SOLICITATION/CONTRACT/ORDER FOR COMMERCIAL ITEMS
OFFEROR TO COMPLETE BLOCKS 12, 17, 23, 24, & 30

1. REQUISITION NUMBER	PAGE	OF
[redacted]	1	41

2. CONTRACT NO.	3. AWARD/ EFFECTIVE DATE	4. ORDER NUMBER	5. SOLICITATION NUMBER	6. SOLICITATION ISSUE DATE
NNJ12GA17C			NNH10CA001K	

7. FOR SOLICITATION INFORMATION CALL:	a. NAME	b. TELEPHONE NUMBER (No collect calls)	8. OFFER DUE DATE/LOCAL TIME
	Learon Comeaux	281-483-6525	

9. ISSUED BY — CODE JSC

NASA/Johnson Space Center
Attn: BG/Learon Comeaux
2101 NASA Parkway
Houston TX 77058-3696

10. THIS ACQUISITION IS ☐ UNRESTRICTED OR ☒ SET ASIDE: 100.00 % FOR:

☒ SMALL BUSINESS
☐ HUBZONE SMALL BUSINESS
☐ SERVICE-DISABLED VETERAN-OWNED SMALL BUSINESS
☐ WOMEN-OWNED SMALL BUSINESS (WOSB) ELIGIBLE UNDER THE WOMEN-OWNED SMALL BUSINESS PROGRAM
☐ EDWOSB
☐ 8(A)

NAICS:
SIZE STANDARD:

11. DELIVERY FOR FOB DESTINATION UNLESS BLOCK IS MARKED ☐ SEE SCHEDULE	12. DISCOUNT TERMS	☐ 13a. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 700)	13b. RATING / 14. METHOD OF SOLICITATION ☐ RFQ ☐ IFB ☐ RFP

15. DELIVER TO — CODE OZ

Tara Ruttley
2100 NASA Parkway
Houston TX 77058

16. ADMINISTERED BY — CODE JSC

NASA/Johnson Space Center
Attn: BG/Learon Comeaux
2101 NASA Parkway
Houston TX 77058-3696

17a. CONTRACTOR/ OFFEROR — CODE 38827 — FACILITY CODE

RESOURCES FOR THE FUTURE, INC.
1616 P ST NW
WASHINGTON DC 20036-1400

TELEPHONE NO.

18a. PAYMENT WILL BE MADE BY — CODE NSSC

NASA/Shared Services Center
Financial Management Division (FMD)
Accounts Payable
Bldg 1111, C Road
NSSC-AccountsPayable@nasa.gov
Stennis Space Center MS 39529-6000

☐ 17b. CHECK IF REMITTANCE IS DIFFERENT AND PUT SUCH ADDRESS IN OFFER

☐ 18b. SUBMIT INVOICES TO ADDRESS SHOWN IN BLOCK 18a UNLESS BLOCK BELOW IS CHECKED ☐ SEE ADDENDUM

19. ITEM NO.	20. SCHEDULE OF SUPPLIES/SERVICES	21. QUANTITY	22. UNIT	23. UNIT PRICE	24. AMOUNT
	INCO TERMS 2: Destination [redacted] Continued ... *(Use Reverse and/or Attach Additional Sheets as Necessary)*				

25. ACCOUNTING AND APPROPRIATION DATA
See schedule

26. TOTAL AWARD AMOUNT *(For Govt. Use Only)* [redacted]

☐ 27a. SOLICITATION INCORPORATES BY REFERENCE FAR 52.212-1, 52.212-4. FAR 52.212-3 AND 52.212-5 ARE ATTACHED. ADDENDA ☐ ARE ☐ ARE NOT ATTACHED.
☐ 27b. CONTRACT/PURCHASE ORDER INCORPORATES BY REFERENCE FAR 52.212-4. FAR 52.212-5 IS ATTACHED. ADDENDA ☐ ARE ☐ ARE NOT ATTACHED.

28. CONTRACTOR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN ____ COPIES TO ISSUING OFFICE. CONTRACTOR AGREES TO FURNISH AND DELIVER ALL ITEMS SET FORTH OR OTHERWISE IDENTIFIED ABOVE AND ON ANY ADDITIONAL SHEETS SUBJECT TO THE TERMS AND CONDITIONS SPECIFIED

☒ 29. AWARD OF CONTRACT: REF Proposal ____ OFFER DATED 12/30/2011. YOUR OFFER ON SOLICITATION (BLOCK 5), INCLUDING ANY ADDITIONS OR CHANGES WHICH ARE SET FORTH HEREIN, IS ACCEPTED AS TO ITEMS:

30a. SIGNATURE OF OFFEROR/CONTRACTOR	30b. NAME AND TITLE OF SIGNER *(Type or print)*	30c. DATE SIGNED	31a. UNITED STATES OF AMERICA *(SIGNATURE OF CONTRACTING OFFICER)*	31b. NAME OF CONTRACTING OFFICER *(Type or print)*	31c. DATE SIGNED
07/12/12	Edward F. Hand, VP	07/11/2012	for	Learon Comeaux	7/24/12

AUTHORIZED FOR LOCAL REPRODUCTION
PREVIOUS EDITION IS NOT USABLE

STANDARD FORM 1449 (REV. 2/2012)
Prescribed by GSA - FAR (48 CFR) 53.212

19. ITEM NO.	20. SCHEDULE OF SUPPLIES/SERVICES	21. QUANTITY	22. UNIT	23. UNIT PRICE	24. AMOUNT
001	Milestone 1 Obligated Amount: [redacted]				[redacted]

32a. QUANTITY IN COLUMN 21 HAS BEEN

☐ RECEIVED ☐ INSPECTED ☐ ACCEPTED, AND CONFORMS TO THE CONTRACT, EXCEPT AS NOTED: _____

32b. SIGNATURE OF AUTHORIZED GOVERNMENT REPRESENTATIVE	32c. DATE	32d. PRINTED NAME AND TITLE OF AUTHORIZED GOVERNMENT REPRESENTATIVE

32e. MAILING ADDRESS OF AUTHORIZED GOVERNMENT REPRESENTATIVE	32f. TELEPHONE NUMBER OF AUTHORIZED GOVERNMENT REPRESENTATIVE
	32g. E-MAIL OF AUTHORIZED GOVERNMENT REPRESENTATIVE

33. SHIP NUMBER	34. VOUCHER NUMBER	35. AMOUNT VERIFIED CORRECT FOR	36. PAYMENT	37. CHECK NUMBER
☐ PARTIAL ☐ FINAL			☐ COMPLETE ☐ PARTIAL ☐ FINAL	

38. S/R ACCOUNT NUMBER	39. S/R VOUCHER NUMBER	40. PAID BY

41a. I CERTIFY THIS ACCOUNT IS CORRECT AND PROPER FOR PAYMENT		42a. RECEIVED BY *(Print)*	
41b. SIGNATURE AND TITLE OF CERTIFYING OFFICER	41c. DATE	42b. RECEIVED AT *(Location)*	
		42c. DATE REC'D *(YY/MM/DD)*	42d. TOTAL CONTAINERS

STANDARD FORM 1449 (REV. 2/2012) BACK

DETAILED TABLE OF CONTENTS

This contract consists of the following Sections:

SECTION A- CONTRACT FORM

PART I- THE SCHEDULE

SECTION B- SUPPLIES OR SERVICES AND PRICES/ COSTS

SECTION C- DESCRIPTION/ SPECIFICATION/ WORK STATEMENT

SECTION D- PACKAGING AND MARKING

SECTION E- INSPECTION AND ACCEPTANCE

SECTION F- DELIVERIES OR PERFORMANCE

SECTION G- CONTRACT ADMINISTRATION DATA

SECTION H- SPECIAL CONTRACT REQUIREMENTS

PART II- CONTRACT CLAUSES

SECTION I- CONTRACT CLAUSES

SECTION B – SUPPLIES OR SERVICES AND PRICES/COSTS

B.1 CLAUSES INCORPORATED BY REFERENCE

NOTICE: The following contract clauses pertinent to this section are hereby incorporated by reference:

I. FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1)

CLAUSE NUMBER	DATE	TITLE
None included by reference		

II. NASA FAR SUPPLEMENT (48 CFR CHAPTER 18) CLAUSES

CLAUSE NUMBER	DATE	TITLE
None included by reference		

(End of clause)

B.2 FIRM FIXED PRICE (1852.216-78)(DECEMBER 1988)

The total firm fixed price of this contract is [redacted].

(End of clause)

B.3 DELIVERABLE REQUIREMENTS AND PAYMENT SCHEDULE

A. Payments will be made based on successful completion of approved milestone schedule and accomplishment criteria per the SOW in Section C.

B. Contract Line Items

CLIN	Deliverable* Requirements	Document Type	Date	Maximum Available Payment
CLIN 1	Design a model database	1	7/27/12	[redacted]
CLIN 2	Report: Data Retrieval and Algorithms	2	6/15/13	[redacted]
CLIN 3	Report: Data Merging and Integration	1	6/15/14	[redacted]
CLIN 4	Atlas of ISS Science	1	6/15/15	[redacted]
	Total Maximum Available Payments			[redacted]

C. Documentation shall be accepted according to the following type categories. Type 1 requires signature by NASA Contracting Officer Technical Representative (COTR) for approval within a mutually agreeable time period (as defined in the work instruction for each process. Type 2 requires review within 30 calendar days by NASA COTR for approval. In the event that NASA does not provide a response within the 30 calendar day period, the contractor will assume approval per ISS Type 2 data instructions.

D. CLINs 1, 2, and 3 are progress payments that are not payment for accepted items. Progress payments are fully recoverable in the event of termination for cause. In accordance with FAR Clause 52.232-16 Alt 1 and NASA FAR Supplement Part 1832.501-1, the contractor may be paid up to 90% of the total costs incurred; however, the total invoice shall not exceed the amount for the corresponding milestone. For computation of the contract price as used in the calculations for progress payments, the contract price is the total of CLINs 1, 2, 3 and 4.

