Institutes of Health (NIH), Department of Energy (DOE), Department of Agriculture (DOA), Environmental Protection Agency (EPA), National Oceanic and Atmospheric Administration (NOAA) and United States Agency for International Development (USAID) [3]. USAID, playing a big role in sustainable international development, receives foreign policy guidance from the Secretary of State - a position currently held by Hillary Rodham Clinton. USAID, desiring to provide a better future for all, supports long-term growth and advances in U.S. foreign policy objectives by supporting agriculture, democracy & governance, economic growth, the environment, education, health, global partnerships/conflict prevention, and humanitarian assistance in more than 100 countries [5].

The United States Congress has two science and technology committees: the Senate’s Committee on Commerce, Science, and Transportation and the House of Representatives Committee on Science and Technology. The Senate’s Committee is responsible for the regulation of consumer products and services. The Committee is also in charge of the nation’s science, engineering, and technology policy. This encompasses the jurisdiction over non-military aeronautical and space science policy including surrounding transportation issues. The Committee comprises seven subcommittees: Aviation Operations, Safety, & Security; Communications, Technology, and the Internet; Competitiveness, Innovation, and Export Promotion; Consumer Protection, Product Safety, and Insurance; Oceans, Atmosphere, Fisheries, and Coast Guard; Science and Space; and Surface Transportation and Merchant Marine Infrastructure, Safety, and Security. The House of Representatives Committee on Science and Technology also plays an important role in much of the legislation Congress considers in domestic and international science, technology, standards and competitiveness. The Committee has jurisdiction over the exploration of outer space, astronautical research and development, scientific research and development, and science scholarships, legislation relating to scientific agencies, and legislation related to the atmosphere, the National Weather Service, civil aviation research and development, energy, and the environment. The Committee comprises five subcommittees: Energy & Environment; Technology & Innovation; Research & Science Education; Space & Aeronautics; and Investigations & Oversight.
Thesis Motivation and Formation

The White House advisory groups and the independent federal agencies provide the majority of the technical expertise within the American S&T diplomacy workforce, while congressional members, even with its large share of jurisdiction over American S&T diplomacy, lack technical expertise. As shown in Table 1, of the congressional members of the Science Committees, 1 out of the 25 Senators and 9 out of the 41 House Representatives has obtained a degree in some sort of hard math or science field. To assist in the matter, these congressmen have staff members with technical backgrounds; however, only about 9 out of 76 Senate Science Committee staff members and about 12 out of the 36 House Science Committee staff members have technical backgrounds [6, 7]. Due to legislative objectives, this lack of technical expertise is expected among congressional members; however, it may not be expected within a technical independent agency such as NASA.

Table 1: Members of the Congressional Science Committees: Senate’s Committee on Commerce, Science, and Transportation and the House of Representatives Committee on Science and Technology [6, 7].

<table>
<thead>
<tr>
<th>Congress Member</th>
<th>Profession/Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sen. John Ensign</td>
<td>Veterinarian</td>
</tr>
<tr>
<td>Rep. Eddie Bernice Johnson</td>
<td>Nurse</td>
</tr>
<tr>
<td>Rep. David Wu</td>
<td>Medical Degree</td>
</tr>
<tr>
<td>Rep. Brian Baird</td>
<td>Clinical Psychology</td>
</tr>
<tr>
<td>Rep. Dan Lipinski</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Rep. Paul Tonko</td>
<td>Mechanical/Industrial Engineering</td>
</tr>
<tr>
<td>Rep. Roscoe Bartlett</td>
<td>Anatomy, Physiology, and Zoology</td>
</tr>
<tr>
<td>Rep. Vern Ehlers</td>
<td>Nuclear Physics</td>
</tr>
<tr>
<td>Rep. Todd Akin</td>
<td>Management Engineering</td>
</tr>
<tr>
<td>Rep. Paul Broun</td>
<td>Chemistry, Medical Doctor</td>
</tr>
</tbody>
</table>

NASA’s Office of External Relations (OER) is responsible for establishing NASA’s cooperative agreements and setting NASA’s international relation strategies. OER’s diplomats, who write the agreements, are formally known as international program specialists (IPS). Cooperation, legalized by agreements, includes working with both domestic and international entities, such as other space agencies, foreign governments, federal agencies, companies, universities, and national labs. OER’s organization directly reflects NASA’s mission directorates: Science, Exploration Systems, Aeronautics Research, and Space Operations. As a support office for NASA, OER is organized to reflect the four NASA mission directorates; although not entirely. OER has three divisions whose purpose is mission directorate support: Science, Exploration Systems and Aeronautics Research, and Space Operations. The cooperative agreements produced reflect the work of the mission directorate. For example, in the Aeronautics Mission Directorate an agreement may consist of NASA allowing the European Space Agency (ESA) to use a NASA airplane for the employment of a telescope during flight to conduct space research.
As an intern at OER the summer of 2009, it was observed that an IPS supports and represents NASA, serves the mission directorates, and serves as a link between the mission directorates and its programs. However, it was also observed that an IPS does not have a technical background, and new IPS employees are not offered an official OER orientation program. This fact raised questions. Without a formal technical education and orientation program, are IPSs tasked with writing agreements consisting of content they do not understand? If not, then how is it that new IPSs are efficiently negotiating agreements on NASA’s behalf? The average IPS, before OER employment, did not know much about NASA, its organization, its history, or its mission. Even if aware, there were technical processes and phrases that are particular to NASA’s mission directorates and organizations that needed to be learned.

In spite of these observations, NASA is obviously a thriving force for American S&T diplomacy, collaborating with many nations on a range of activities, such as satellite and human exploration missions. In order to be such a thriving force, NASA OER’s conduction of diplomacy is obviously working, and because of the IPS’ lack of technical expertise, there must be heavy interaction between the IPS and the technical expert. Therefore, one can conclude that technical expertise used for American S&T diplomacy is solely provided by technical experts.

However, this reliance on technical expertise is not specific to American S&T diplomacy. As science and technology are increasingly at the center of global issues, diplomats – who generally lack technical backgrounds – are less capable of effectively completing their work without having to heavily rely on scientists and engineers for clarification and insight. Therefore, the efficiency of a diplomat’s work depends in large part on the efficiency of the diplomat’s working relationship with scientists and engineers.

Using this as motivation, there is a need to examine the relationship between to diplomat and the technical expert to determine if implications of negative affects on international agreements exist. The first step towards this goal is to gain an understanding of the diplomat’s technical competencies and abilities. There is also a need to examine the relationship between the technical expert and the diplomat to determine how the expertise is provided.

This is accomplished by using NASA OER as a case study to answer the following question and sub-questions: What are the technical interactions of international program specialists at NASA’s Office of External Relations?

- What is their working relationship with scientists and engineers?
- How do they go about writing the technical content of agreements?
• What is their technical competence (is it really non-technical)?

The answers will help to define OER’s diplomatic processes and interactions with technical experts.

**Thesis Structure**

The thesis is organized strategically and logically to present the answers to the proposed questions. The next chapter, the literature review, will present an overview of the field of diplomacy involving science and technology. Chapter 3 will (1) present the research study design, (2) define the data needed for collection, and (3) identify the procedures for collection, analysis, and validation. Chapter 4 presents the study results and hypotheses, which are are discussed in Chapter 5. The thesis concludes with Chapter 6. Here the study is summarized and the study’s contributions are presented. The study’s limitations and future work are also discussed in Chapter 6.
CHAPTER 2: SCIENCE, TECHNOLOGY, AND DIPLOMACY

An overview of the field of diplomacy involving science and technology is presented in this chapter. The review of current research and methods only includes the sources best considered for their argument, most convincing of their opinions, and making the greatest contribution to the understanding and development of their area of research. The chapter concludes with a presentation of the proposed study.

Diplomacy is a political means, employing the art of negotiation, in which states pursue foreign activities [9]. Science and technology is a diverse and enormously inter-disciplined area within the field of diplomacy because all entities of science and technology are represented. Scientific and technological research includes a widely diverse set of issues, methods, schools of thought, implications, et cetera. Research areas can span from cell phone and laptop recycling to outer space debris clean-up to climate change. Varying degrees of scientific input is needed for science-based activities conducted by international agencies. Such activities include, creating policy, setting standards, conducting assessments, and monitoring and researching scientific phenomenon.

Literature identifies two major methods in which science and technology are represented in diplomacy: the method of science and technology aiding diplomacy and the method of diplomacy aiding science and technology. The method of science aiding diplomacy, where science includes engineering, technology, the social sciences, health, agriculture, is the inclusion of scientific knowledge in the international diplomacy decision making process [10]. There is extensive literature on this method. The major source of information on science aiding diplomacy is the Knowledge and Diplomacy: Science Advice in the United Nations System written by the National Research Council’s (NRC) Committee for Survey and Analysis of Science Advice on Sustainable Development to International Organizations [10]. The NRC’s study highlights the inherent difficulty of using credible scientific knowledge to influence the political process of diplomacy.

The method of diplomacy aiding science and technology is the use of diplomatic processes to establish or further science and technology collaboration. An extensive literature search yielded no empirical studies on this method. Therefore to find out more about how America conducts its international science and technology policy collaboration, the U.S. Department of State’s (DOS) public
documents were searched. The DOS, as head of all American foreign activities and policies, has a set of procedures for international science and technology cooperative agreements. Understanding this process will help to shine light on how the method of diplomacy aiding science and technology is conducted in America.

Science and Technology Aiding Diplomacy

Literature is clear that the method of science and technology aiding diplomacy has its inefficiencies. Science searches for truth through means that conflict with politics [11]. As Weingart [12] states in his 1999 Science and Public Policy journal article:

Two paradoxes form the nucleus of the problems of scientific expertise and policy-making. The first is the simultaneous scientification of politics and the politicisation of science. This has destructive effects: the increased use of scientific expertise by policy-makers has not increased the degree of certainty, in fact it becomes de-legitimating. This gives rise to the second paradox: despite the loss of authority of scientific expertise, policy-makers do not abandon their reliance on existing advisory arrangements, nor do the scholars adapt their ideas on science and its relation to politics. How can this stability be achieved? How can science–politics be institutionalised? [12]

The body of scientific knowledge evolves with time through experiment, discovery, and new theoretical ideas. The scientific community places great pride in peer review, where research or recommendations of a group of scientists are reviewed and criticized, usually anonymously by other scientists of equal expertise and standing. The original group is then expected to respond to the their criticisms. These processes, which are intended to embody expertise, independence, and objectivity, ensure what is known as scientific credibility, where bias and conflicts of interest are eliminated or balanced [10]. On the other hand, political processes rest on different foundations. The political organizations are representative bodies, and use the interplay of the interests of constituents and stakeholders for decision making. Expertise is frequently given less weight than balance of interests. This is the opposite of the independence prized by scientists. In advisory bodies, weight is also given to geographical, economic, and even religious balance [10].

However, in spite of this oil-water type of relationship that science and politics have, the availability of quality scientific input for science-based decision making by the international diplomacy community (governing bodies, governments, and the UN) is necessary. Over the decades, the UN has focused on geographical representation with little concern for scientific credibility. For example, most scientists work in the Western industrialized countries and Japan. A recruitment of the
world’s best experts in many technical areas will result in an expert group with a majority of West-
erners; such a body is given little credence with the UN system [10]. As a result of such issues, the
National Research Council (NRC) conducted a study that surveyed and analyzed the institutional
arrangements for science advice to international agencies specific to those involved in international
sustainable development. The study focused on improving science advice in the area of sustainable
development because “the global environmental movement has been an important source of expe-
rience on the use of science advice in international diplomacy [10].” The study’s purpose was to
evaluate the quality and effectiveness of the UN’s science advice procedures and recommend ways
to improve the scientific input.

The NRC originally asked the following questions:

- How is scientific information sought and utilized by international, multilateral and bilateral
  organizations in the following areas: energy, freshwater quality and use, oceans, and fisheries?
- What is the role of existing scientific bodies, governmental, intergovernmental, and nongovern-
  mental, in providing such information?
- To what extent does the scientific information come from peer-reviewed and independent
  sources, and how open is the process?

However, after initial research, the NRC realized that these questions did not have simple answers.
The initial research yielded an overwhelming amount of examples of science advice in the UN’s bod-
ies; however, the number of examples lacked apparent patterns or quality standards or evaluation
procedures. The Committee decided that in order to make a valuable contribution it was best to
examine established science advice mechanisms outside of the UN system. This would allow for the
extraction of a set of principles that would be useful for assessing the mechanisms and processes
within the system [10].

To obtain information for the study, a qualitative research method was used. The UN operates
through a wide range of organs including the General Assembly, commissions, programs, research
institutes, agencies, treaty bodies, forums, and conferences [10]. Science advisory mechanisms of one
sort or another are found throughout the system. Some of these organizations and affiliate organi-
zations were emailed questionnaires requesting information regarding procedures they had adopted
for developing science advice. The organizations questioned were the Inter-Academy Council (IAC),
the Council of Academies of Engineering and Technological Sciences (CAETS), the Third World
Academy of Sciences (TWAS), the European Council of Applied Sciences and Engineering (Euro-
CASE), and the UK Royal Academy of Engineering (UKRAE). The procedures reported found to
be consistent. They consisted of the following process: knowing when science advice is needed, stating the science advisory task, identification and recruitment of a study committee, balance of regions, disciplines, and views, management of bias and conflict, management of data and role of staff, drafting a report consisting of the science advice, report consensus and dissent, report review, choice of delivery of advice, implications of the process, and follow-up and impact. Best practices and insights were also presented with the synthesized procedure reporting from the organizations questioned. The NRC in turn used the procedures as a foundation upon which to assess the role of the science advice in the United Nations system [10].

Outside of findings specific to the UN, the study concluded that:

- The real task of the science advisor is to serve as an intermediary to engage the broad scientific community in the service of the organization or the decision maker.

- The participation of the science advisor can make the difference between successful use of science and the failure of an action because of scientific constraints.

- Best known experts with experience on expert committees providing science advice in most fields is likely to find more candidates from the industrialized countries and few from developing nations. Such a politically incorrect imbalance could affect the legitimacy of science advice provided by such groups.

- It is easier to improve the functioning of science advice while enhancing scientific credibility by broadening the input base and introducing or strengthening the peer review processes than by just promoting interactions between science and policy while maintaining scientific credibility.

The most significant finding of the study is that science advice mechanisms function most effectively where a balance between scientific credibility and policy involvement has been achieved. Weingart, on the other hand, believes that the interacting mechanisms, which constitute the coupling of science and politics, will never come to a stable state and that the boundary between science and politics has to be constantly redrawn and reiterated [12].

**Diplomacy Aiding Science and Technology**

With no research conducted in the area of diplomacy aiding science and technology, the DOS’ documents were searched. The DOS has established the “Circular 175 (C-175) procedure,” which “seeks to confirm that the making of treaties and other international agreements by the United States is carried out within constitutional and other legal limitations, with due consideration of the
agreement’s foreign policy implications, and with appropriate involvement by the State Department [13].” The C-175 process allows for the DOS to coordinate and oversee major science and technology agreements and activities between the United States and foreign entities. An international agreement may not be signed or concluded on behalf of the U.S. government without prior consultation with the Secretary of State [14].

The process begins when the originating agency determines that a cooperative activity with a foreign government entity is desirable or necessary. The agency then drafts an agreement and conducts an internal review and clearance process, including review by its general counsel or legal adviser. Part of the review should include a determination of whether the agency wishes the text to be legally binding under international law [14]. After the internal review is conducted, the government agency will submit a C-175 request or an action in memorandum form to the State Department seeking authority to negotiate, conclude, amend, extend, or terminate an international agreement [13].

A Circular 175 memorandum will generally address the following issues [13]:

- The proposed agreement’s principal features, indicating any special problems that may be encountered and, if possible, the contemplated solutions to those problems;
- The policy benefits to the United States, as well as potential risks;
- Whether congressional consultations on the agreement have been or will be undertaken;
- The funding sources that will be committed by execution of the proposed agreement;
- Whether the proposed agreement reasonably could be expected to have a significant regulatory impact on domestic entities or persons; and
- The environmental impact that may arise as a result of the agreement.

Each Circular 175 memorandum is accompanied by a separate Memorandum of Law, prepared by the Office of the Legal Adviser. This legal memorandum generally will include [13]:

- A discussion and justification of the designation given to the proposed agreement (treaty vs. executive agreement);
- An explanation of the legal authority for negotiating and/or concluding the proposed agreement, including an analysis of the Constitutional powers relied upon as well as any pertinent legislation;
• An analysis of the issues surrounding the agreement’s implementation as a matter of domestic law (e.g., whether the agreement is self-executing, whether domestic implementing legislation or regulations will be necessary before or after the agreement’s execution).

Upon receipt of the agency’s draft agreement with supporting documents, the documents are first logged into a register to acknowledge receipt and permit subsequent tracking. An action officer is subsequently chosen to manage the proposed agreement through the C-175 inter-agency clearance and authorization process [14]. While at the DOS, the request is passed through an inter-agency review of the proposed agreement and bilateral memoranda of understanding is conducted.

Ultimately, the C-175 process only includes routine international science and technology agreements, where “routine” refers to those agreements which do not have such significant budgetary, legal, or political implications as to warrant extensive legal, political, or other high level review and approval. The process is not designed to cover agreements related to defense or large multilateral undertakings (e.g., the agreement covering the International Space Station) [14].

Proposed Study

It is apparent that very little is known about the method of diplomacy aiding science in comparison to what is known about the method of science and technology aiding diplomacy. Any research conducted to help fill this substantial knowledge gap must use a hypothesis-generating research method because there is little or no prior knowledge of an area. In the literature search it was discovered that science advice mechanisms function most effectively where a balance between scientific credibility and policy involvement has been achieved. How would diplomatic advice function most effectively? To answer this question, there is a primary need to understand the role that both diplomats and technical experts play, and this is the proposed area of study for this thesis.

The purpose of this study is to employ the grounded theory, a qualitative method of the same concept as the method used in the UN study, to explore and gain an understanding of the relationship that exists between the technical expert and the diplomat. This study is also looking to understand the diplomat’s technical competency. The National Aeronautics and Space Administration’s Office of External Relations will be examined as a case study. The study has been narrowed to the perspective of the diplomat written to address a technical audience.

It is hoped that the results of the study will include: insight into the method in which technical expertise is provided when diplomacy is aiding science and technology, information to help better the communication and relationship between NASA’s diplomats and technical experts, implications of general diplomat-technical expert behavior to be tested, inspiration for diplomats and
technical experts to build better relationships for the sake of developing the best solutions to global and societal issues.

Chapter Summary

This chapter has given a general overview of the topic of science and technology in diplomacy. There are two major methods in which science and technology are represented in diplomacy: the method of science and technology aiding diplomacy and the method of diplomacy aiding science and technology. The method of science aiding diplomacy, supported by extensive research, is the inclusion of scientific knowledge in the international diplomacy decision making process. The method of diplomacy aiding science, with no empirical study support, is the use of diplomatic processes to establish or further science and technology collaboration. Even though it was discovered that science advice mechanisms function most effectively where a balance between scientific credibility and policy involvement has been achieved, science and politics will seem to always have an apparent oil-water type of relationship due to the conflicting process to truth in their respected areas.

With no existing literature on the method of diplomacy aiding science, this study proposes to use a hypothesis-generating method to help fill the knowledge gap. This study is specifically looking to understand the technical interaction and the technical competence of NASA's diplomats, known as international program specialists, to gain insight into the technical competencies and abilities of all American diplomats and their working relationship with technical experts.
CHAPTER 3: METHODOLOGY

The following chapter presents the research design used in answering the proposed research questions. There are three major sections. The data sources and the purpose for these sources are provided in the first section. The second section provides the data analysis, including the method of choice, and the analysis procedures. The third and final section finishes the chapter with an explanation of the validity check for the study’s methodology.

Data Sources

All research involving humans that is performed at Massachusetts Institute of Technology (MIT) is first reviewed and approved by Committee on the Use of Humans as Experimental Subjects (COUHES) before any data can be collected [15]. Therefore, prior to data collection, the author required training, and the pre-interview and interview questions were approved.

Open interviews were chosen as a method of data collection to allow honest answers and insight. The pre-interview and interview questions were designed to gain an understanding of the IPS’ technical competencies, day-to-day technical interactions, and educational and training backgrounds. The questionnaire requested information pertaining to educational training, on-the-job training, and further education or schooling (see Appendix A for a sample of the pre-interview questions). This questionnaire was issued to help cut down on the in-person interview time and to allow more time for the interviewee to reflect on personal experiences. The interview questions were designed to gain an understanding of the skills and abilities of the IPS’s job, the interaction with the technical content of the agreements, and real examples of technical challenges faced by the IPS in writing agreements. There were three versions of interview questions; however, the third and final version is shown in Appendix B. The changes were made as a result of the learning curve effect; the more interviews conducted, the more poorly designed questions or poorly asked questions were recognized and improved.

There are approximately 18 international program specialists and 3 mission support division directors in NASA OER. After gaining approval from OER management, an initial mass email was sent to the IPSs requesting participation in the study. After a limited response, every IPS was
contacted directly via phone; inquiring directly about interest to participate in the study. Twelve of the eighteen IPSs, and one of the three division directors agreed to participate. Upon agreement, interview dates were arranged to be conducted in person, at separate times at NASA Headquarters in Washington, D.C. Subsequently, a COUHES interview participation form and the pre-interview questionnaire were emailed to each participant.

In order to supplement the data collected from interviews and to gain an understanding of the IPSs' technical competencies, an anonymous competency list of OER's employees was provided by NASA's Office of Human Capital Management (OHCM). OHCM uses a Competency Management System (CMS), which is a collection of business processes and tools that are used to measure and monitor the Agency’s corporate knowledge base. The CMS is also used as a means of strategic human capital management, business processes integration, employee development, expertise locator, knowledge management, and a communication tool. NASA’s Human Resources define a competency as a conceptual representation of a body of knowledge. The competencies in the CMS are used to categorize the capabilities of an employee, identify the knowledge requirements of a job position, forecast the workforce requirements for a project, and stimulate the interaction and sharing of knowledge across the Agency. The CMS is not designed or used as an Agency employment and selection system. When defining a job, competencies relate to, and can help define, the knowledge requirements for the position. But there are several other qualifications factors (such as duties, skills, abilities, location, job environment, etc.) that are defined and used during the competitive selection process. Furthermore, the competencies of CMS are not used for pay setting, employee performance evaluation, nor for determining task/work assignments [16].

Data Analysis

This thesis employs both quantitative and qualitative techniques. Statistics and charts were produced using the pre-interview questionnaire and the competency data. The data are used as supporting evidence to gain insight into and perspective on the interview data.