(End of clause)

(End of Section)

SECTION C – DESCRIPTION/SPECIFICATIONS/STATEMENT OF WORK

Measuring Research Performance in Space Station Research

III.A.1. Objectives

We value what we measure and measure what we value. The nation's investment in the International Space Station (ISS) reflects expectations of scientific return in new discoveries and improvements in the quality of life throughout the world. As expressed in the President's FY12 budget, the ISS is "humanity's foothold in space, bringing nations together in a common pursuit of knowledge and excellence."[1] ISS research is taking place within and across several disciplines, including fluid physics, materials science, and other physical and natural sciences. Notably, the ISS provides the only place to study long-term physical effects of the absence of gravity. In the fields of biology and biotechnology, research conducted in this unique microgravity environment has implications for the directionality and geometry of cell and tissue growth. In earth and space science, the ISS serves as a platform in low earth orbit to provide unique observational capacity. And the ISS human research facility enables distinctive opportunities to advance diagnostic telemedicine as well as other important studies pertaining to human life science.

In all cases, the scientific benefits of this research include new knowledge – that is, new data, advances in theory, information, and findings. New knowledge changes what we know, expands how much we know, challenges what we thought we knew, and even plays a role in how we perceive the world. That our knowledge is changing in these ways is measurable, particularly because much of the research is reported in peer-reviewed and other literature. In addition, applied research findings are leading to patents, licenses, and wholly new, tangible advances in technologies, products, and services.[2]

Because of the unique environment on the ISS, the conduct of multidisciplinary research on board, its international inclusiveness, and the significance of the efforts that culminated in its achievement, the station presents a special challenge for those who wish to analyze its impact. A primary goal of this research is to create a framework to measure and communicates the dynamic scientific progress resulting from ISS science.

Our objective is to design an *Atlas of ISS Science*, a systematic, rigorous and peer-reviewed framework and analysis that is then visually displayed to compellingly characterize and demonstrate the new knowledge created from the nation's "lab aloft."[3] In essence, the *Atlas*, and the data and analysis on which it is built, will be the visual representation of the metaphor of maximization of "delta K over K" – an expression used by the Chief Scientist of the National

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[1] Office of Management and Budget, National Aeronautics and Space Administration, *The Federal Budget FY12 Fact Sheet*, at http://www.whitehouse.gov/omb/factsheet_department_nasa, accessed 11/30/2011.

[2] Applications research is a critical component of the ISS as a national laboratory; however, the goal of this proposal is to design a science of science framework for the basic science research on ISS. The protocol we develop has applicability to applications research, however. The Center for the Advancement of Science in Space (CASIS) is developing a database to attempt to evaluate economic benefits/performance through its portfolio, and we may be able to leverage this to some extent if CASIS has advanced its model of their early research portfolio around year 3 of our proposed effort. We have included the opportunity for CASIS to send a representative to our proposed external steering group to allow regular exchange of information.

[3] Blog of Julie Robinson, ISS Chief Scientist.

Aeronautics and Space Administration (NASA) to appeal to the science community to define, as a task of scientific leadership, how the agency's research changes our knowledge relative to what we know.[4] We will use state-of-the-art "science of science" quantitative techniques applied to bibliometric and other databases of scientific return to document advances in knowledge across a range of ISS science disciplines. The project team includes recognized experts in the blend of disciplines required for this interdisciplinary research: science of science methods, space policy, the economics of innovation, computer programming, and graphics design.

We structure our approach specifically to answer these questions:

- *What is the nature of the science return from ISS research as indicated by one possible measure, scientific publications?*
- *What are the limits and advantages of scientific publications as a measure of science return?*
- *Are indications of 'breakthrough' results discernible in patterns of these publications and citations to them within and across disciplines and subdisciplines?*
- *Can we discern which disciplines appear to provide the greatest scientific return as indicated by relative trends in the number, rate, and citation influence in peer-reviewed publications?*
- *Can patterns in scientific publications in non-space based research serve as benchmarks for science return from human space-flight based research?*
- *How does the science return from ISS research compare to these benchmarks?*
- *What is the timeframe for realization of returns from ISS research as measured by scientific publications?*
- *Do scientific publications derived from ISS research appear to be differentially treated in mainstream journals (those not limited to space research) and is there discernible evidence about the cause? ISS results may receive differential treatment in the scientific community for many reasons, including difficulty in replicability of results, the problem of agency (someone other than the investigator may carry out the experiment and record the results), and applicability (when processes require the ISS to be applied).*

We appreciate that there are additional questions that could be asked about valuing ISS research, such as what are the appropriate metrics for the value of commercial products derived from ISS research? What are appropriate metrics for the value of engineering technology demonstration and materials testing on ISS to NASA and the aerospace industry? And, of keen importance, what are appropriate metrics for the value of ISS educational activities leveraging students' interest in space? Our framework and approach are likely to be useful for future research related to these issues. We therefore see our research as a prototype of an interesting approach to evaluate some important intangible benefits of ISS science. Our proposed research emphasizes the evaluation of knowledge diffusion through the metric of peer-reviewed publications as the first application of our overall approach.

We will combine the NASA ISS databases[5] which track and record ISS achievements with additional extensive and comprehensive existing bibliometric databases. To this merged database, we will then apply state-of-the-art tools -- based largely in information science and the

[4] Waleed Abdalati, at open session of Spring 2011 Meetings of the Aeronautics and Space Engineering Board and Space Studies Board, Washington, DC, 6 April 2011.
[5] We have worked with NASA's ISS database managers to identify these data resources.

well-established literature known as the value of information – to carry out multiple statistical analyses. These analyses will allow us to identify changes in the direction, rate, and other characteristics pertaining to the creation and diffusion of new knowledge attributable to ISS science. This research will probe traditional boundaries within and across different scientific disciplines and relative to science carried out in other nonspace-based laboratory settings. Our approach is inspired by and modeled after state-of-the-art practices of the National Science Foundation, the National Institutes of Health, the US Department of Agriculture, and other agencies that now use science-of-science techniques to evaluate advances and patterns in knowledge diffusion.[6]

Our key outputs will be a computer-based statistical methodology, results from preliminary application of this methodology to the existing ISS publications database, results from tested hypotheses, and research findings centered on the questions above. We will also discuss the advantages and limitations of bibliometric approaches to the special circumstances that pertain to ISS science. In that discussion, we note that although peer-reviewed publications are often seen as a 'gold standard' of accomplishment in the scientific community and are a traceable, tractable output, there are recognized limitations and biases in these measures. Even so, we argue that including analysis of peer-reviewed output is a necessary and useful step to fully understanding the value of ISS science.

We anticipate that our methodology will be useful for ISS science management and performance reporting. Our results will be presented in both tabular and atlas (mapping) formats, using the latest advances in the visual display of quantitative information for science of science analyses (see *Atlas of Science: Visualizing What We Know* (2010, MIT Press at http://scimaps.org/atlas/)). These results will be of value to NASA managers in tracking, assessing, and communicating the value of ISS science. Furthermore, we expect that these methods will enhance management and communication of ISS science and its return to the nation. At the project's end, ISS management can choose to maintain the performance measurement architecture either within NASA or with a third party, consider whether to extend the approach to include additional dimensions of ISS science performance, and possibly, consider it a viable template for other NASA directorates for analysis and communication of science impact.

Our project aligns with the goals of the Broad Agency Announcement for support and services for ISS by providing a service in support of an ISS laboratory-wide need to define, track, and measure laboratory achievements. It also will provide a basis for enhancing lab management by creating an information architecture that can be used to help maximize these achievements. Our project is also responsive to the request from the Office of Management and Budget (OMB 2010, pp. 1-2) to heads of executive departments and agencies directing them "to develop outcome-oriented goals for their science, technology, and innovation activities, and target investments toward high-performing programs in their budget submissions." The OMB further directed that "agencies should support the development and use of 'science of science policy' tools that can improve management of their R&D portfolios and better assess the impact of their science, technology, and innovation investments." As the ISS approaches its second decade of full operation, establishing a framework and methodology for systematic tracking of ISS scientific return will not only respond to the OMB directive and provide information for ISS management, but will enhance public understanding of some of the more intangible benefits of

[6] For example, see Office of Technology Assessment 1986, Borner et al 2009, Fuglie and Heisey 2007.

the ISS. Finally, the "atlas of ISS science" we will create will be a compelling, data rich representation of the value of the nation's investment in the ISS program.

III.A.2. Technical Approach

We next describe our technical approach, including an overview of the concept of science-of-science methodology and a detailed discussion of the data and analytical tools we will use. We then describe the work plan.

III.A.2.a. Overview

We base our approach on a field of study known as the science of science, or scientometrics. In this burgeoning field, researchers have developed methods and metrics that statistically identify and visually "map" relational data. These maps reveal emerging patterns of new knowledge over time, the spread of geographic diversity among investigators, interactions among scientific disciplines and subdisciplines, partnerships between public and private partnering organizations, and other a host of other relationships. The National Science Foundation has funded the development of cyberinfrastructure used for some of the mapping methods. Practitioners often have expertise in fields such as information science, cyberinformation, scientometrics, computer programming, education, physical sciences, social sciences, research administration, policy analysis, and graphic design. In federal agency decisionmaking, the science of science methods and tools are serving several purposes. For example, in 2008, the National Science and Technology Council (NSTC) developed a Federal Research "Roadmap" for increasing the Nation's knowledge base. This roadmap emphasized that it was necessary to improve data, methods, and information infrastructure to enable more rigorous and quantitative assessment and evaluation of science and technology policy decisions (National Science and Technology Council 2008). Included in the roadmap are national goals to 1) better understand science and innovation, 2) use the science-of-science policy to address national priorities, and 3) use the roadmap to guide investments in science and innovation.

Among the models, tools, and metrics identified in the roadmap were bibliometrics, network analysis, visual analytics, science mapping, and scientometrics. These metric-based analytics are grounded in graph theory and combinatorics. Methodologically, they analyze data from the concept of connection. Whether the connection is between people (co-authors), ideas (topics), grounded research (citation analysis), or other relationships, the basic concept is that a network emerges when two things or people are connected. Figure 1 illustrates the basic concept. The nodes A and B represent two scientific investigators or two of their outputs (for example, a publication, a patent, a license). The lines connecting the nodes represent observable measures of the spread of the outputs (knowledge), through direct collaboration, indirect or longitudinal citation, co-citation (when A and B are cited by a subsequent investigator or paper), and bibliographic coupling (when references are shared across papers).