The qualitative research method of grounded theory, used to analyze the interview data, is a hypothesis-generating research method originally developed by two sociologists, Barney Glaser and Anselm Strauss [17]. This method was chosen because there is little or no prior knowledge of an area. As sources support, this research method is chosen when a researcher does not know enough to state meaningful hypotheses or when subjective information is needed [18]. Furthermore, it is well noted that this research method is best suited for the type of research question that is related to the interaction between “persons or among individuals and specific environments [19].”

The subjectivity of qualitative research is often dismissed as unreliable and irrelevant as compared to the traditional objective scientific way of thinking. Qualitative research involves an inescapable
element of interpretation and is complementary to quantitative research despite what traditionalists may think. The main issue is that each researcher's interpretations must be transparent or understandable to others.” [18] Grounded theory excels at “teasing” out experiences by employing two principles: (1) listening rather than measuring, and (2) generating hypotheses using theoretical coding. Theoretical coding involves analyzing and interpreting texts and interviews in order to discover meaningful patterns descriptive of a particular phenomenon [18]. However, the fragmentation of the data through coding can lead to a loss of the bigger picture [19]. According to Auerbach and Silverstein [18], grounded theory coding consists of the following steps:

1. Summarize raw data (Raw Data).
2. Separate relevant data from the irrelevant data (Relevant Text).
3. Identify repeating ideas (Repeating Ideas).
4. Group the repeating ideas into themes (Themes).
5. Group the themes into theories, seeking literature to fill any knowledge gaps (Theoretical Constructs).
6. Express the theories as related to the study’s research concerns developed in forms of narratives (Theoretical Narratives).

This grounded theory coding process, which is consistent with open coding literature [17], appears to be contradictory to the purpose of the grounded theory method; the process yields theories instead of hypotheses. However, the authors do acknowledge that hypotheses can also be drawn during this process. Searching for the authors’ definition of theory for clarification, it is discovered that Auerbach and Silverstein are not particularly clear about their theory definition; but it appears that their implication of the definition is what others in the field have defined as social theory or “the use of abstract concepts to describe some aspects of social structure or social change [20].”

Social theory, however, is controversial. Slawski [20] argues that a concept, an abstraction observed from a recurrence of some phenomenon, or classification of concepts cannot in itself explain why a social structure exists. Nor can concepts alone explain change in the structure of relations between people. At best, these can only give information to help to begin to explain what has happened [20]. Only a hypothesis, the relationship between two or more concepts together in a statement that tells us something about the casual relationship between the concepts, can begin to explain why something has happened. When a set of hypotheses are put together in a deductive interrelated way, a theory is formed [20]. Therefore, according to Slawski, Auerbach and Silverstein’s coding process does not yield theories, but concepts and hypotheses. In turn, this study uses Auerbach and Silverstein’s coding process to derive concepts and hypotheses for further study, not theories. Furthermore, because this thesis is of limited scope, generalization would not be possible (even if deriving theories were the objective). A single case study cannot prove a general theory;
however, it can disprove a general theory.

Analysis Procedures

The interviews were either audio recorded or summarized by note-taking. Instead of transcribing each of the audio recorded interviews, the information given for each question was summarized. During this summary process, duplicate answers were combined to establish a more well-rounded answer. Strauss and Corbin [17] supports this and states that the general rule of thumb is to transcribe as much as needed, according to the particular demands of the research study. Transcribing the first interviews conducted is helpful so that they can be analyzed before more interviews are conducted [17].

The following are the altered Auerbach and Silverstein's grounded theory coding procedures that were employed during this study:

1. Summarizing the raw data.
2. Separating the relevant data from the irrelevant data.
3. Identifying the repeating ideas.
4. Grouping the repeating ideas into themes.
5. Grouping the themes into theoretical constructs or hypotheses, and seeking literature to fill any knowledge gaps.
6. Explicitly writing the hypotheses as related to the study's research concerns developed.

The raw text is the raw data supplied by the interviewees. This raw text is subsequently summarized. Relevant data are data in line with research concerns. It is common in open-ended interviews that interviewees tend to diverge from the question asked. This irrelevant data are to be discarded; it is important. The irrelevant data is set aside to be addressed in Chapter 6 as the basis for future research.

In forming the themes, the repeating ideas and the insightful ideas are compiled into a list, in no particular order. Next, the first listed repeating idea is used as the starter or anchor idea. The anchor idea is removed from the list and is compared to each of the repeating and insightful ideas on the list one by one. When an idea is found to be related to this anchor idea, it is removed from the list as well and grouped with the anchor idea. The reasoning for its relation is also noted. After each idea is compared to the anchor idea, the resulting group of extracted ideas form the first theme and the similarities noted form the conceptual basis for the theme. This first round is now finished. The next repeating idea on the list becomes the new anchor idea. It is removed from the
list and is compared to each of the remaining ideas. This new anchor is not compared the ideas constituting the newly formed theme because the comparison was done in the first round. After each idea is compared to the new anchor idea, the resulting group of extracted ideas form the second theme and the similarities noted form the conceptual basis for the theme. This process continues until all ideas are grouped into themes [18]. This same process and logic is used in forming the theoretical constructs in Step 5. The method of grouping the repeating ideas is left to the discretion of the evaluator; therefore, the evaluator must be explicit about the biases, logical reasoning, and theoretical framework that is used during the process. In this study, the research concerns and the theoretical framework - Chapter 2 - provides the conceptual basis for the logical reasoning behind the grouping of the repeating ideas.

In Step 6, the study’s hypotheses are formally stated. The hypotheses are presented with literature support and research study design recommendations in Chapter 5.

**Reliability and Validity**

Reliability is the repeatability of the same phenomenon from one observer. Validity checks whether or not the observer is actually observing the phenomenon stated to have been observed [20].

The reliability of the grounded theory coding process, as used in this study, is supported by the evaluation of the raw data for repeating ideas in Step 1 of the process. The process’ validity check is in the comparison between the research concerns and the resulting hypotheses (see Figure 1). The thesis questions are the research concerns. These research concerns become the themes of the interview questions. The interview process presents inefficiencies in the interpretation of the questions asked and the interpretation of the answers given. Therefore the yielding raw data should not be predictive. Next, this raw data are subjective answers that then become coded using the five steps previously explained. After the subjective answers are coded, the resulting hypotheses are conditionally related to the study’s research concerns. This is done in the sixth step of the coding process. The linkage between the research concerns and the hypotheses is the validity test of the analysis process.
Figure 1: Visual Explanation of the Study’s Grounded Theory Coding Process Validity
This chapter presents the raw competency, pre-interview, and interview data. The results of the grounded theory coding process of the interview data, which are hypotheses, are also presented at the end of the chapter.

Competency Data

The competency data from NASA Headquarter’s Office of Human Capital Management (OHCM) provided an overall synopsis of the competency composition of NASA OER (everyone included from the administrative assistants to the international program specialists). Of the CMS competency domains, there are two domains in which the competencies of OER fall. These domains are the Business Knowledge and Leadership and Management Knowledge Domains. Figure 2 shows that 42% of the competencies are Leadership and Management Knowledge related and the remaining 58% are Business Knowledge related. The specific competencies and the number of people in OER possessing them are shown in Table 2. The last competency in Table 2, the NASA Leadership Competency, is further broken down into four subgroups, as seen in Table 3.

Only three of the competencies shown are either technical or technically related (the rest could
Table 2: Competencies of the Mission Support Divisions of NASA OER

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business Knowledge Domain</strong></td>
<td></td>
</tr>
<tr>
<td>Business Management</td>
<td>9</td>
</tr>
<tr>
<td>Commercial Technology</td>
<td>2</td>
</tr>
<tr>
<td>Education Programs and Technologies</td>
<td>2</td>
</tr>
<tr>
<td>Export Control</td>
<td>2</td>
</tr>
<tr>
<td>Governmental Affairs</td>
<td>6</td>
</tr>
<tr>
<td>Legal Application Practice: International Law</td>
<td>2</td>
</tr>
<tr>
<td>Public Communications and Outreach</td>
<td>2</td>
</tr>
<tr>
<td>International Program Development</td>
<td>25</td>
</tr>
<tr>
<td>Policy Management</td>
<td>2</td>
</tr>
<tr>
<td>Financial Management</td>
<td>2</td>
</tr>
<tr>
<td>Professional Administrative Operations</td>
<td>3</td>
</tr>
<tr>
<td>Para-Professional Business Operations</td>
<td>3</td>
</tr>
<tr>
<td><strong>Leadership and Management Knowledge Domain</strong></td>
<td></td>
</tr>
<tr>
<td>Executive Management</td>
<td>3</td>
</tr>
<tr>
<td>Business Work and Team Management</td>
<td>3</td>
</tr>
<tr>
<td>Project Work and Team Management</td>
<td>1</td>
</tr>
<tr>
<td>Technical Work and Team Management</td>
<td>1</td>
</tr>
<tr>
<td>Program/Project Management</td>
<td>2</td>
</tr>
<tr>
<td>NASA Leadership Competency</td>
<td>34</td>
</tr>
</tbody>
</table>

Table 3: NASA Leadership Competency Breakdown

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NASA Leadership Competency</strong></td>
<td>33</td>
</tr>
<tr>
<td>Employee and Team Leadership</td>
<td>7</td>
</tr>
<tr>
<td>Knowledge and Communication Management</td>
<td>3</td>
</tr>
<tr>
<td>Work Performance Leadership</td>
<td>4</td>
</tr>
<tr>
<td>International Relations</td>
<td>19</td>
</tr>
</tbody>
</table>

roughly be grouped as technical aiding). In other words, only 1% of these competencies are technical and only 4% are technically related (see Figure 3). In this thesis, to qualify as a technical competency, practical knowledge of a mechanical and scientific subject must be required. To qualify as a technical related competency, only a theoretical technical knowledge is required. The only technical competency is the Technical Work and Team Management competency. This competency is described as knowledge, capabilities, and practices associated with individuals that must understand and manage both the aspects of technical work, as well as management of employees and/or teams. This competency requires the supervisor or lead to have the following competencies: Technical Management, Employee & Team Leadership, Work Performance Leadership. The Technical Management competency includes the knowledge to manage technical activities during the life cycle of projects that include: technical planning, requirements, management, interface management,
technical risk management, configuration management, technical data management, technical assessment, and decision analysis [16]. The technical management process is one of the technical sub-processes within the systems engineering approach as used by NASA [?].

Figure 3: Technical Competency Composition of the Mission Support Divisions of NASA OER

The two technical related competencies are Commercial Technology and the Education Programs and Technologies. The Commercial Technology competency is the knowledge and ability associated with transferring current and future NASA technology to external entities in order to meet broad NASA vision and missions, and extend the life-cycle and broaden the usefulness of NASA technologies. This competency also involves expertise in business practices pertaining to intellectual property, patents, licenses and partnerships as well as general business knowledge for assessing potential partners. A broad understanding of NASA's technologies and programs, as well as familiarity with external entities and markets, are also needed [16].

The Education Programs and Technologies competency encompasses the knowledge, capabilities and practices associated with the research and application of education programs, standards, requirements, activities and services relevant to the fields and disciplines of science, technology, engineering, and mathematics (STEM) within the contexts of pre-college, higher education, and non-traditional learning. A knowledge of education concepts and principles, curriculum development, infrastructure, audiences, instructional technologies and distance learning tools, and trends in order for NASA to appropriately influence and contribute to national and state education initiatives and requirements through the use of NASA's unique assets, is needed. Furthermore, a knowledge of NASA Enterprise and Center-based research and technology needs, and ability to align education activities and programs with these needs, is also needed. Lastly, a knowledge of demographic and geographic dynamics that influence the educational effectiveness and success within the various student and educator communities, is also needed.
Pre-Interview Questionnaires

The educational backgrounds of the interview participants are shown in Table 4. Each degree obtained is counted separately; for example, if someone has both a bachelors and masters in business, it is counted twice. Additionally, if the degree fits into more than one category, such as international business, it is counted twice (international studies and business). Table 5 shows the region of the U.S. where the degrees were obtained. Once again, each degree is counted separately. Table 6 shows the interest in returning to school and desired fields of study. See Appendix C for full data listing.

Table 4: International Program Specialists: Educational Backgrounds

<table>
<thead>
<tr>
<th>Degree Field</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Studies</td>
<td>11</td>
</tr>
<tr>
<td>Economics</td>
<td>2</td>
</tr>
<tr>
<td>Business</td>
<td>6</td>
</tr>
<tr>
<td>Public Policy Management and Administration</td>
<td>3</td>
</tr>
<tr>
<td>Foreign Language</td>
<td>4</td>
</tr>
<tr>
<td>Political Science</td>
<td>5</td>
</tr>
<tr>
<td>Sociology and Social Policy</td>
<td>3</td>
</tr>
<tr>
<td>History</td>
<td>3</td>
</tr>
<tr>
<td>Communications</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 5: Region of U.S. Degree Was Obtained

<table>
<thead>
<tr>
<th>U.S. Region</th>
<th>Number of Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northeast</td>
<td>5</td>
</tr>
<tr>
<td>Midwest</td>
<td>6</td>
</tr>
<tr>
<td>South</td>
<td>8</td>
</tr>
<tr>
<td>West</td>
<td>8</td>
</tr>
<tr>
<td>Outside of U.S.</td>
<td>1</td>
</tr>
</tbody>
</table>

The NASA career summary of the interview participants can be seen in Table 7. Each interviewee has been sorted by their career level. An interviewee serving between one and ten years total at NASA is considered to be in the entry level career category. An interviewee having served 11 to 20 years total at NASA is considered to be in the mid-level career category. An interviewee having served 21 years or more total at NASA is considered to be in the senior level career category. The time spent as an international program specialist (IPS) includes time served as an officer representative at a partner foreign space agency.

The last few questions of the pre-interview questionnaire requested information regarding the training courses taken by the interviewees. The interviewee's opinion about the effectiveness of training
### Table 6: Further Educational Goals

<table>
<thead>
<tr>
<th>Do you plan to go back to school?</th>
<th>What would you study?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Maybe</td>
<td>History or Law</td>
</tr>
<tr>
<td>2 Yes</td>
<td>Accounting and Law</td>
</tr>
<tr>
<td>3 Yes</td>
<td>Education or International Relations</td>
</tr>
<tr>
<td>4 Yes</td>
<td>No answer</td>
</tr>
<tr>
<td>5 No</td>
<td>N/A</td>
</tr>
<tr>
<td>6 No</td>
<td>N/A</td>
</tr>
<tr>
<td>7 Yes</td>
<td>Business or Law</td>
</tr>
<tr>
<td>8 Yes</td>
<td>Economics, International Relations, Law, or Engineering</td>
</tr>
<tr>
<td>9 Yes</td>
<td>Astrophysics, Political Science, or Law</td>
</tr>
<tr>
<td>10 In School: Chemistry/Biology</td>
<td>Environmental Science and Policy</td>
</tr>
<tr>
<td>11 Yes</td>
<td>Not Sure</td>
</tr>
<tr>
<td>12 In School: Leadership Development</td>
<td>Executive Leadership and Organizational Learning</td>
</tr>
<tr>
<td>13 Yes</td>
<td>Science and Technology Policy</td>
</tr>
</tbody>
</table>

### Table 7: NASA Career Summary of Interviewees

<table>
<thead>
<tr>
<th>Career Level</th>
<th>Number of Employees</th>
<th>Total Years at NASA</th>
<th>Total Years as an IPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry Level (1 to 10 years)</td>
<td>8</td>
<td>41.5</td>
<td>25.5</td>
</tr>
<tr>
<td>Mid-Level (11 to 20 years)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Senior Level (21 or more years)</td>
<td>5</td>
<td>115</td>
<td>64.5</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>156.5</td>
<td>90</td>
</tr>
</tbody>
</table>
courses were also requested. Table 8 lists only the training courses that were cited as either most or least helpful and the respective given reasons. Other training courses or areas that were taken but not considered to be most or least helpful are: Appropriations Law, Introduction to Technology Transfer, Mission Operations Directorate Orientation, Legislative Affairs/Understanding Congress, NASA Business Executive Program, Collaborating Internationally and Establishing International Alliances, Masters in Business Administration crash trainings, Excellence in Government, Designing Cost-Effective Space Missions, Dealing with Difficult People, Networking Know How: Make Your Contacts Count, The Human Element, team building and leadership, negotiating, foreign countries' public policy and resources, language training, personality training, and human capital management training.

Interviews: Grounded Theory Coding Process

To reiterate, as described in the Chapter 3, the grounded theory coding procedure consists of the following steps [18]:

1. Summarizing the raw data.
2. Separating the relevant data from the irrelevant data.
3. Identifying the repeating ideas.
4. Grouping the repeating ideas into themes.
5. Grouping the themes into theoretical constructs or hypotheses, and seeking literature to fill any knowledge gaps.
6. Explicitly writing the hypotheses as related to the study's research concerns developed.

Steps Two through Six incrementally present the data analyzed in order to clearly demonstrate the path to the development of the theories.

Step One: Summary of Raw Data

Step One of the coding process, the summary of the raw data, is presented directly below beginning with an outline of the layout of the information.

Interview Raw Data Outline

1. Mission Directorate Support and Interaction with Partners
2. Writing Agreements
<table>
<thead>
<tr>
<th>Technical Hard Science or Math</th>
<th>Most Helpful</th>
<th>Least Helpful</th>
<th>Reasoning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Science Technical Workshop</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introduction to Aeronautics</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Astronomy and Planetary Science for the Science Professional</td>
<td>X</td>
<td>X</td>
<td>“Some sections were less helpful to me than others”</td>
</tr>
<tr>
<td>Foundations of Aerospace at NASA</td>
<td>X, X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Technically Related - Policy, Program/Project Management          |              | X, X         |                                                       |
| Ground Operations Training                                       | X            |              |                                                       |
| NASA Academy of Program/Project & Engineering Leadership (APPEL)  |              |              |                                                       |
| International Program Management                                 | X, X         |              |                                                       |

| Other - Management, Leadership, Business Administration, etc.     |              | X, X         |                                                       |
| Contracting                                                      | X            |              |                                                       |
| Foreign Policy Program (Outside of NASA)                         | X            |              |                                                       |
| Program in Excellence                                            |              | X            |                                                       |
| Project Management Software                                      | X            |              | Information is not needed for my job                  |
| Seven Habit and Principle Centered Leadership                    | X            |              | “I did not apply the principles”                       |
| Leadership for a Democratic Society                              | X            |              |                                                       |
| Generic Management Training                                      |              | X            | Principles taught are not useful in normal government |
| NASA Foundations of Influence, Relationships, Success, and Teamwork (FIRST) | X            |              | Develops the leadership capabilities and inter-agency |
|                                                                  |              |              | collaboration of NASA’s junior professionals by        |
|                                                                  |              |              | providing increased awareness of the NASA vision,     |
|                                                                  |              |              | mission, and goals.                                  |

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As a member of the OER team, an international program specialist has to be able to clearly and efficiently communicate with other federal agencies, scientists and engineers (domestically internal and external to NASA and internationally). The IPS has to also communicate with senior management; providing policy guidance to technical NASA officials regarding international issues. Possessing political savvy knowledge is essential because an IPS is the expert on issues affecting NASA in regards to the country they support. An IPS also has to be culturally aware to be able to adjust to the nuances of cultural changes of the partners. OER is also tasked with aiding in the implementation of the missions of the mission directorates, serving as a link between the mission directorates and programs. Therefore, having a knowledge of NASA’s programs and their history is also essential. Furthermore, OER is not funded by a program and is not driven by incentives to sustain the program and promote cooperation that may not be best suited to further NASA’s strategic goals. In serving as a link between the mission directorates and programs, an IPS is better positioned to impartially serve and represent the interests of NASA.

In order to fulfill his or her duties, an IPS facilitates and organizes domestic and international meetings and conferences. The meetings are to inform senior NASA staff of international travel logistics (2) establish first contact with new international partners or establish ideas for new cooperation with current partners, or (3) fulfill liaison work - communication necessary to maintain cooperation and relationships. Liaison work also includes supportive attendance at partner events, such as embassy or agency conferences. International travel logistics includes preparing briefing books for each NASA official who will be traveling internationally to meet with a partner space agency or government. The briefing books are comprised of all the relative information NASA senior leadership will need while on international travel; information, such as meeting itineraries, and lodging and transportation details. Most IPS stated that the preparation of the briefing books is a huge commitment. According to one IPS, the amount of time spent on briefing books can take an IPS two weeks to complete if also working on the weekend; however, it usually takes around three weeks to complete.

Another aspect of an IPS’ job is to negotiate agreements. When writing agreements, IPSs are
interested in answering the following questions: Is NASA getting a good deal? Would this cooperation be in line with NASA's interests? What parts do or can the partners actually play? How much money and time do the partners actually have? Which skills do they have to contribute to the project? There is a common process that most IPSs go through to write the technical content of their agreements. For most IPSs, there is an initial technical experts' meeting where the IPS listens and takes notes as to what NASA's technical experts want. The IPS then drafts the technical component of the agreement and relies on the technical expert to fill in the specifics. Next, the draft document is edited iteratively until the IPS feels the technical expert has explained the technical content sufficiently enough in laymen terms. There are also challenges when writing and negotiating agreements. Most challenges are a result of establishing new partnerships, agreement process logistical roadblocks, and issues with partner's domestic political instabilities. The only agreements cited as difficult because of their technical content were the International Space Station (ISS) agreements, which are rich with technical details. In order to negotiate agreements, IPSs have to understand the technical content of each agreement and work with scientists and engineers (domestically and internationally).

When asked about the degree to which an IPS must understand the technical content, there were various answers. There were some who answered that they must understand it completely. In other words, an IPS is supposed to be able to regurgitate the technical information only on a general or holistic level. However, it was well cited that the more an IPS understands, the better they can strategically advise their customer. An IPS does not have to be an engineer, but some wish they were because an IPS cannot write an agreement without understanding it. An IPS often meets with other parties involved in the process of establishing an agreement, such as the Department of State, where the technical expert is not present. As a representative of NASA, an IPS must be able to explain the technical content. On the other hand, there were others who felt that they only need to understand the technical content to little or no degree. For this reason it is possible for an IPS to go without ever understanding the technical content. An IPS does not have to write the technical portions of agreements. They can rely solely on the technical expert to write the technical portion of the agreement; editing and formatting it as necessary. The IPSs who feel this way, believe this is part of the scientist's or engineer's job because, as an international expertise, the IPS is supposed to help the technical experts write strategically and efficiently for the best of the agency.