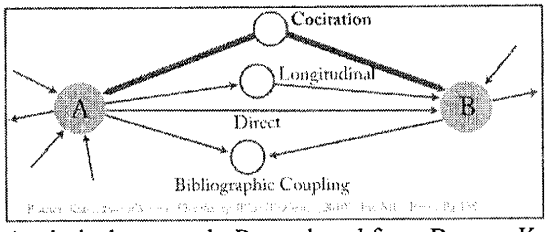

Figure 1. Analytical approach. Reproduced from Borner, Katy.
Atlas of Science: Visualizing What We Know (2010), MIT Press, pg. 138.

The relationships can multiply exponentially with the number of outputs, their distribution across investigators, institutions, over time, and within and across disciplines and subdisciplines. These relationships can also change with bursts of new knowledge that lead to a rapid increase or even a new direction in knowledge. Early studies (1960s) of these relationships were computed by hand as citation index databases did not yet exist and computers were not yet widely available. Computational scientometrics today can involve advanced analytical software and large on-line databases (often with terrabytes of data representing hundreds of thousands of published papers).

We next present several illustrative examples that demonstrate our ultimate goal: to answer the questions we pose in our **Objectives** by carrying out similar analyses for ISS science. Our analysis will employ the ISS science database, merge it with additional existing databases, and visually display the quantitative results to provide a compelling, informed description of ISS science return. The audience for our work includes a range of stakeholders: ISS management, NASA, other agencies, decision makers, ISS investigators, the scientific community at large, research managers, and the interested public. The following illustrative examples are drawn from the large body of existing research in the science of science. These examples depict knowledge diffusion across investigators, institutions, and disciplines as measured through in-depth statistical analysis of publications and citations.

The first example, in figure 2, is the last frame of an animated sequence showing the evolution of coauthorship networks in other fields of science. In this map, nodes, links, and their sizes and color represent quantitative values of the size and strength of these relationships. The authors of this visualization asked whether science is driven "by prolific single experts or by high-impact co-authorship teams." Their findings can be used to inform the management of science. In this case, Shneiderman (represented by the large node in the southwest portion of the map), who worked in a student-dominated academic setting, experienced a different collaborative environment than did Card, Mackinlay, and Robertson (linked by the triangle in the middle), who worked at Xerox Parc during the time period in the analysis. In a similar way, this approach will help us to answer our questions about the relative differences of ISS scientist relationships in their space- and non-space-based research in terms of flows of knowledge within their disciplines.

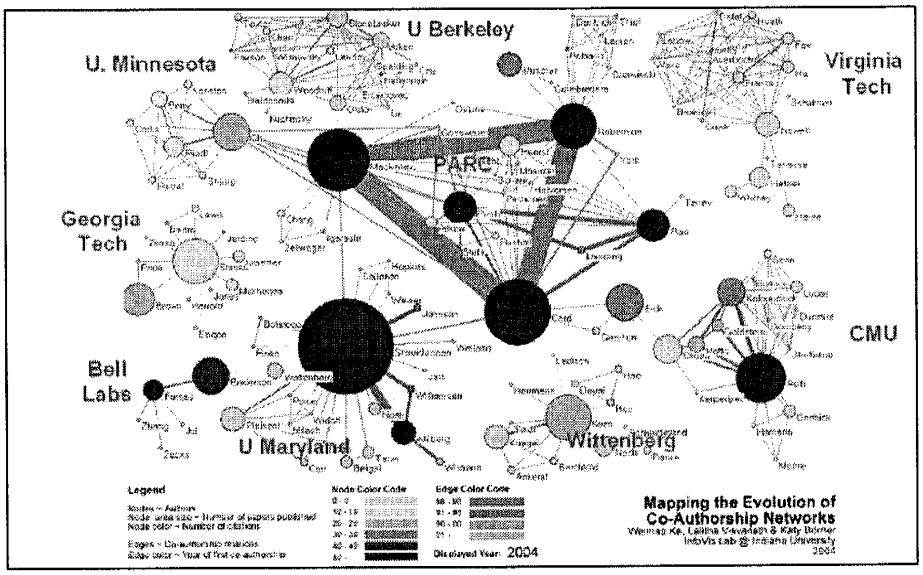

Figure 2. Knowledge diffusion through investigators. From Weimao Ke, Lalitha Viswanath and Katy Borner 2004, *Mapping the Evolution of Co-Authorship Networks* IEEE Symposium on Information Visualization (INFOVIS 2004) at http://scimaps.org/exhibit/docs/091001-meeting/ppt/09-Media-Borner.pdf

The second example, in figure 3, is a three-dimensional display of knowledge flows across disciplines. The data are analyzed, mapped on a sphere, and then flattened using a Mercator projection to create a 2-D version. This analysis was carried out by the University of California San Diego's Maps of Science program and uses bibliographic coupling to reveal the sizes and directions of flows of knowledge across disciplines and sub-disciplines for the period 2001 to 2005. (This map is also part of a *Mapping of Science* curated exhibit.) Approaches such as this will help us to answer questions about cross-disciplinary interactions and comparative competencies from ISS science.

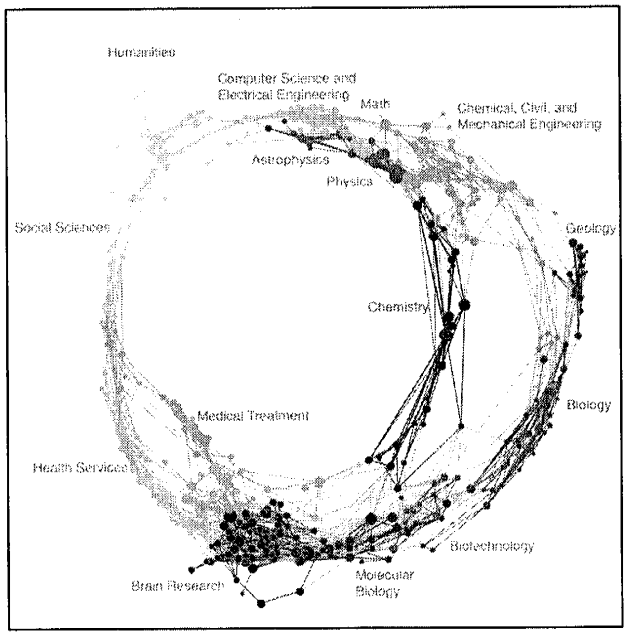

Figure 3. Knowledge diffusion among disciplines. From the UCSD Maps of Science Program at http://mapofscience.com/ucsd.html and reproduced from Borner, Katy. *Atlas of Science: Visualizing What We Know* (2010), MIT Press, pg. 13.

Our final example, in figure 4, is reproduced from Mane and Borner (2004) and illustrates knowledge breakthroughs between 1982 and 2001which have been identified using burst detection algorithms. This procedure semantically analyzes publications to observe patterns of word occurrence and co-occurrence. These patterns can be used to interpret various aspects of knowledge evolution and emergence of new knowledge. Figure 4 identifies trends over time in major research topics including the rise and fall of polymerase chain reaction technology for gene expression experiments, the boost in molecular sequence research under the impetus of funding from the Human Genome Project, and the overall relative size, growth,

diversification, and linkages in and among subfields of biological research.

We will use such burst detection algorithms to explore similar changes in the emergence and importance of new knowledge and its relationship to other events.

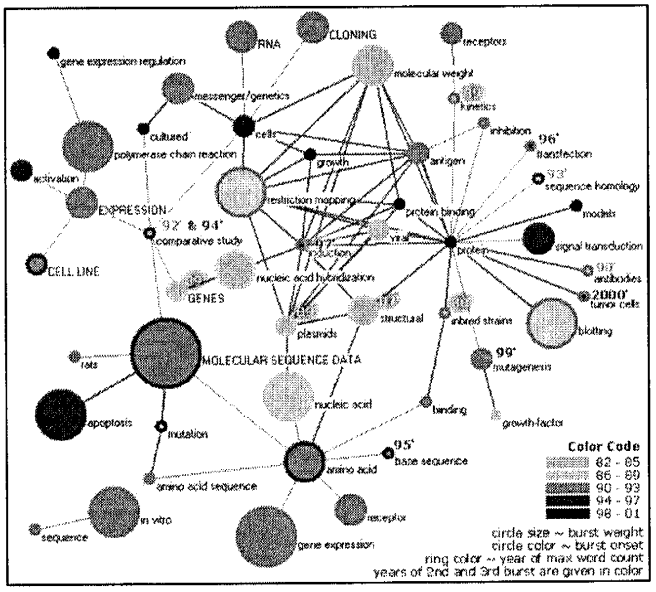

Figure 4. New knowledge through burst detection. Reproduced from Ketan K. Mane and Katy Borner, "Mapping Topics and Topic Bursts in PNAS," Proceedings of the National Academy of Sciences, 6 April 2004, 101(supplement 1), 5287-5290 at http://www.pnas.org/content/101/suppl.1/5287.full.pdf

III.A.2.b. Research Plan

For our project, the unit of observation is an individual ISS investigator with peer-reviewed (journal) scientific publications that have been collected and curated by the ISS office in its Program Science Database (see table 1). We note that our framework can be extended in the future to include additional measures of ISS science return, including analysis of other written products, patents, and other intellectual property.[7]

Table 1. ISS PSD Summary of Outputs (from ISS Office)

Research Discipline	Journal	Conference	Patent	Technical Paper	Other
Biology and Biotechnology	122	8	1		
Earth and Space Science	26	4			
Human Research	115	11		3	5
Physical Science	50	33		2	
Educational Activity	6	6			4
Technology	27	69		14	
Exploration	5	24		5	2
Summary/Review	13	23			

[7] Reviewers stated that patent analysis is no longer the contemporary best indicator for successful pursuit of applications research; licensing and equity agreements are the preferred indicators in current practice. We agree that patent analysis is no longer the contemporary best indicator for applications research and economic impact analysis pertaining to ISS Science. Licensing and equity agreements, while preferred indicators for economic impact research, are frequently unavailable or are considered proprietary or private information. Should licensing or equity data be made available to the PI's for inclusion in the study, the PI's would be delighted to add this dimension to our data analysis. We look forward to probing the available data for inclusion in the analysis. In addition, the PI's remain convinced that analyzing patent data for the more discrete and intangible value related to sociological ties represented by co-invention (and thereby research collaboration) is an important research pursuit in its own right.