The amount of time an IPS spends trying to understand the technical content varies by agreement, person, project, and program. One IPS stated that 85% of their time is spent trying to understand the technical content. Some methods of trying to understand the technical content include: asking the "experts" questions until it is understood, visiting the mock-up of an instrument, vehicle, or satellite if that is at the center of the agreement, engulfing oneself in the mission directorate and listening in on technical experts' meetings involved in the agreement at NASA Headquarters. More academic styles of methods include: researching on-line, reading the abstracts that the researchers
provide, collecting many publications, booklets, doing outside research, and training. Of these methods, training is the one most supported and encouraged by NASA.

When asked about the daily working relationship with scientists and engineers, initially, some IPSs felt the need to clarify that lumping scientists and engineers into one category was difficult to do. One IPS explained that by experience scientists think in terms of gray and are generally more open-minded in thought process and also open-minded to non-technical people playing a key role on the team. On the other hand, engineers tend to think in terms of black and white and are not open-minded to non-technical people playing a key role on the team. Some IPSs clarified that just knowing someone’s background gives you a hint as to how they approach a problem.

Frustrations due to differences in job objectives and communication issues with technical experts were expressed. Generally the IPSs have experienced a relationship of mutual understanding with the technical experts, where the experts appreciate the IPS’s work and vice versa. Most of NASA Headquarters’ technical experts and the IPSs are mutually respective of each other. However, there are cases where scientists and/or engineers feel that they are the true essence of the NASA workforce and the IPS’ job is to support their agenda. An IPS’ job is to represent NASA’s interests; however, a principal investigator at a field center (PI) is mostly concerned with the success of his or her project. They see OER’s task requests as more bureaucratic work especially when they have heavy workloads. Sometimes field center PIs will make collaborative promises with foreign partners at international conferences, only to find out that the collaboration is politically illegal (not in line with White House policies). This causes headaches for OER and IPSs. This is linked to another point made about how NASA’s field centers really do not know much about HQ’s offices and purposes. Regarding communication issues, some domestic scientists and/or engineers, although having a great understanding of their work, can not communicate what they do in laymen terms. Furthermore, it is a separate level of understanding to communicate with techies from other countries who do not speak English fluently (must overcome both a technical and cultural barrier). However, aside from these few examples of frustrations, most experts have taken the time to understand that OER desk officers do not have a technical background and most experts have a teaching mentality.

An IPS stated that about 30% of their time is spent in meetings with scientists and/or engineers. However, there is a range of opinions about whether the reliance on technical experts has remained the same, increased, or decreased over the time spent working as an IPS. Some IPSs feel that the reliance has remained the same due to the consistency in the number of meetings. Others feel that the reliance has decreased due to their increase in experience, responsibility, and knowledge. On the contrary, the remaining IPSs feel that reliance has greatly increased due to (1) the increase of the IPS’ responsibilities and (2) the increase of technological political issues, which has led to an increase in interactions with technical experts.
From the data above, one can began to see the skills required to be an international program specialist (IPS). Table 9 lists the skills and abilities, in no order of importance, as described by IPS themselves. Good communication skills, described as most important and key, includes good writing skills (clear and concise) and verbal communication. The ability to understanding was described as having the desire and the capacity to learn, as well as, having a genuine interest in the work that NASA does (which is important to engage more knowledgeable counterparts). The international relations work that IPS do can be done elsewhere (it is not specific to NASA); therefore, it is good for them to have an interest in NASA in order to enjoy their work. This interest to some seems imperative to office success. This interest will then enable IPSs to have general technical conversations with both international partners and NASA HQ scientists and engineers.

Table 9: Skills needed to perform as an International Program Specialist

<table>
<thead>
<tr>
<th>Skills and Abilities</th>
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<tr>
<td>Communication</td>
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<tr>
<td>Understanding</td>
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<tr>
<td>Patience, Persistence, and Thoroughness</td>
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<tr>
<td>Research and Analysis</td>
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<tr>
<td>Critical Thinking</td>
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<tr>
<td>Negotiating</td>
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<tr>
<td>Building/ Maintaining Relations</td>
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<tr>
<td>Interpersonal Skills</td>
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<tr>
<td>Organization</td>
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International program specialists cited that patience, persistence, and thoroughness is necessary to ensure each party’s collaboration desires are clearly expressed in the agreement (especially non-English speaking partners). Research and analysis skills were said to include analyzing ambiguous information and employing good note-taking skills. It is important to have the ability to follow technical discussions and be able to translate that clearly. Critical thinking skills involves seeing issues from the stakeholders’ different perspectives and relate them to NASA’s goals. Negotiating skills consists of the ability bring to an agreement the different collaboration desires of two or more diverse parties. In order to build and maintain relations, IPSs are constantly meeting new people. It also requires cross-cultural awareness and respect and the ability to listen and dispel any prejudices. Interpersonal skills include the ability to know how to work with different personalities, listen and respect others, and even go so far as to include recognizing when others are upset or what upsets them. Any given individual may have the best education, resume, training, etc., but if that individual lacks the ability to work well with others that is a big negative. Organizational skills include planning meetings and trips, the ability to quickly multi-task, being flexible and adaptable, time-management, efficiency, and to ability to prioritize.

There are also skills that can only be obtained on the job. IPSs with no technical background
have been learning from the world’s leading aerospace and aeronautics experts to accomplish their job. This takes great skill and the ability to understand the background or history of NASA’s programs. The IPS also has to employ strategic planning and thinking and have an understanding of how the U.S. government works, how it makes decisions, and how the decisions are implemented. This knowledge is essential to explain to foreign partners who may not understand the workings of the U.S. government. It is also important for the IPS to have the ability to influence others on their point of view and to be able to identify opportunities and argue effectively. If they are certain of their point of view in a group meeting where the majority has mostly settled on an opposing idea, wrong decisions could be made if that IPS does have to courage to strongly state their case and persuade the group.

These skills learned on the job do not come from an IPS new OER employee orientation because such a program does not exist. On their first day of work, a new IPS will usually have their division director and a veteran IPS to quickly present an overview of the office’s policies, procedures, and common practices. They will also be given a binder that contains an overview of the common procedures. It is worth noting here that this binder was assembled by an IPS out of the frustration of having no employee orientation. As explained by OER management, an orientation program does not exist because of a low turnover rate and constrained resources. For these reasons and the fact that there are so few OER employees, the cost of an orientation program does not justify the cost (to include both time and effort). An employee orientation is a huge time commitment. Most, but not all, IPSs feel that they would have benefited from an orientation program. The new employee experience was said to have been initially challenging and overwhelming. Others were okay with and actually preferred having to learn by doing and asking. However, regardless of the perception of the new employee experience, with time and experience all IPSs become acquainted to the office because of learning by doing. One IPS stated that with each completed agreement there is improvement.

Feedback on current orientation practices is that the IPS reference binder is not complete and sufficient for every IPS. An IPS’s job portfolio (or official statement of job responsibilities) changes every two to five years. No two IPSs’ jobs are exactly the same, which makes a one-fits-all orientation program difficult to implement. There are differences per division and per program. The IPS’ job is also dependent on the changes in the mission directorate they serve and the frequent changes that come from the Office of the Administrator. It is hard to train people for these reasons. The travel and logistical procedures, as set forth by NASA HQ or DOS, also change often which contributes to the problem. The suggestions offered include: each division manager creating guidelines for each person coming in or hiring a separate individual that would do all the training (which is costly). Additionally, some feel that having no new employee orientation may be a NASA-wide problem. Other federal agencies have 6 week training programs that run about 40 hours per week. There were suggestions for an NASA “Orientation 101” whose purpose would be to give an overview of NASA. As previously stated, many centers do not understand how NASA HQ operates and vice
versa.

As stated previously, NASA encourages training for job enhancement, which has served and can serve to orient new employees. The OER management feels that training introduces major topics of concern for the mission directorates. For example, the NASA Academy of Program/Project & Engineering Leadership (APPEL) training courses are very helpful; especially the training courses in international project management. For one week, trainees are taught to understand budgets and everything that goes into NASA's missions. It is very critical for the OER IPSs to understand how the programs are put together in order to better support the mission directorate in which they serve. IPSs are also introduced to technical terms and key people in the mission directorate in which they serve. The OER management feels that these training courses are a great substitution for an official OER new employee orientation. Furthermore, training outside of NASA HQ helps the officers to see how a field center operates and the cultures that exist there. Most international program specialists feel that training, especially technical training is helpful. However, the IPS' workload is heavy. OER has lost approximately ten IPS job positions in the last past 10 years. Therefore, for most, training is not a priority. In order to receive training, an IPS must make time and also take the initiative.

Step Two and Three: Relevant Data and Repeating Ideas

In Step Two, there were only a few irrelevant points found in the raw data. These irrelevant points are highlighted in Chapter 6, where future work is discussed. Presented here, in no order of importance, is the work concerning the relevant data and the repeating ideas, ideas that were mentioned by most interviewees, that has emerged from it. The repeating ideas are shown below:

1. An IPS must understand the technical content only on a general or holistic level. An IPS cannot write an agreement without understanding it. An IPS does not have to be an engineer, but some wish they were.

2. An IPS needs to understand the technical content to little or no degree. An IPS does not have to write the technical portions of agreements. This is part of the scientist's or engineer’s job because, as an international expertise, the IPS is supposed to help the technical experts write strategically and efficiently for the best of the agency.

3. Some methods of trying to understand the technical content include: asking the experts questions until it is understood, engulfing oneself in the mission directorate and listening in on technical experts’ meetings involved in the agreement at NASA Headquarters, and conducting on-line research.
4. Generally the IPSs have experienced a relationship of mutual understanding with the NASA HQ technical experts, where the experts appreciate the IPS's work and *vice versa*. Most experts have taken the time to understand that OER desk officers do not have a technical background and most experts have a teaching mentality.

5. International travel logistics; briefing books are a huge commitment.

6. Most agreement challenges are a result of establishing new partnerships, agreement process logistical roadblocks, and issues with partner's domestic political instabilities.

7. An IPS has to be able to clearly and efficiently communicate with other federal agencies, scientists, and engineers.

8. The most important skills quoted were: communication, writing, analytical, critical thinking, building/maintaining relationships, interpersonal and organization skills.

9. An IPS serves as a link between the mission directorates and programs.

10. IPS also establishes first contact with new international partners or establishes ideas for new cooperation with current partners.

11. The NASA Academy of Program/Project & Engineering Leadership (APPEL) training courses are very helpful.

12. Most international program specialists feel that training, especially technical training is helpful. IPS workload is heavy.

13. The new employee experience was said to have been initially challenging and overwhelming. Most, but not all, IPSs feel that they would have benefited from an orientation program. However, no two IPS jobs are exactly the same, which makes a one-fits-all orientation program difficult to implement.

In analyzing the relevant raw data for repeating ideas, insightful data - an idea mentioned by a just one or a few IPS - were found. Therefore, these insightful ideas were simultaneously collected and merged with the repeating ideas to for the themes of Step Four. These insights are listed below, in no order of importance:

1. The amount of time an IPS spends trying to understand the technical content varies by agreement, person, project, and program.

2. Reliance on technical experts has greatly increased due to (1) the increase of the IPS' responsibilities and (2) the increase of technological political issues, which has led to an increase in interactions with technical experts.
3. An IPS' job is to represent NASA's interests; however, a principal investigator at a field center (PI) is mostly concerned with the success of his or her project, especially when they have heavy workloads, and see OER's task requests as more bureaucratic work. This is linked to another point made about how NASA's field centers really do not know much about HQ's offices and purposes.

4. The only agreements cited as difficult because of their technical content were the International Space Station (ISS) agreements, which are rich with technical details.

5. An IPS also has to be culturally aware to be able to adjust to the nuances of cultural changes of the partners.

6. Any given individual may have the best education, resume, training, etc., but if that individual lacks the ability to work well with others that is a big negative.

7. An IPS must have a genuine interest in the work that NASA does. The international relations work that IPS do can be done elsewhere (it is not specific to NASA); therefore, it is good for them to have an interest in NASA in order to enjoy their work.

8. An IPS must have the ability and capacity to understand is important. IPSs with no technical background have been learning from the world's leading aerospace and aeronautics experts to accomplish their job.

9. OER is not funded by a program and is not driven by incentives to sustain the program and promote cooperation that may not be best suited to further NASA's strategic goals. In serving as a link between the mission directorates and programs, an IPS is better positioned to impartially serve and represent the interests of NASA.

10. The OER management feels that the APPEL courses in International Project Management are a great substitution for an official OER new employee orientation.

11. As explained by OER management, an orientation program does not exist because of a low turnover rate, constrained resources, and the fact that there are so few OER employees.

**Step Four: Themes**

The grouping process used to create the themes is described in Chapter 3, Analysis Procedures. In order to be transparent about the logical reasoning behind the grouping of the repeating ideas and insights, each theme's title describes the conceptual basis for its creation. The themes, presented below, are in order of their establishment, not in order of importance.

1. The perception of technical competence.
(a) An IPS must understand the technical content only on a general or holistic level. An IPS cannot write an agreement without understanding it. An IPS does not have to be an engineer, but some wish they were.

(b) An IPS needs to understand the technical content to little or no degree. An IPS does not have to write the technical portions of agreements. This is part of the scientist’s or engineer’s job because, as an international expertise, the IPS is supposed to help the technical experts write strategically and efficiently for the best of the agency.

2. The nature of and the methods of understanding technical content.

(a) The amount of time an IPS spends trying to understand the technical content varies by agreement, person, project, and program.

(b) Some methods of trying to understand the technical content include: asking the experts questions until it is understood, engulfing oneself in the mission directorate and listening in on technical experts’ meetings involved in the agreement at NASA Headquarters, and conducting on-line research.

(c) Reliance on technical experts has greatly increased due to (1) the increase of the IPS’ responsibilities and (2) the increase of technological political issues, which has led to an increase in interactions with technical experts.

3. The working relationship of the international relation specialist (IPS) and the technical expert.

(a) Generally the IPSs have experienced a relationship of mutual understanding with the NASA HQ technical experts, where the experts appreciate the IPS’s work and vice versa. Most experts have taken the time to understand that OER desk officers do not have a technical background and most experts have a teaching mentality.

(b) An IPS’ job is to represent NASA’s interests; however, a principal investigator at a field center (PI) is mostly concerned with the success of his or her project, especially when they have heavy workloads, and see OER’s task requests as more bureaucratic work. This is linked to another point made about how NASA’s field centers really do not know much about HQ’s offices and purposes.

4. The major work issues that exist for the IPS.

(a) International travel logistics; briefing books are a huge commitment.
(b) Most agreement challenges are a result of establishing new partnerships, agreement process logistical roadblocks, and issues with partner’s domestic political instabilities.

(c) The only agreements cited as difficult because of their technical content were the International Space Station (ISS) agreements, which are rich with technical details.

5. The skills and abilities critically important to an IPS’ job.

(a) An IPS has to be able to clearly and efficiently communicate with other federal agencies, scientists, and engineers.

(b) The most important skills quoted were: communication, writing, analytical, critical thinking, building/maintaining relationships, interpersonal and organization skills.

(c) An IPS also has to be culturally aware to be able to adjust to the nuances of cultural changes of the partners.

(d) Any given individual may have the best education, resume, training, etc., but if that individual lacks the ability to work well with others that is a big negative.

(e) An IPS must have a genuine interest in the work that NASA does. The international relations work that IPS do can be done elsewhere (it is not specific to NASA); therefore, it is good for them to have an interest in NASA in order to enjoy their work.

(f) An IPS must have the ability and capacity to understand is important. IPSs with no technical background have been learning from the world’s leading aerospace and aeronautics experts to accomplish their job.

6. The critical elements of an IPS’ job.

(a) An IPS serves as a link between the mission directorates and programs.

(b) IPS also establishes first contact with new international partners or establishes ideas for new cooperation with current partners.

(c) OER is not funded by a program and is not driven by incentives to sustain the program and promote cooperation that may not be best suited to further NASA’s strategic goals. In serving as a link between the mission directorates and programs, an IPS is better positioned to impartially serve and represent the interests of NASA.

7. Helpful on-the-job training options for the IPS.
(a) The NASA Academy of Program/Project & Engineering Leadership (APPEL) training courses are very helpful.

(b) Most IPSs feel that training, especially technical training is helpful. However, the IPS workload is heavy.

8. The elements of the IPS new employee orientation.

(a) The new employee experience was said to have been initially challenging and overwhelming. Most, but not all, IPSs feel that they would have benefited from an orientation program. However, no two IPS jobs are exactly the same, which makes a one-fits-all orientation program difficult to implement.

(b) As explained by OER management, an orientation program does not exist because of a low turnover rate, constrained resources, and the fact that there are so few OER employees.

(c) The OER management feels that the APPEL courses in International Project Management are a great substitution for an official OER new employee orientation.

Step Five and Six: Theoretical Constructs and Theoretical Narratives

The same grouping process used to create the themes was used to create the theoretical constructs or the concepts developed to support the hypothetical bases for future theory development. However, there are two themes that have been used twice because they related strongly to other themes. The concepts, shown below, are given subjects to represent the relationship between the constituting themes. Following the theoretical constructs, the theoretical narratives explicitly state the hypotheses as supported by details of the concepts.

The first concept is centered around the new IPS employee orientation and the OER employee training and development experiences. The themes forming this concept are:

1. The skills and abilities critically important to an IPS' job.
2. Helpful on-the-job training options for the IPS.
3. The elements of the IPS new employee orientation.
Hypothesis 1: An evaluation of the current IPS orientation process and OER training procedures may show that, despite perceived difficulties, are the best available.

On a search to gain insight into the IPS' technical competence, it was discovered that there is frustration concerning the new IPS employee orientation and the OER employee training and development. It appears that OER aims to hire people with personality traits, skills, and/or abilities that have been said are hard to learn or teach. Then once hired, the current orientation process is brief, lasting one to two days. During this time the IPS is given a brief NASA/OER overview, introduced to a fraction of the people with whom they will work, and is handed a binder to read. Over the course of their first year, the IPS will learn how to do their job mostly by trial-and-error and also by consulting office veterans. As explained by OER management, an official orientation program does not exist because of a low turnover rate, constrained resources, and the fact that there are so few OER employees. Therefore, during this first year, and this is to be true over their tenure as an IPS, they are encouraged to seek training. However, the new IPS is occupied with learning how to do their job and the veteran IPS is swamped with the workload of two IPS, such that training - in most cases - takes a back seat. This inability to properly take advantage of much needed training is the source of most IPSs frustration. An outright revamp of the orientation and training procedures is not the best primary action to be taken. There are outside factors to consider, such as HR limitations to the number of IPSs in OER. Therefore, an evaluation analysis of the current orientation process would help to determine whether or not OER should change its orientation and training practices.

The second concept addresses the role of the IPS and the interaction between the IPS and the technical expert. The themes constituting this concept are:

1. The critical elements of an IPS’s job.
2. The major work issues that exist for the IPS.
3. The working relationship of the international relation specialist (IPS) and the technical expert.

Hypothesis 2: An increased understanding of the IPS’s role, on behalf of the technical experts - especially the field experts, should improve the relationship of the IPS and the technical expert.

On a search to gain insight into the IPS’ relationship with the technical expert, the role of the IPS and the interaction between the IPS and the technical expert were observed. It was discovered that the essence of what an IPS does is to serve as a link between the mission directorates and programs, establish first contact with new international partners, and establish ideas for new
cooperation with current partners. It was also discovered that the IPSs more than likely will have a relationship of mutual understanding with the NASA HQ technical experts; however, this is more than likely not true with a principal investigator at a field center. This is partly because each party has different motives and there is a lack of understanding about HQ's offices and purposes. Therefore, it appears that the interaction between the IPS and the technical expert would be better at NASA HQ than with a PI at a field center.

The third, and last, concept addresses the process of technical comprehension, using the following themes:

1. The perception of technical competence.
2. The nature of and the methods of understanding technical content.
3. The skills and abilities critically important to an IPS' job.
4. The working relationship of the international relation specialist (IPS) and the technical expert.

Hypothesis 3: The technical competence of an IPS is, to some degree, dependent on both (1) the working relationship an IPS has with the technical expert and (2) the IPS' capability, capacity, and desire to learn.

On a search to gain insight into how the IPSs go about writing the technical content of agreements, the process of technical comprehension was discovered. The amount of time an IPS spends trying to understand the technical content varies by agreement, person, project, and program. Even though IPSs disagree about the extent of their technical competence, it is clear that their reliance on technical expertise is increasing. So much that the technical competence of an IPS is, to some degree, dependent on the working relationship an IPS has with the technical expert because the IPS main source of technical content clarification is provided by the technical expert. If the working relationship is good, then the IPS ideally should have no problem understanding the technical content; however, if the working relationship is bad, then the IPS will have to work harder to understand the technical content.

**Chapter Summary**

The competency and pre-interview questionnaire data are used as supporting data for the grounded theory coding process of the interview data. The two domains in which the competencies of OER fall are in the Business Knowledge and Leadership and Management Knowledge Domains.
of the competencies are Leadership and Management Knowledge related and the remaining 58% are Business Knowledge related. Only 1% of these competencies are technical and only 4% are technically related. According to the pre-interview responses, the majority of IPS have had formal educational training in international studies and/or business (see Table 4). As shown in Table 5, the training more than likely has taken place at a southern or western U.S. university. Regarding the desire for IPS to return to school, of the eight IPS interested, two technically related degrees and two technical degrees were mentioned by IPS as degrees of choice (see Table 6). Furthermore, one of the two IPS currently in school is taking hard science courses.

The pre-interview data also contains the NASA career summary of the interview participants (in number of years served) can be seen in Table 7. No mid-level career IPSs, having served 11 to 20 years, were interviewed. Most of the IPSs interviewed are considered entry-level, having served one to ten years; however, the bulk of the years in experience come from the senior-level IPS or division director interviewed. The last of the pre-interview questionnaire data are about training. As shown in Table 8, half of the business, management, or leadership type training courses cited, 4/5 of the technically related training courses cited, and 3/4 of the technical training courses cited were valued as most helpful to the IPS’ job.

Step one of the grounded theory coding process for the interview data, the summary of the raw data, is presented in a form detailing the IPS job experience. Step two of the process highlights only the relevant data and the repeating ideas that have emerged from it. The irrelevant data are discussed in Chapter 6. In the process of analyzing the relevant raw data for repeating ideas, insightful data - not qualifying as a repeating idea - were found. This insightful data was simultaneously collected and combined with the repeating ideas to form themes. The themes, in turn, were grouped to create the theoretical constructs or the concepts developed to support the hypothetical bases for future theory development.