The major tasks are (1) data extraction and retrieval from both the ISS and external databases; (2) data cleaning, assembly, and documentation for quality control and reproducibility of our results; (3) data aggregation, transformation, interpretation and analysis; and (4) reporting and communication of results in tabular and visual displays and in conventional publications, briefings, and other outreach.

III.A.2.b.i. Data Sources and Acquisition

For this project, 1,577 investigators have been identified involving 939 ISS investigations since the first experiments were conducted in 2000. From these investigations, there are 1,295 directly attributed publications to date. Data for these publications and investigations have been carefully collected and curated by the ISS office. These include the Program Science Database (PSD), for which the interface is the ISS Program Scientist Toolbox. A subset of these data is delivered to the research and technology section of nasa.gov at regular intervals. The ISS office is also in the process of obtaining and curating the SpaceLine database (SLD), covering research conducted on space platforms including those that preceded ISS. The ISS office in the future may obtain the Microgravity Science Archive. Our initial source of data, then, will be the PSD. In the workplan, we have stipulated our desire to use and incorporate the SLD as it becomes available because it will allow us to consider a longer time series of patterns and comparisons pertaining to the impact of science from all space platforms (including those that predate the current space station). In response to reviewers' comments about the sufficiency of data samples in the combined ISS databases and statistical significance, we note that a key strength of this study is that it is not based on sampling techniques. The data are known to be highly skewed, subject to power law relationships, and highly susceptible to misrepresentation when sampling techniques are used. Rather this study attempts to include the universe of data pertaining to ISS scientists and the relationship of ISS research to their overall research contribution. Because sampling is not involved, tests of statistical significance will not, in every case, be the best argument for the relevance of our findings.

The PSD is populated across several research disciplines. As a result of discussions with the ISS office, we will focus on four of these: Biology and Biotechnology, Human Research, Physical Science, and Earth Science (a subset of which is collected in the category Space and Earth Science). Also as a result of discussions with the ISS office, we will use the peer-reviewed article subset of the PSD. We appreciate that our focus on peer-reviewed publications has known limitations. For instance, revolutionary advances in science can be unrepresented. Critics of bibliometric approaches to valuing research point out that Nobel awards have been granted to scientists whose pathbreaking work was peer-rejected or accepted only decades beyond the original breakthrough. Critics also illustrate that there are biases against interdisciplinary research and research by some demographic groups. As we noted earlier in the **Objectives** section, there may be additional reasons why peer review of ISS science in particular may be problematic. Nevertheless, peer-reviewed publications are a starting point for this research because for many ISS researchers, they remain an observable and relevant measure for individual career success. Moreover, peer reviewed publications remain widely used in performance measurement in tenure decisions and other academic awards, for tracking productivity of university departments, and in government research funding decisions. Other ISS output measures such as patents, licenses, commercial products and services, as well as other ISS functions such as education, merit review and will be included in future analyses.

A distinctive contribution of this study is that we will expand the primary PSD dataset by merging it and incorporating it with other datasets so that we will have an extended view of the complexity of both tangible and intangible aspects of space station science. In the past, ISS analysis has focused largely on the direct reports provided by NASA funded principal investigators as part of their annual reporting process. The NASA librarians carefully checked these data and have reconciled it using other data sources. Traditional impact studies might propose to create a boundary around the studies directly funded under this program. These boundaries have historically been tied to logistic considerations pertaining to access to information and computer power. Using the expanded opportunities from recent developments in search strategies and computing power, we will extend the traditional concept of impact analysis by using complex systems methods at the individual level of analysis. As such, we will integrate, merge and validate multiple sets of data using the individual scientist as our object of analysis. Both of the co-principal investigators have access to the databases:
--The ISI Web of Science: a database that includes scholarly literature and conference proceedings since 1955. Included in this database are author records, bibliographic references, and abstracts for articles published in more than 10,000 peer reviewed journals and 120,000 conferences. For more information on the Web of Science, see: http://wokinfo.com/about/whatitis/).
--Medline: a database maintained by the U.S. National Library of Medicine pertaining to research literature in the life sciences, biomedicine, bioengineering, public health, clinical care, and plant and animal science since 1950. Included in this database are author records, bibliographic references and abstracts for articles published in peer-reviewed journals. For more information about Medline data, see: http://www.nlm.nih.gov/bsd/pmresources.html).
--JSTOR: a multidisciplinary database containing more than 1,000 academic journals and other primary sources. Information at the author, abstract and bibliographic level is included.
--Elsevier's Scopus database of abstracts from journals and conferences. Like the Web of Knowledge, it is a bibliometric database that will allow us to verify and crosscheck our work for inclusiveness and accuracy. For more information about Scopus, see: http://www.scopus.com/home.url).
--NSF Award Search: A database that can be searched by PI name and other fields to search and retrieve project descriptions, investigator and co-investigator information, funding amounts and project years for project funded by the National Science Foundation
--NIH Reporter database: funding data provided by the National Institutes of Health that contains publications and patents associated with NIH funded projects.
--Google Scholar: an open source database that will allow us to validate the comprehensiveness and accuracy of our data collection efforts across the breadth of scholarly research. In addition, this source will help us to validate the citation information for articles written by the ISS scientists.

III.A.2.b.ii. Data Challenges

We allocate much of the first year of our project workplan to data retrieval (that is, collection and assembly from the commercial databases and merging with the ISS databases), data clean up, validation and format preparation. We will also be carrying out preliminary analysis during the first year. We are generous in our allocation of time to data management for several reasons. The main reason is that the commercial databases, while widely used, are also well known for imperfections. For example, our studies rely on accurate and unique identification of individual

scientists and institutional affiliates in the databases described above. By way of example, a common and widely recognized problem is that there are many cases where two or more unique scientists share the same name and contribute to the same body of literature. In this instance, there is a large risk that we could incorrectly attribute results from one scientist to another. Our data validation process will include crosschecks to eliminate these "false positives." We will reconcile instances of authorship using multiple databases, the World Wide Web, and communications with individual scientists when necessary.

A major contribution of this study is its inclusiveness and its accuracy. The data we will be analyzing are known to be characterized by power-law dynamics. As such, the data are highly skewed and do not follow the properties of normal bell-shaped data distributions; sampling techniques applied to these data can lead to misinterpretations. For instance, some articles receive many citations and others receive only a few. When just one high impact study is omitted from the analysis, the potential for faulty interpretations of the data can be high. We mitigate this risk by analyzing the corpus of work pertaining to each ISS scientist. As such, we will analyze the role the ISS played in the research trajectory of the scientist and the impact of the ISS work as it relates to the other work produced by the ISS scientist, by others scholars in the same discipline, and across disciplines.

The largest burden of conducting this analysis will be creating an accurate, reliable and inclusive database. It will require cross-checking all data entries used in the project, as mistakes in the data will skew all subsequent analysis. Furthermore, the sociological studies grow quite quickly. For each scientist involved in ISS research, he or she may have several co-authors on each article produced. In some instances, an ISS scientist may produce more than three hundred articles over his/her career. Using both algorithmic approaches and hand curating, this data cleaning will take much of the first year of our project. Nevertheless, beginning at the end of year one, we will routinely produce preliminary results. We will seek review by domain experts on the first prototypes of our approach. Subsequently, we will produce a series of outputs and subject them to peer review. Once we have this massive database in place, however, we anticipate that subsequent curation by NASA's ISS office can proceed routinely, on a periodic basis by using our protocols.

III.A.2.b.iii. Data Analysis

We will apply several tools and analytical techniques throughout our analysis.

Network Analysis. Network analysis is particularly relevant to the study of otherwise intangible assessments of scientific impact and processes of knowledge diffusion because it is through seemingly invisible relationships that knowledge is transferred. We will analyze the relationships between international space station participants and their collaborators through coauthor relationships of journal articles and other outputs related to their ISS experience. In these analyses, issues of expertise and proximity are explored using the relationship of co-authorship as a window to otherwise indiscernible flows of knowledge that necessarily rely on, and are bound by, these social dynamics. Network data are derived from connections, ties and contacts between one entity and another. These relational data can be explored, mapped and understood as systems of people. Such data can include shared experiments, authorship, inventions, patents, institutions or places that are connected to other scientists, inventors, patents, organizations or places in networks of affiliation. These systems of people have in some way been stimulated by scientific participation in research emanating from ISS. At the core, these networks involve local

and global topological features that can be compared across networks and disciplines (Albert & Barabási 2002; Barabási 2003, 2005; Barabási & Bonabeau 2003; Börner, Sanyal, & Vespignani 2007; Wasserman & Faust 1994; Watts 2003, 2004). By examining node level behavior, network science contends that it is possible to understand the extent to which individual actors ultimately change systems. It is conceivable that new ways to encourage positive changes in the overall system could be imagined from this study. In essence, separate networks of data will be created for analysis: the scientific ISS network, the co-authorship network stimulated by the ISS experience, the larger institution network related to the scientific participation, the bibliometric citation network, and the networks of words contained in scientific outputs such as articles.