As a result of the grounded theory coding process, three hypotheses for further research were formed: An evaluation of the current IPS orientation process and OER training procedures may show that, despite perceived difficulties, are the best available; An increased understanding of the IPS’s role, on behalf of the technical experts - especially the field experts, should improve the relationship between the IPS and the technical expert; The technical competence of an IPS is, to some degree, dependent on (1) the working relationship an IPS has with the technical expert and (2) the IPS’ capability, capacity, and desire to learn.
CHAPTER 5: DISCUSSION

This chapter integrates the information presented thus far and answers the study’s research questions. In answering the questions, the study’s methodology is checked for its accuracy. This chapter then builds upon the study and draws from literature, not previously presented, to prove the accuracy of the hypotheses drawn. The chapter concludes with an explanation of the study’s limitation and future work recommendations are made.

Method Validation: Thesis Question Answered

The thesis question, “What are the technical interactions of international program specialists at NASA’s Office of External Relations?” is answered here. As explained in Chapter 3, the method’s validity check is in the comparison between the research concerns and the hypotheses drawn. If the comparison shows that the two are related, then the methodology is valid. This comparison is included in the answers to the sub-thesis questions poised in Chapter 1. Therefore, the overarching question is answered through the presentation of the comparison.

What is the IPS’s working relationship with scientists and engineers?

This question was poised to identify the dynamics of the interaction between scientists/engineers and international program specialists. The first logically perceived step towards establishing this identification, was to identify the working relationship between the two parties.

It was found that the essence of what an IPS does is to serve as the link or liaison between the mission directorates and programs, to establish first contact with new international partners, and establish ideas for new cooperation with current partners. What enables the IPS to validly perform this duty is the fact that OER is not funded by a program and is not driven by incentives to sustain the program and promote cooperation that may be damaging for NASA in the long term. In serving as a link between the mission directorate and programs, an IPS is better positioned to impartially serve and represent the interests of NASA. In serving in this liaison role, the IPS assists NASA’s technical experts, but also negotiates and mediates between these technical experts and
their collaborating partners.

After having identified the role of the IPS, it was found that the IPS is more likely to have a relationship of mutual understanding with NASA HQ’s technical experts than with the technical experts at a NASA field center. This is because the technical experts themselves (at HQ or field center) have different motives. A principal investigator at a field center (PI) is mostly concerned with the success of his or her project. This is also the concern of HQ technical experts, but they have a better understanding of the need for OER by being at HQ (where the overall goals of NASA are easily perceived). Similarly, the separation of the IPS from the field expert attributes to the field expert’s lack of understanding about what OER does at HQ.

These findings, a derivation of the aforementioned working relationship research concern, have directly contributed to the development of the hypothesis stating that an increased understanding of the IPS’s role, on behalf of the technical experts - especially the field experts, should improve the relationship between the IPS and the technical expert.

**How do IPS go about writing the technical content of agreements?**

This question was generated to discover what an IPS does and how the IPS goes about it. The study has found that an IPS does not *have* to write the technical portions of agreements. They can rely solely on the technical expert to write the technical portion of the agreement; editing and formatting it as necessary.

In discovering this, it was also found that the process of writing the technical content is heavily tied to the condition of the IPS’ working relationship with the technical expert, and the IPS’ technical competence. The IPS is not the technical expert relies on the expert for the technical information and the insight into what the information means. If the working relationship is *good*, then the IPS ideally should have no problem understanding the technical content; however, if the working relationship is *bad*, then the IPS will have to work harder to understand the technical content. Furthermore, depending on the formal educational and training backgrounds of the IPS, the process of understanding the technical content will vary. Other factors tied to the learning process, are years of experience, educational background, and personal interest/motivation/work standards.

These findings, a derivation of the research concern to discover what an IPS does and how he or she goes about it, have directly contributed to the development of the hypothesis stating the technical competence of an IPS is, to some degree, dependent on (1) the working relationship an IPS has with the technical expert and (2) the IPS’ capability, capacity, and desire to learn.
What is the IPS’ technical competence?

This question’s purpose was to discover what an IPS knows and/or understands. According to the pre-interview responses, there is indication that some of the most technically interested IPSs desire formal technical education although the majority of the IPSs have only had formal educational training in international studies and/or business prior to being hired as an IPS (see Table 4). In support of this, the competency data collected proves that OER’s employees do not have technical competencies, as only 1% of the competencies are technical and only 4% are technically related. This in turn is supported by the heavy reliance on the technical experts for technical content clarification, which is another indicator as to lack of technical competence.

In the absence of their technical competence, IPSs look to training for job development, especially - as most IPSs feel - in the absence of an orientation program. Therefore, in gaining insight into the IPS’ technical competence, it was also discovered that there is frustration concerning the new IPS employee orientation and the OER employee training and development. These findings, the research concern to discover what an IPS knows and/or understands, have directly contributed to the development of the hypothesis stating that an evaluation of the current IPS orientation process and OER training procedures may show that, despite perceived difficulties, are the best available.

Validation and Implications of Hypotheses

Showing that the method is valid does not automatically guarantee that the hypotheses are also correct. This section will look to other studies and literature related to the each of the hypotheses to help (1) validate or disprove the hypotheses drawn, and/or (2) further elaborate on the hypotheses generated in this study.

Training and Orientation

To be clear, training as used in this thesis is referring to knowledge taught to enhance performance on the trainee’s current job. Development is referring to the acquisition of knowledge prior to its application. Orientation consists of an organization overview, the work unit, and a summary of how things are done and what matters [21]. A successful orientation program should 1) welcome the employee, 2) help the employee to understand the organization in a broad sense (vision, goals, culture, history, vision for the future) and the policies and procedures, 3) explain what the firm expects in terms of work and behavior, and 4) help the employee become socialized in the firm/organization’s preferred way of acting and doing things [22].

IPSs feel that the current orientation practices are challenging and overwhelming. Managers believe that current practices are necessary, and that no official orientation program does not exist because
of a low turnover rate, constrained resources, too few employees, and the fact that no two IPS jobs are exactly the same. This is the reason why employees are encouraged to seek the international program training and others within the NASA APPEL program. However, contrary to what is believed, there is an unofficial orientation program in existence. Approximately twenty-five percent of the orientation practice consists of a brief introduction to resources, people, and infrastructure. About 65% of the practice is comprised of veteran help with the remaining 10% representing learning by doing. However, these percentages only represent the first day or two on the job. It takes IPSs a year before they are fully oriented to OER. The rest of the year the percentages change to 5% manager help, 45% veteran help, and 50% learning by doing (to include taking initiative to enroll in training courses).

Training, or in the case of OER - orientation, is not an expense, but an investment in the human capital of employees. Regardless of this fact, “one of the most neglected areas of training is new-employee orientation [23].” A new employee’s initial experience with an organization can have a major effect on his or her career [23]. Managers and supervisors should also be aware of the importance of their role in the career development of emerging professionals ages 18-25 [24], which has a strong implication towards the importance of new employee orientation. When the supervisor provides welcomed support to the 18-25 age group, this support is considered thoughtful because this support helps these employees through life and career transitions particularly crucial to this group [24]. “Unfortunately, managers’ mindsets cause them to often be biased towards treating financial and physical capital as more “real” than the intellectual capital embedded in their employees. That perspective, in turn, may lead to an underinvestment in human capital [25].”

However, in spite of these facts, an official orientation program may not be the best solution for OER. Surveys from the American Society for Training and Development, show that 80% of what employees learn on the job came from informal procedures (performance and working with veteran employees) than from a formal training program [22]. Therefore, the first step in correcting a problem is to conduct an analysis of what needs to be done. But before an analysis is to be conducted, it is wise to keep in mind that there is a great deal of error in measures of training. Both the establishments and the workers agree that there is a great deal of informal training for newly hired workers. The incidence rate of each type of training exceeded 70% and the mean number of hours for each type of informal training was over 20 hours in the first weeks of employment. In contrast, formal training measures had relatively low incidence rates than the mean hours of formal training in the first 4 weeks [26]. Performance-based evaluation measures for training programs, such as surveys, on their own are not necessarily a sound basis for evaluating investments in training. The appropriate means of evaluating any particular form of human capital investment will depend enormously on the specifics of the employee, the type of training, and the organization and its context [25].
In assessing an orientation program, literature points out four steps to follow (assessment, design, implementation, evaluation) [25]. This area of assessment is referred to as a training needs analysis (TNA) [27]. A TNA examines whether training is the desired solution to determine, as much as possible, how to design the training program and how effective training will be in its usage [27, 28]. There are three major areas of the TNA, the organization (organizational/context analysis), the job (the work or task/job analysis), and the person to be trained (user analysis). The organizational or context analysis examines broad factors, such as the organization’s culture, mission, long- and short-term goals, values, and structure are related to the external environment [28]. Furthermore, this analysis would include an examination of documents, laws, and procedures used on the job would be useful. The job analysis is the examination of the tasks to be performed on the job. Here the job requirements, tasks, knowledge, skills, and abilities are identified. The user analysis determines who needs training and to what extent based on the worker’s performance and the “organization’s expectations or standards [28].” In addition to these three fundamental analyses, an employer could conduct a cost-benefit analysis of the return on investment (ROI) of training to help identify effective training results in a return of value to the organization. However, when designing or evaluating training programs, one should bear in mind that cost-benefit calculations concerning human capital investments may be distorted because important benefits are intangible or long-term in nature [25].

I believe that an evaluation of the current IPS orientation process and OER training procedures may show that, despite perceived difficulties, are the best available is a valid hypothesis. Throughout the study, there have been strong implications that the current practices not only serve the traditional role of an orientation, but help to build a lasting relationship between the new and veteran IPSs. Furthermore, I believe that the current orientation practice is a “sink or swim” concept, which may be necessary to help the IPS establish their place within OER. Therefore, I feel that these assumptions establish this hypothesis as legitimate.

**Interaction**

There is a need for an interpersonal understanding between the technical expert and the international program specialist, and interpersonal interaction can be improved with an increased understanding of the role each party involves plays. Searching existing methods that could help to identify relationship roles, the use of the Transactional Analysis (TA) was discovered. The TA is a psychotherapy used to analyze the inter-relational transactions between people by characterizing the roles played in the transactions as a parent, adult, or child [27]. The roles are defined in the quotation below.

The Parent role represents authority, tradition and the routine knowledge of how things are done. The Adult role mediates between the Parent and Child parts of the personality. Is represents mastery of skills and an objective, rational, data-processing kind of
approach to a situation. The Child role represents spontaneity, creativity, intuition and pleasure [27].

TA literature shows that healthy transactions are those that are complementary, as in an Adult-Adult interaction. An IPS-Technical Expert interaction can be used as an example to demonstrate this. If a technical expert were to ask an IPS “Do you know the file of my C-175 cleared agreement is?” that is considered an Adult agent - initiating - transaction. If the IPS says “It is in your mailbox,” this is considered to be an Adult response. However, if the respondent (IPS) were to say “Well it can not have gone far, let’s see if we can find it for you,” this is considered to be a Parent response. On the other hand, in a crossed transaction the respondent responds with inappropriate feelings for an appropriate Adult response. So, if the IPS were to originally say, “How should I know where your file is? You always blame me for everything;” it would be considered to be a Child response [27].

I believe that an increased understanding of the IPS’s role, on behalf of the technical experts - especially the field experts, should improve the relationship between the IPS and the technical expert is a valid hypothesis. I feel that TA could be used by researchers as a means of examining and generalizing the roles that are played between IPS and HQ technical experts and IPS and field technical experts. Once general roles are identified, steps for relationship improvement can be recommended. The resulting information would be helpful to inter-professional work environments, such as OER. Furthermore, this lack of understanding of the diplomat’s role may not only be apparent here in the relationship between the IPS and the technical expert, but apparent in the other technical organizations where the method of diplomacy aiding science and technology is practiced. Therefore, I feel that these assumptions establish this hypothesis as legitimate.