Network Measures. We will include standard network measures of connectivity from the information pertaining to collaborations between authors and organizational entities contained in the data files. The networks will be represented as graphs of undirected data such that if an inventor or an institution *A* authors an article related to a scientific study he/she published with co-authors or co-institutions *B* and *C,* all of the relationships are considered to be equal and undirected. Each individual author and institution will be uniquely identified as a node. Connections between nodes will be denoted by edges. The more edges that exist relative to the number of nodes throughout the graph, the more complete, connected and traversable is the entire graph. The degree of a node is the number of edges that connect to it. Once the degree measures for each node are calculated throughout the network, other network measures will be determined such as the average degree for the entire graph, the shortest path length connecting two nodes, how many isolated nodes are in the network, the average path length for the graph and the largest geodesic distance between any two nodes in the network (this represents the distance between the two most dissimilar nodes in the network). Several algorithms will be used to detect community structure. These include density, the clustering coefficient, beta index, giant component and various methods to analyze possible small worlds in the Power-Law degree distributions. For most analyses, the Network Workbench and Sci2 tool developed for network analysis at Indiana University through funding provided by the National Science Foundation is used (Network Work Bench Team 2006; Sci2 Team 2009). In addition, Mallet, a semantic analysis tool developed at the University of Massachusetts will be employed for topic modeling (McCallum, A. K. 2002). These tools and measures will identify highly productive and influential ISS scientists and their scientific impact; the size and distribution of the connected components will be analyzed and social, semantic, and bibliometric networks will be analyzed for measures of collaborative homogeneity and diversity (instances where scientists co-author either with the same person repeatedly, or when scientists co-author with many different scientists).

Assortativity Coefficient. The extent to which nodes in the co-author and institution networks connect with nodes that are similar to themselves is frequently measured by the degree of the node. When high degree nodes connect with other high degree nodes, the network is assortative. When highly connected nodes link to nodes with a low degree, the network is disassortative. We calculate correlations between degrees by plotting the average degrees of the nearest neighbors of a node. If the relationship is characterized by a positive slope, it indicates a relationship between nodes of similar degree value and is thereby assortative. Conversely, when the slope of the line is negative, the coefficient indicates relationships are disassortative. The range of values

for the assortativity coefficient is between -1 and 1 (Chang, Su, Zhou, & He 2007; Newman 2002, 2004; Shi, Bonner, Adamic, & Gilbert 2008).

Burst Detection. Both Mallet and Network Workbench will be used to run burst detection algorithms on ISS investigator authored article titles and the article abstract information (McCallum 2002; Network Work Bench Team 2006). Conceptually, for each scientist involved in ISS funded projects a dataset will be analyzed as a discrete time series: in other words, a sequence of observations (articles) that are ordered in one dimension – time. In this study, articles exist for regularly spaced intervals, e.g., each month, year, or five year interval. Kleinberg's burst detection algorithm (2002) will be used to identify sudden increases in the usage frequency of words. These words may connect to author names, country names, references, and terms used in titles and/or abstracts of the scientific articles. Rather than using plain frequency counts of the occurrences of words, Kleinberg's algorithm uses a probability script that corresponds to the frequencies of individual words. Transitions in the burst of words correspond to points in time around which the frequencies of the choice of words change significantly. The algorithm will generate an ordered list of the word bursts in the abstract and title data, and will indicate the time interval in which they occurred (Mallet 2002; Network Work Bench Team 2006). We will analyze these bursts and will therefore be able to detect changing topical emphasis in the scientific article titles and abstracts across both time and geographical space—before and after the ISS experience.

Topic Analysis. We will apply semantic analysis to the title and abstract information contained in the ISS investigator-authored journal articles to determine the topic similarity of the authors and institutions in the data file. By identifying the frequency with which two words occur across the data file, the similarity of the word used in the abstracts and titles across the scientific journal space can be calculated. Then using cluster analysis, we will assign the articles to groups so that those that are most similar to each other in word choice appear in the same cluster. From these clusters, we will derive several different levels of topic definition through data reduction techniques. We will compare the distances between two articles in the same cluster space to identify topical linkages. This analysis has the potential to identify scientists who are working on similar research together despite geographic distances and bring them together.

Citation Networks and the Impact Factor. Citations to articles are an indication that a given article may have played a role in the germination and gestation of a useful idea. Scientific norms dictate that authors of scientific literature disclose and attribute other scientific literature that was relevant to the development of the new scientific article. These linkages are found in the bibliographic reference section of the scientific article. Citations to scientific articles are one straightforward indicator of the importance of a given piece of scientific literature to the development of a new finding. Because much is unknown about the process of creativity, citations are thought to represent a fundamental observable link concerning flows of knowledge (K. Hall 2005; Henderson et al. 1998; Leydesdorff 2011; Tijssen 2001; Trajtenberg 1990; Trajtenberg & Henderson 1997). The number of times an article has been cited, then, is used in calculating the impact of a given publication (Office of Technology Assessment 1976; Trajtenberg 1990).

Citation lag and truncation are important factors to consider when interpreting citation strength. As we noted in questions posed in our **Objectives**, ISS science may be differentially

treated in the literature because of problems of reproducibility, agency, and applicability. We will seek to identify whether differential treatment can be discerned relative to usual patterns of citation lag and truncation. Citation lag is the difference between the date that an article is published and the date it is cited in another published article. Truncation occurs when future research has not yet had the opportunity to cite a scientific article. Leydesdorff (2011) has proposed an integrated impact factor "I3" that normalizes skewed citation distributions by discipline at the article level. We will employ Leydesdorff's integrated impact factor for scientific article production.

Process Model and Temporal Analysis. The database we are constructing provides an exceptional opportunity to examine and apply various models of technology diffusion. How and why scientific literature and new technologies are cited and adopted by others is a perplexing issue in the study of science and innovation. The reasons why some technologies seem to take longer to adopt than others inherently involves complex interactions among people, firms, agencies, and abilities. Likewise, social choices are seemingly interdependent and technological abilities are not equally distributed. It should be noted that there are differences between the rates at which ideas spread as opposed to technologies. Technologies, in general, are more costly to adopt than are ideas. By focusing on the research literature initially, we will employ epidemic models of knowledge diffusion in order to analyze how long it takes for ISS-originated ideas to spread in the wider research literature base (Christakis & Fowler 2007; Cowan & Jonard 2004; Geroski 2000; Newman 2007). As such, various models of information diffusion between and among the co-authors in an ISS scientist's network will be explored, analyzed and mapped. Then, because space station research is characterized by atypical scientific opportunities due to its environment, we will utilize various percolation algorithms of technological innovation and diffusion. Applying percolation algorithms is appropriate given the extraordinary characteristics of the conduct of research on the space station (Silverberg & Verspagen 2005; Xulvi-Brunet & Sokolov 2005). Then, if possible, we will examine the extent to which "information cascades" are present in the data. Information cascades occur when an author or an inventor is able to follow the work of someone ahead of him by merely observing the outcomes of another's research (Geroski 2000). This approach could be especially relevant for ISS science because researchers at large would typically not have access to the space station where they might conduct experiments themselves.

Geospatial Analysis. Information about the geographic locations of authors and institutions is available in the data file. We will include a geospatial analysis of collaboration on scientific articles granted to ISS investigators. For each institution and author in the data file, specific information such as zip code, city and country location will be used to aggregate the level of activity by location. This will make it possible to see the numbers of peer-reviewed scientific articles that result from the ISS experience per country or region. Studied over time, it might be possible to interpret how and when policy changes were adopted around the world with regard to space station science. Similarly, it might be possible to trace the germination and spread of an idea or topic over geography. The author, inventor, and institution data will be overlaid on a map to indicate exactly where scientific articles and patents are being produced and what domains are included in the innovation space of geographic region around the world.

Data Visualization. Data will be visualized using various methods to communicate the growth and interaction patterns of investigator and networks across collaborators, institutions, disciplines, geographic location, and with respect to burst detection. These resulting networks will be visualized using both static and interactive techniques. Several data visualizations will be created. No fewer than four high quality visualizations of science will be produced each year pertaining to the impact of ISS science. Initially, this study will use the DrL: Distributed Recursive Layout algorithms developed at Sandia National Laboratories (Martin, Brown, Klavans, & Boyack, 2007).This algorithm is a force-directed layout algorithm that was developed specifically for use with large datasets pertaining to the real world. By clustering nodes through several iterations in the layout of the graph on the x and y axes, both attraction and repulsion are function on the nodes. This attraction and repulsion in the layout of the nodes (based on the network measures described earlier) places the nodes which are similar to one another more closely together. At the same time, nodes with weak relations are pushed away. The figures discussed above are examples of these visualizations.

III.A.2.b.iv. Top-Level Schedule of Tasks

Our project extends over three years, with prototype results and interim findings planned for each year. The team expertise, described further below, include analysts, programmers, a graphics designer, and graduate and undergraduate student assistants. Quality control and project risk management is included for all tasks. A detailed work breakdown schedule appears in Volume 2 of this proposal.

Year One: Our primary effort in year 1 is data collection and management, including specification of data retrieval and cleaning algorithms for data to be assembled from the external databases; merging of the ISS data and external data; and data documentation, validation, and verification to ensure reproducibility of all steps. We will first assemble these data for a purposive sample of the 7 most prolific ISS scientists within our themes (these investigators have been identified for us by the ISS office). In year one, we will also initiate exploratory hypothesis testing of network patterns and focal breakthroughs. We will conduct the first analysis of this sample of data, providing by end of year one a prototype of our full approach, initial results for the sample, and our first draft of tabular and graphical visualizations. Also in year one, we will establish a project SharePoint, assemble and convene two meetings of the project steering group, provide monthly reports to NASA, and by year end, produce and present a working paper and set of briefing charts describing the research objectives, methods, expected outputs, and initial results. We plan to attend the 1st Annual ISS R&D conference and one additional conference for peer review and communication of our work. As described in our 'risk section,' we anticipate that our main risk management actions in year one will be insuring data validity and quality in our retrievals from the external databases.

Year Two: We continue data collection and management for larger samples across all four ISS science themes. We focus on statistical analysis and profiling, hypothesis testing, and network extraction with co-author, citation, institutional, and geographic networks. By the 3rd quarter of year two, we will carry out the development and analysis of co-author, institutional, and geographic networks. We will produce by year end our first set of four high quality visualizations of ISS science prepared in conjunction with our graphics designer. We also begin disciplinary and multidisciplinary analyses; burst detection analysis, and meta analysis using results of a limited set of similar studies drawn from the existing literature. We plan to present

our work at two peer-reviewed conferences, convene two meetings of the steering group, and provide regular briefings to NASA as scheduled.

Year Three: During the 1st to 3rd quarters, we complete statistical analysis and profiling, network analyses, disciplinary and multidisciplinary analyses, and meta analysis. By year end, we develop our second set of four high quality visualizations to produce, with the visualizations from year two, the first "atlas of ISS science." We convene the steering group in two meetings and present a draft report and briefing to NASA. We complete a final written report to NASA. We present our findings at two peer-reviewed conferences to continue communication and outreach. During the last quarter, we will also work with NASA to transition the project architecture and data for sustained management by NASA or for a third party, and engage in initial discussion about the usefulness of extending the framework to include patent analysis.

III.A.3. Deliverables

We will deliver specific outputs as well as a framework that NASA would be able to incorporate into routine ISS management and performance measurement into the future. Although our focus is on a subset of ISS science results (peer reviewed articles), our method will be applicable, with suitable modifications, to future analysis of ISS patents.

Specifically, we will deliver:

1. An intellectually consistent and rigorous, peer-reviewed method, using state of the art science of science statistical analysis and visualization tools, for tracking and representing science advances enabled by ISS science
2. The first 'atlas of ISS science' containing tabular and high quality graphical visualizations of new knowledge and its diffusion across people, institutions, time, geography, and within and across disciplines to demonstrate the value of ISS science
3. A database containing metadata relative to ISS peer-reviewed publications merged with external databases; data cleaning, validation, and verification; and documentation of data management protocols to ensure reproducibility of our findings
4. A community of experts who, having served on our project steering group, can assist in outreach and communication of our approach and findings, to enhance familiarity with, and appreciation for ISS science
5. A series of working papers submitted for peer review that incorporate comments received at professional conferences convened by the space research and science-of-science research communities
6. Key findings and recommendations about possible barriers to the diffusion of ISS science with implications for project management and/or NASA interaction with the science community that could enhance ISS science productivity.

III.A.4. Project Milestones

After coordination with NASA, we propose the following four milestones:

CLIN 1 (July 2, 2012): The model database for [redacted] (this is year 1 funding requested in the proposal)

CLIN 2 (June 15, 2013): A detailed report that will contain: specification of data retrieval and cleaning algorithms for external databases and parameter values; description of algorithms for data retrieval from the external databases; documentation of data retrieval, upload, and all steps taken to clean the data for the first sample; summary of all initial results from exploratory hypothesis testing; first prototype of multiple temporal, topical, and geospatial network and citation analysis; summary of steering group findings and recommendations; and plans for year two of project. [redacted] (this is what is requested for year 2 in the proposal)

CLIN 3 (June 15, 2014): A detailed report that includes: specification of steps for data merging and integration for larger samples across all themes with data documentation for replicability of all steps; statistical summaries of the database including network measures for co-author networks, citation networks, institutional networks, and geographical networks; disciplinary, burst detection, and temporal analyses; summary of research results; first set of visualizations; steering group findings and recommendations; and plans for year 3 of project. [redacted] (3/4 of the proposal's Year 3 funding)

CLIN 4 (June 15, 2015): Final "atlas of ISS science" with all visualizations; final report summarizing project and findings; summary of final set of steering group findings and recommendations. [redacted] (this is final 1/4 of year 3 funding requested in the proposal)

SECTION D – PACKING AND MARKETING

D.1 CLAUSES INCORPORATED BY REFERENCE (FAR 52.252-2) (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

Federal Acquisition Regulation (FAR) clauses:
http://www.acquisition.gov/far/index.html

NASA FAR Supplement (NFS) Clauses:
http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm

(End of clause)

I. FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1)

CLAUSE NUMBER	DATE	TITLE

None included by reference

II. NASA FAR SUPPLEMENT (48 CFR CHAPTER 18) CLAUSES

CLAUSE NUMBER	DATE	TITLE
1852.211-70	SEPT 2005	PACKAGING, HANDLING AND TRANSPORTATION

(End of clause)

[END OF SECTION]

SECTION E - INSPECTION AND ACCEPTANCE

E.1 CLAUSES INCORPORATED BY REFERENCE (FAR 52.252-2) (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

Federal Acquisition Regulation (FAR) clauses:
http://www.acquisition.gov/far/index.html

NASA FAR Supplement (NFS) Clauses:
http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm

(End of clause)

I. FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1)

CLAUSE NUMBER	DATE	TITLE
52.246-2	AUG 1996	INSPECTION OF SUPPLIES - FIXED-PRICE
52.246-4	AUG 1996	INSPECTION OF SERVICES - FIXED-PRICE

II. NASA FAR SUPPLEMENT (48 CFR CHAPTER 18) CLAUSES

CLAUSE NUMBER	DATE	TITLE
1852.246-71	OCT 1988	GOVERNMENT CONTRACT QUALITY ASSURANCE FUNCTIONS

E.2 ACCEPTANCE--MULTIPLE LOCATIONS

The Contracting Officer or authorized representative will accomplish acceptance at the following location(s):

Item (As listed in B.3)	Location	Authorized Representative
CLIN 1	NASA JSC	COTR or Designee
CLIN 2	NASA JSC	COTR or Designee
CLIN 3	NASA or HQ	COTR or Designee
CLIN 4	NASA JSC	COTR or Designee

Acceptance, for the purposes of this clause, relates solely to the receipt of hardware at the locations and by the authorized representatives so noted.

The Contracting Officer reserves the right to designate other Government agents as authorized representatives. The Contractor will be notified by a written notice or by a copy of the delegation letter if other agents are authorized.

(End of clause)

[END OF SECTION]

SECTION F - DELIVERIES OR PERFORMANCE

F.1 CLAUSES INCORPORATED BY REFERENCE (FAR 52.252-2) (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

Federal Acquisition Regulation (FAR) clauses:
http://www.acquisition.gov/far/index.html

NASA FAR Supplement (NFS) Clauses:
http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm

(End of clause)

I. FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1)

CLAUSE NUMBER	DATE	TITLE
52.242-15	AUG 1989	STOP-WORK ORDER
52.242-17	APR 1984	GOVERNMENT DELAY OF WORK
52.247-34	NOV 1991	F.O.B DESTINATION

II. NASA FAR SUPPLEMENT (48 CFR CHAPTER 18) CLAUSES

CLAUSE NUMBER	DATE	TITLE

None included by reference

F.2 PERIOD OF PERFORMANCE

The period of performance of this contract shall be from July 20, 2012 through June 30, 2015.

F.3 PLACE OF PERFORMANCE - SERVICES

The primary effort under this contract shall be performed at the contractor's facilities, Washington, DC.

(End of clause)

[END OF SECTION]

SECTION G – CONTRACT ADMINISTRATION

G.1 SUBMISSION OF INVOICES

Invoices shall be prepared and submitted in quadruplicate unless otherwise specified. Invoices shall contain the following information as applicable: contract and order number, item numbers, description of supplies or services, sizes, quantities, unit prices, and extended totals. Invoices shall be submitted to:

NSSC- FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Phone: 1-877-677-2123
Fax: 1-866-209-5415
E-mail: NSSC-AccountsPayable@nasa.gov

(End of clause)

G.2 Patent Rights – Ownership by the Contractor (FAR 52.227-11)(Dec 2007)

(a) As used in this clause—

"Invention" means any invention or discovery that is or may be patentable or otherwise protectable under title 35 of the U.S. Code, or any variety of plant that is or may be protectable under the Plant Variety Protection Act (7 U.S.C. 2321, *et seq.*)

"Made" means—

(1) When used in relation to any invention other than a plant variety, the conception or first actual reduction to practice of the invention; or

(2) When used in relation to a plant variety, that the Contractor has at least tentatively determined that the variety has been reproduced with recognized characteristics.

"Nonprofit organization" means a university or other institution of higher education or an organization of the type described in section 501(c)(3) of the Internal Revenue Code of 1954 (26 U.S.C. 501(c)) and exempt from taxation under section 501(a) of the Internal Revenue Code (26 U.S.C. 501(a)), or any nonprofit scientific or educational organization qualified under a State nonprofit organization statute.

"Practical application" means to manufacture, in the case of a composition of product; to practice, in the case of a process or method; or to operate, in the case of a machine or system; and, in each case, under such conditions as to establish that the invention is being utilized and that its benefits are, to the extent permitted by law or Government regulations, available to the public on reasonable terms.

"Subject invention" means any invention of the Contractor made in the performance of work under this contract.

(b) *Contractor's rights.*

(1) *Ownership.* The Contractor may retain ownership of each subject invention throughout the world in accordance with the provisions of this clause.

(2) *License.*

(i) The Contractor shall retain a nonexclusive royalty-free license throughout the world in each subject invention to which the Government obtains title, unless the Contractor fails to disclose the invention within the times specified in paragraph (c) of this clause. The Contractor's license extends to any domestic subsidiaries and affiliates within the corporate structure of which the Contractor is a part, and includes the right to grant sublicenses to the extent the Contractor was legally obligated to do so at contract award. The license is transferable only with the written approval of the agency, except when transferred to the successor of that part of the Contractor's business to which the invention pertains.

(ii) The Contractor's license may be revoked or modified by the agency to the extent necessary to achieve expeditious practical application of the subject invention in a particular country in accordance with the procedures in FAR 27.302(i)(2) and 27.304-1(f).

(c) *Contractor's obligations.*

(1) The Contractor shall disclose in writing each subject invention to the Contracting Officer within 2 months after the inventor discloses it in writing to Contractor personnel responsible for patent matters. The disclosure shall identify the inventor(s) and this contract under which the subject invention was made. It shall be sufficiently complete in technical detail to convey a clear understanding of the subject invention. The disclosure shall also identify any publication, on sale (*i.e.*, sale or offer for sale), or public use of the subject invention, or whether a manuscript describing the subject invention has been submitted for publication and, if so, whether it has been accepted for publication. In addition, after disclosure to the agency, the Contractor shall promptly notify the Contracting Officer of the acceptance of any manuscript describing the subject invention for publication and any on sale or public use.

(2) The Contractor shall elect in writing whether or not to retain ownership of any subject invention by notifying the Contracting Officer within 2 years of disclosure to the agency. However, in any case where publication, on sale, or public use has initiated the 1-year statutory period during which valid patent protection can be obtained in the United States, the period for election of title may be shortened by the agency to a date that is no more than 60 days prior to the end of the statutory period.