**Technical Competence**

Searching existing competence and learning literature, the assumption of formal education theory was found. The theory simply says that measures of formal education are assumed to accurately represent human abilities. However, the concept of formal schooling as an institutional process ignores the inherent nature of learning as the acquisition of cognitive knowledge and abilities by experience. In application, this theory is saying that it is necessary to consider that a worker both learns as he or she performs a job [29]. This supports the fact that behaviors can change due to learning. Such learning is known as incidental learning or learning that takes place unconsciously [27]. However, learning requires arousal and motivation. The sole presence of arousal and motivation will automatically provide learning [27]. Therefore, as the hypothesis states, if an IPS has the capability, capacity, and desire to learn, they will learn.

Two constituents of incompetence are the inability or the unwillingness to learn or change and
deficits in communication [30]. The inability or the unwillingness to learn or change can be linked to an IPS with low job interests. Deficits in communication can be linked to difficulties in the IPS-Technical Expert working relationship, where the IPS is dependent upon the technical expert for technical content clarification. Using the incompetence definition as a model, the incompetence of an IPS can be accredited to low job interests (arousal and motivation) and difficulties in the IPS-Technical Expert working relationship. Therefore, I believe that the technical competence of an IPS is, to some degree, dependent on both (1) the working relationship an IPS has with the technical expert and (2) the IPS’ capability, capacity, and desire to learn is a valid hypothesis; and the new-found definition of the incompetence of an IPS helps to establish the hypothesis as legitimate.

Final Thoughts

In discovering the technical interactions of IPSs and technical experts, one can see that the use of the method of diplomacy aiding science is rarely used and even more rarely documented or studied. This may be the reason for the lack of understanding on behalf of the technical expert as to the role the diplomat is to play. Furthermore, the lack of understanding of the diplomat’s role may not only be apparent here in the relationship between the IPS and the technical expert, but in the other technical organizations where the method of diplomacy aiding science and technology is practiced.

It is hoped that the results of the study has presented information to help better the communication and relationship between NASA’s diplomats and technical experts, found evidence of general diplomat-technical expert behavior for further research, and provided inspiration for diplomats and technical experts to build better relationships for the sake of developing the best solutions to global and societal issues.
CHAPTER 6: CONCLUSIONS

A review of current literature identifies that there are two major methods in which science and technology are represented in diplomacy: the method of science aiding diplomacy and the method of diplomacy aiding science, where science includes engineering, technology, the social sciences, health, agriculture. The method of science aiding diplomacy is supported by extensive research, and the method of diplomacy aiding science has no empirical support. With intentions to contribute to the lack the latter, this study employed the hypothesis-generating grounded theory to gain an understanding of the diplomat’s technical competence and the diplomat’s relationship with the technical expert. The study, narrowed to the perspective of the diplomat written to address a technical audience, examined as a case study, the National Aeronautics and Space Administration Office of External Relations’ (OER) diplomats - officially known as international program specialists (IPS). IPSs were interviewed and the data was analyzed using the grounded theory coding process. Statistics and charts were produced from pre-interview questionnaires and competency data and used as supporting evidence for the interview data.

The thesis question, “What are the technical interactions of international program specialists at NASA’s Office of External Relations?”, is expressed and answered through its three sub-questions: What is the IPS’s working relationship with scientists and engineers? How do IPSs go about writing the technical content of agreements? What is the IPS’ competence? The collective answer is that an IPS does not generate the technical content of agreements, but relies heavily on the technical expert for both the content and its clarification. This lack of technical competence is supported by the fact that only 1% of reported OER’s employees’ competencies are technical (hard math and science) and only 4% are technically related. Hypotheses developed through the grounded theory coding process include: An evaluation of the current IPS orientation process and OER training procedures may show that, despite perceived difficulties, are the best available; An increased understanding of the IPS’s role, on behalf of the technical experts - especially the field experts, should improve the relationship between the IPS and the technical expert; The technical competence of an IPS is, to some degree, dependent on both (1) the working relationship an IPS has with the technical expert and (2) the IPS’ capability, capacity, and desire to learn. The study’s methodology was proven to be valid through a demonstrated relation between the research concerns and the hypotheses drawn. The hypotheses were validated by the support of current studies.
In discovering the technical interactions of IPSs and technical experts, it was observed that the lack of understanding on behalf of the technical expert as to the role the diplomat is to play, may be a result of the lack of research on the method of diplomacy aiding science. Furthermore, the lack of understanding of the diplomat’s role may not only be apparent in the relationship between the IPS and the technical expert, but in the other technical organizations where the method of diplomacy aiding science and technology is practiced.

**Thesis Contribution**

Contributions have been made to the lack of research concerning the practice of diplomacy aiding science and technology. This was accomplished by first analyzing the diplomat’s relationship between scientists and engineers. The thesis has discovered that there is a lack of understanding on behalf of the technical expert as to the role the diplomat is to play. The overall study implies that the lack of understanding of the diplomat’s role may also be apparent in other technical organizations where the method of diplomacy aiding science and technology is practiced.

**Limitations of Study**

To be able to truly advance the research conducted on the practice of diplomacy aiding science, there has to be an immense amount of data collected. The scope of this study has only allowed for the examination of an element of the American science and technology diplomacy workforce, the NASA Office of External Relations, to gain insight into the technical competencies and abilities of diplomats and their working relationship with technical experts. At other organizations, the technical interactions between diplomats and technical experts will have other externalities (organization culture, individual personalities, organization procedures and policies, etc.) affecting the technical interaction between diplomats and technology experts. Furthermore, this study’s data was collected from the interviews of IPSs and the thesis written to address a technical audience. Therefore, the hypotheses derived are heavily weighted to reflect the IPS’ perspective.

**Future Work**

Further research should examine the diplomat-technical expert relationships at other organizations within the American S&T workforce that practice the method of diplomacy aiding science. This would to add other dimensions of the understanding to the American diplomat-technical expert relationship. Further research should also conduct studies from the technical expert’s perspective. This would add even further dimensions of the understanding to the American diplomat-technical expert relationship. It is not until a more complete perspective is gained that research in this field
can begin to focus on determining if convincing evidence exists that the lack of diplomats’ technical knowledge and/or existing relational difficulties between the diplomat and the technical expert have negative effects on international agreements.

Other areas of interest for further research include:

1. **Whether or not potential employees with interdisciplinary formal educations (a combination of international relations, policy, engineering or science) would be ideal candidates for the role of the IPS.**

2. Which of the OER mission-support divisions rely more on technical expertise? Which of these divisions have gained a deeper understanding of the technical content in which they deal?

3. Should OER concentrate on hiring certain personality types that will be okay with the no official orientation tradition (personalities that thrive and can succeed with diving into the deep end on day one)? What is the measure of success of IPSs who work best by learning? Maybe OER should look for these individuals in recruitment as opposed to establishing a new employee orientation program?

Also, as aforementioned in Chapter 4, the irrelevant data separated from the data relevant to the study’s research concerns are presented here for further analysis. In other words, these data - although collected for this study, were not folded into the research. Below the data is presented in the form of short statements that readers can use as motivation for further research.

*Training data for further research:* It was found that some IPSs feel that having no new employee orientation may be a NASA-wide problem. Other federal agencies have 6 week training programs that run about 40 hours per week. A suggestive solution is the implementation of a NASA “Orientation 101” program, the purpose of which would be to give an overview of NASA. This would also help to address the fact that many centers do not understand how certain offices within NASA HQ operate.

*Other skills and abilities considered:* The IPS has to be able to employ strategic planning/thinking and have an understanding of how the U.S. government works, how it makes decisions, and how these decisions are implemented. This knowledge is essential to explain to foreign partners who may not understand the workings of the U.S. government. It is also important for the IPS to have the ability to influence others on their point of view and to be able to identify opportunities and argue effectively. Another ability an IPS should possess is the ability to stand firm on great ideas. If the IPS are certain of their point of view in a group meeting, where the majority has mostly settled
on an opposing idea, wrong decisions could be made if that IPS does have to courage to strongly state their case and persuade the group.
References


Appendix A: Pre-Interview Questionnaire

1. What post-secondary degree/s do you have? In what disciplines? (spell out disciplines)
2. From where did you receive the degree/s? (spell out names)
3. Do you desire to go back to school or are you currently in school?
4. If so, what degree and in what field would you or are you pursuing?
5. What has been your career path at NASA (please state the job position title and the number of years you held that position)?
6. Have you had training workshops during your career? If so, please list the names of the training programs, spelling out any abbreviations.
7. Which of these training workshops have been MOST helpful in improving your job performance?
8. Which of these training workshops have NOT been helpful in improving your job performance?
Appendix B: Interview Questions

Understanding the Skills/Abilities of the Job

1. What are the main duties/requirements of your job?
2. What skills and or abilities have served you well on this job?
3. Amongst these skills, how would you rank them from most important to the least important?
4. Are there any skills that can only be obtained by on the job experience?
5. How do you feel about there being no official new OER employee training? Why do you think there is no new employee training?

Understanding the Interaction with the Technical Content of Agreements

6. To what degree, if any, are you required to understand the technical content of the agreements on which you work?
7. How do you go about understanding or working with the technical content of the agreements on which you work?
8. How often do you spend attend internal meetings with scientists and engineers? What are the general purposes for these meetings?
9. Do you spend more time in these meetings now then when you first began here as an IRS or did you spend more time in meetings in the beginning?
10. Would you say that you rely more, less, or about the same on scientists/engineers than when you first began as an IRS?

Personal Technical Challenges/ Real Examples

1. What was the most challenging agreement on which you have worked? Why or why not would you say this agreement was your most challenging? Was it challenging because of the technical content?
2. In what ways did the office support you in any of the challenges you have mentioned?
3. How would you characterize your working relationship with scientists and/or engineers?
4. What types of difficulties (Do you have difficulties in communicating with Engineers/Scientists? Do they have difficulties in communicating with you?)
Appendix C: Educational Background’s Raw Data

LIST OF DEGREES

MA in International Relations, BS in Sociology, MS in Social Policy, MBA, MA in International Transactions, MPA (Public Administration), BA in Political Theory and Constitutional Democracy, MA in Political Science, MPM (Public Policy/Management and Financial Management), BA in History, BA in International Relations, MA in History, BS in Business, MA in Asian Languages and Cultures, BA in International Studies, BA in Economics, MBA in International Business, MA in German and European Studies (International Business), International Executive MBA, Philosophy European Studies BA in German (History/Political Science), MA in Public Policy and Management, BA in Chinese and Political Science, BA in Political Science (Sociology), MA East Asian Languages and Literature, BA in Communications Studies, MA in International Policy Studies focus Non-Proliferation and Conflict Resolution, PhD in History (American Foreign Relations), MA in International Economics and Japanese Studies, BA in International Relations

LIST OF SCHOOLS

University of Maryland, University of Notre Dame, University of Rhode Island, Cornell University, University of Oregon, Georgetown University, George Washington University, University of California - Irvine, University of Connecticut, Colorado College, Colorado State University/Pueblo University of Colorado - Denver, University of California- LA, George Mason University, University of Cambridge, Washington College, Michigan State University, Rutgers University, American University, Northeastern University, England Mount Union College, Monterey Institute of International Studies, California State University - Long Beach, John Hopkins: School of Advanced International Studies, The Ohio State University