(3) The Contractor shall file either a provisional or a nonprovisional patent application or a Plant Variety Protection Application on an elected subject invention within 1 year after election. However, in any case where a publication, on sale, or public use has initiated the 1-year statutory period during which valid patent protection can be obtained in the United States, the Contractor shall file the application prior to the end of that statutory period. If the Contractor files a provisional application, it shall file a nonprovisional application within 10 months of the filing of the provisional application. The Contractor shall file patent applications in additional countries or international patent offices within either 10 months of the first filed patent application (whether provisional or nonprovisional) or 6 months from the date permission is granted by the Commissioner of Patents to file foreign patent applications where such filing has been prohibited by a Secrecy Order.

(4) The Contractor may request extensions of time for disclosure, election, or filing under paragraphs (c)(1), (c)(2), and (c)(3) of this clause.

(c)(5) The Contractor may use whatever format is convenient to disclose subject inventions required in subparagraph (c)(1). NASA prefers that the contractor use either the electronic or

paper version of NASA Form 1679, Disclosure of Invention and New Technology (Including Software) to disclose subject inventions. Both the electronic and paper versions of NASA Form 1679 may be accessed at the electronic New Technology Reporting Web site http://invention.nasa.gov.

(End of addition)

(d) *Government's rights—*

(1) *Ownership.* The Contractor shall assign to the agency, on written request, title to any subject invention—

(i) If the Contractor fails to disclose or elect ownership to the subject invention within the times specified in paragraph (c) of this clause, or elects not to retain ownership; provided, that the agency may request title only within 60 days after learning of the Contractor's failure to disclose or elect within the specified times.

(ii) In those countries in which the Contractor fails to file patent applications within the times specified in paragraph (c) of this clause; provided, however, that if the Contractor has filed a patent application in a country after the times specified in paragraph (c) of this clause, but prior to its receipt of the written request of the agency, the Contractor shall continue to retain ownership in that country.

(iii) In any country in which the Contractor decides not to continue the prosecution of any application for, to pay the maintenance fees on, or defend in reexamination or opposition proceeding on, a patent on a subject invention.

(2) *License.* If the Contractor retains ownership of any subject invention, the Government shall have a nonexclusive, nontransferable, irrevocable, paid-up license to practice, or have practiced for or on its behalf, the subject invention throughout the world.

(e) *Contractor action to protect the Government's interest.*

(1) The Contractor shall execute or have executed and promptly deliver to the agency all instruments necessary to—

(i) Establish or confirm the rights the Government has throughout the world in those subject inventions in which the Contractor elects to retain ownership; and

(ii) Assign title to the agency when requested under paragraph (d) of this clause and to enable the Government to obtain patent protection and plant variety protection for that subject invention in any country.

(2) The Contractor shall require, by written agreement, its employees, other than clerical and nontechnical employees, to disclose promptly in writing to personnel identified as responsible for the administration of patent matters and in the Contractor's format, each subject invention in order that the Contractor can comply with the disclosure provisions of paragraph (c) of this clause, and to execute all papers necessary to file patent applications on subject inventions and to establish the Government's rights in the subject inventions. The disclosure format should require, as a minimum, the information required by paragraph (c)(1) of this clause. The Contractor shall instruct such employees, through employee agreements or other suitable educational programs, as to the importance of reporting inventions in sufficient time to permit the filing of patent applications prior to U.S. or foreign statutory bars.

(3) The Contractor shall notify the Contracting Officer of any decisions not to file a nonprovisional patent application, continue the prosecution of a patent application, pay maintenance fees, or defend in a reexamination or opposition proceeding on a patent, in any country, not less than 30 days before the expiration of the response or filing period required by the relevant patent office.

(4) The Contractor shall include, within the specification of any United States nonprovisional patent or plant variety protection application and any patent or plant variety protection certificate issuing thereon covering a subject invention, the following statement, "This invention was made with Government support under (identify the contract) awarded by (identify the agency). The Government has certain rights in the invention."

(f) *Reporting on utilization of subject inventions.* The Contractor shall submit, on request, periodic reports no more frequently than annually on the utilization of a subject invention or on efforts at obtaining utilization of the subject invention that are being made by the Contractor or its licensees or assignees. The reports shall include information regarding the status of development, date of first commercial sale or use, gross royalties received by the Contractor, and other data and information as the agency may reasonably specify. The Contractor also shall provide additional reports as may be requested by the agency in connection with any march-in proceeding undertaken by the agency in accordance with paragraph (h) of this clause. The Contractor also shall mark any utilization report as confidential/proprietary to help prevent inadvertent release outside the Government. As required by 35 U.S.C. 202(c)(5), the agency will not disclose that information to persons outside the Government without the Contractor's permission.

(f)(5) The Contractor shall provide the Contracting Officer the following:

(i) A listing every 12 months (or such longer period as the Contracting Officer may specify) from the date of the contract, of all subject inventions required to be disclosed during the period.

(ii) A final report prior to closeout of the contract listing all subject inventions or certifying that there were none.

(iii) Upon request, the filing date, serial number and title, a copy of the patent application, and patent number and issue date for any subject invention in any country in which the contractor has applied for patents.

(iv) An irrevocable power to inspect and make copies of the patent application file, by the Government, when a Federal Government employee is a coinventor.

(End of addition

(g) *Preference for United States industry.* Notwithstanding any other provision of this clause, neither the Contractor nor any assignee shall grant to any person the exclusive right to use or sell any subject invention in the United States unless the person agrees that any products embodying the subject invention or produced through the use of the subject invention will be manufactured substantially in the United States. However, in individual cases, the requirement for an agreement may be waived by the agency upon a showing by the Contractor or its assignee that reasonable but unsuccessful efforts have been made to grant licenses on similar terms to potential licensees that would be likely to manufacture substantially in the United States, or that under the circumstances domestic manufacture is not commercially feasible.

(g)(2) The Contractor shall include the clause in the NASA FAR Supplement at 1852.227-70, New Technology, suitably modified to identify the parties, in all subcontracts, regardless of tier, for experimental, developmental, research, design, or engineering work to be performed by other than a small business firm or nonprofit organization.

(End of substitution)

(h) *March-in rights.* The Contractor acknowledges that, with respect to any subject invention in which it has retained ownership, the agency has the right to require licensing pursuant to 35 U.S.C. 203 and 210(c), and in accordance with the procedures in 37 CFR 401.6 and any supplemental regulations of the agency in effect on the date of contract award.

(i) Special provisions for contracts with nonprofit organizations. If the Contractor is a nonprofit organization, it shall—

(1) Not assign rights to a subject invention in the United States without the written approval of the agency, except where an assignment is made to an organization that has as one of its primary functions the management of inventions, *provided*, that the assignee shall be subject to the same provisions as the Contractor;

(2) Share royalties collected on a subject invention with the inventor, including Federal employee co-inventors (but through their agency if the agency deems it appropriate) when the subject invention is assigned in accordance with 35 U.S.C. 202(e) and 37 CFR 401.10;

(3) Use the balance of any royalties or income earned by the Contractor with respect to subject inventions, after payment of expenses (including payments to inventors) incidental to the administration of subject inventions for the support of scientific research or education; and

(4) Make efforts that are reasonable under the circumstances to attract licensees of subject inventions that are small business concerns, and give a preference to a small business concern when licensing a subject invention if the Contractor determines that the small business concern has a plan or proposal for marketing the invention which, if executed, is equally as likely to bring the invention to practical application as any plans or proposals from applicants that are not small business concerns; *provided*, that the Contractor is also satisfied that the small business concern has the capability and resources to carry out its plan or proposal. The decision whether to give a preference in any specific case will be at the discretion of the Contractor.

(5) Allow the Secretary of Commerce to review the Contractor's licensing program and decisions regarding small business applicants, and negotiate changes to its licensing policies, procedures, or practices with the Secretary of Commerce when the Secretary's review discloses that the Contractor could take reasonable steps to more effectively implement the requirements of paragraph (i)(4) of this clause.

(j) *Communications.* [*Complete according to agency instructions.*]

(k) *Subcontracts.*

(1) The Contractor shall include the substance of this clause, including this paragraph (k), in all subcontracts for experimental, developmental, or research work to be performed by a small business concern or nonprofit organization.

(2) The Contractor shall include in all other subcontracts for experimental, developmental, or research work the substance of the patent rights clause required by FAR Subpart 27.3.

(3) At all tiers, the patent rights clause must be modified to identify the parties as follows: references to the Government are not changed, and the subcontractor has all rights and

obligations of the Contractor in the clause. The Contractor shall not, as part of the consideration for awarding the subcontract, obtain rights in the subcontractor's subject inventions.

(4) In subcontracts, at any tier, the agency, the subcontractor, and the Contractor agree that the mutual obligations of the parties created by this clause constitute a contract between the subcontractor and the agency with respect to the matters covered by the clause; provided, however, that nothing in this paragraph is intended to confer any jurisdiction under the Contract Disputes Act in connection with proceedings under paragraph (h) of this clause.

(End of clause)

G.3 Designation of New Technology Representative and Patent Representative (NFS 1852.227-72)(July 1997)

(a) For purposes of administration of the clause of this contract entitled "New Technology" or "Patent Rights--Retention by the Contractor (Short Form)," whichever is included, the following named representatives are hereby designated by the Contracting Officer to administer such clause:

Title	Office Code	Address (including zip code)
New Technology Representative	Edward Fein, AL	281-483-4871
Patent Representative	Jane Fox, AF	281-483-4815

(b) Reports of reportable items, and disclosure of subject inventions, interim reports, final reports, utilization reports, and other reports required by the clause, as well as any correspondence with respect to such matters, should be directed to the New Technology Representative unless transmitted in response to correspondence or request from the Patent Representative. Inquires or requests regarding disposition of rights, election of rights, or related matters should be directed to the Patent Representative. This clause shall be included in any subcontract hereunder requiring a "New Technology" clause or "Patent Rights--Retention by the Contractor (Short Form)" clause, unless otherwise authorized or directed by the Contracting Officer. The respective responsibilities and authorities of the above-named representatives are set forth in 1827.305-370 of the NASA FAR Supplement.

(End of clause)

G.4 Submission Of Requests For Progress Payments (NFS 1852.232-82) MAR 1989)

The Contractor shall request progress payments in accordance with the Progress Payments clause by submitting to the Contracting Officer an original and two copies of Standard Form (SF) 1443, Contractor's Request for Progress Payment, and the contractor's invoice (if applicable). The Contracting Officer's office is the designated billing office for progress payments for purposes of the Prompt Payment clause.

(End of clause)

[END OF SECTION]

SECTION H – SPECIAL CONTRACT REQUIREMENTS

H.1 CLAUSES INCORPORATED BY REFERENCE (FAR 52.252-2) (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

Federal Acquisition Regulation (FAR) clauses:
http://www.acquisition.gov/far/index.html
NASA FAR Supplement (NFS) Clauses:
http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm

(End of clause)

I FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1)

CLAUSE NUMBER	DATE	TITLE
None included by reference		

II NASA FAR SUPPLEMENT (48 CFR CHAPTER 18) CLAUSES

CLAUSE NUMBER	DATE	TITLE
1852.208-81	NOV 2004	RESTRICTIONS ON PRINTING AND DUPLICATING
1852.223-72	APR 2002	SAFETY AND HEALTH (SHORT FORM)
1852.223-75	FEB 2002	MAJOR BREACH OF SAFETY OR SECURITY
1852.225-70	FEB 2000	EXPORT LICENSE

(End of Clause)

[END OF SECTION]

PART II – CONTRACT CLAUSES

SECTION I – CONTRACT CLAUSES

I.1 CLAUSES INCORPORATED BY REFERENCE (FAR 52.252-2) (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

Federal Acquisition Regulation (FAR) clauses:
http://www.acquisition.gov/far/index.html

NASA FAR Supplement (NFS) Clauses:
http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm

(End of clause)

I FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1)

CLAUSE NUMBER	DATE	TITLE
52.202-1	JAN 2012	DEFINITIONS
52.203-3	APR 1984	GRATUITIES
52.203-5	APR 1984	COVENANT AGAINST CONTINGENT FEES
52.203-6	SEP 2006	RESTRICTIONS ON SUBCONTRACTOR SALES TO THE GOVERNMENT
52.203-7	OCT 2010	ANTI-KICKBACK PROCEDURES
52.203-8	JAN 1997	CANCELLATION, RESCISSION, AND RECOVERY OF FUNDS FOR ILLEGAL OR IMPROPER ACTIVITY
52.203-10	JAN 1997	PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY
52.203-12	OCT 2010	LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS
52.204-4	MAY 2011	PRINTED OR COPIED DOUBLE-SIDED ON RECYCLED PAPER
52.204-7	FEB 2012	CENTRAL CONTRACTOR REGISTRATION
52.204-10	FEB 2012	REPORTING EXECUTIVE COMPENSATION AND FIRST-TIER SUBCONTRACTING AWARDS
52.209-6	DEC 2010	PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR DEBARMENT
52.209-10	May 2012	PROHIBITION ON CONTRACTING WITH INVERTED DOMESTIC CORPORATIONS

52.215-2	OCT 2010	AUDIT AND RECORDS - NEGOTIATIONS
52.215-8	OCT 1997	ORDER OF PRECEDENCE - UNIFORM CONTRACT FORMAT
52.215-21	OCT 2010	REQUIREMENTS FOR COST OR PRICING DATA OR INFORMATION OTHER THAN COST OR PRICING DATA – MODIFICATIONS ALT III & ALT IV
52.219-6	JUN 2003	NOTICE OF TOTAL SMALL BUSINESS SET-ASIDE
52.219-8	MAY 2004	UTILIZATION OF SMALL BUSINESS CONCERNS
52.219-14	NOV 2011	LIMITATIONS ON SUBCONTRACTING
52.219-28	APR 2012	POST-AWARD SMALL BUSINESS PROGRAM REPRESENTATION
52.222-1	FEB 1997	NOTICE TO THE GOVERNMENT OF LABOR DISPUTES
52.222-3	JUN 2003	CONVICT LABOR
52.222-21	FEB 1999	PROHIBITION OF SEGREGATED FACILITIES
52.222-26	MAR 2007	EQUAL OPPORTUNITY
52.222-35	SEP 2010	EQUAL OPPORTUNITY FOR VETERANS
52.222-36	OCT 2010	AFFIRMATIVE ACTION FOR WORKERS WITH DISABILITIES
52.222-37	SEP 2010	EMPLOYMENT REPORTS VETERANS
52.222-40	DEC 2010	Notification of Employee Rights Under the National Labor Relations Act
52.222-41	NOV 2007	SERVICE CONTRACT ACT OF 1965
52.222-43	SEP 2009	FAIR LABOR STANDARDS ACT AND SERVICE CONTRACT ACT - PRICE ADJUSTMENT (MULTIPLE YEAR AND OPTION CONTRACTS)
52.222-50	FEB 2009	COMBATING TRAFFICKING IN PERSONS
52.222-54	JAN 2009	EMPLOYMENT ELIGIBILITY VERIFICATION
52.223-6	MAY 2001	DRUG-FREE WORKPLACE
52.223-18	AUG 2011	CONTRACTOR POLICY TO BAN TEXT MESSAGING WHILE DRIVING
52.225-13	JUN 2008	RESTRICTIONS ON CERTAIN FOREIGN PURCHASES
52.227-1	DEC 2007	AUTHORIZATION AND CONSENT
52.227-2	DEC 2007	NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT
52.227-14	DEC 2007	RIGHTS IN DATA-GENERAL
52.227-16	JUN 1987	ADDITIONAL DATA REQUIREMENTS
52.229-3	APR 2003	FEDERAL, STATE, AND LOCAL TAXES
52.232-1	APR 1984	PAYMENTS
52.232-8	FEB 2002	DISCOUNTS FOR PROMPT PAYMENT
52.232-11	APR 1984	EXTRAS
52.232-16	APR 2012	PROGRESS PAYMENTS (ALT 1) Change each mention of the progress payment and liquidation rates excepting paragraph (k) to the customary rate of 90 percent for small business concerns per NFS 1852.501-1
52.232-17	OCT 2010	INTEREST
52.232-18	APR 1984	AVAILABILITY OF FUNDS
52.232-23	JAN 1986	ASSIGNMENT OF CLAIMS
52.232-25	OCT 2008	PROMPT PAYMENT

52.232-33	OCT 2003	PAYMENT BY ELECTRONIC FUNDS TRANSFER – CENTRAL CONTRACTOR REGISTRATION
52.233-1	JUL 2002	DISPUTES
52.233-3	AUG 1996	PROTEST AFTER AWARD
52.233-4	OCT 2004	APPLICABLE LAW FOR BREACH OF CONTRACT CLAIM
52.237-2	APR 1984	PROTECTION OF GOVERNMENT BUILDINGS, EQUIPMENT, AND VEGETATION
52.239-1	AUG 1996	PRIVACY OR SECURITY SAFEGUARDS
52.242-13	JUL 1995	BANKRUPTCY
52.243-1	AUG 1987	CHANGES - FIXED-PRICE ALTERNATE I
52.244-6	DEC 2010	SUBCONTRACTS FOR COMMERCIAL ITEMS
52.245-9	APR 2012	USE AND CHARGES
52.246-25	FEB 1997	LIMITATION OF LIABILITY - SERVICES
52.248-1	OCT 2010	VALUE ENGINEERING
52.249-2	MAY 2004	TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED PRICE)
52.249-8	APR 1984	DEFAULT (FIXED-PRICE SUPPLY AND SERVICE)
52.251-1	APR 2012	GOVERNMENT SUPPLY SOURCES
52.253-1	JAN 1991	COMPUTER GENERATED FORMS

II NASA FAR SUPPLEMENT (48 CFR CHAPTER 18) CLAUSES

CLAUSE NUMBER	DATE	TITLE
1852.227-14	N/A	Rights in Data- General

I.2 STATEMENT OF EQUIVALENT RATES FOR FEDERAL HIRES (FAR 52.222-42)(MAY 1989)

In compliance with the Service Contract Act of 1965, as amended, and the regulations of the Secretary of Labor (29 CFR Part 4), this clause identifies the classes of service employees expected to be employed under the contract and states the wages and fringe benefits payable to each if they were employed by the contracting agency subject to the provisions of 5 U.S.C. 5341 or 5332.

This Statement is for Information Only:
It is not a Wage Determination

Employee Class Monetary Wage	Fringe Benefits
See Attachment J-1, U.S. Department of Labor Wage Determination	

(End of clause)

I.3 SECURITY REQUIREMENTS FOR UNCLASSIFIED INFORMATION TECHNOLOGY RESOURCES (NFS 1852.204-76) (OCT 2009)

(a) The Contractor shall protect the confidentiality, integrity, and availability of NASA Electronic Information and IT resources and protect NASA Electronic Information from unauthorized disclosure.

(b) This clause is applicable to all NASA contractors and subcontractors that process, manage, access, or store unclassified electronic information, to include Sensitive But Unclassified (SBU) information, for NASA in support of NASA's missions, programs, projects and/or institutional requirements. Applicable requirements, regulations, policies, and guidelines are identified in the Applicable Documents List (ADL) provided as an attachment to the contract. The documents listed in the ADL can be found at: www.nasa.gov/offices/ocio/itsecurity/index.html. For policy information considered sensitive, the documents will be identified as such in the ADL and made available through the Contracting Officer.

(c) Definitions

(1) IT resources means any hardware or software or interconnected system or subsystem of equipment, that is used to process, manage, access, or store electronic information.

(2) NASA Electronic Information is any data (as defined in the Rights in Data clause of this contract) or information (including information incidental to contract administration, such as financial, administrative, cost or pricing, or management information) that is processed, managed, accessed or stored on an IT system(s) in the performance of a NASA contract.

(3) IT Security Management Plan -- This plan shall describe the processes and procedures that will be followed to ensure appropriate security of IT resources that are developed, processed, or used under this contract.

(4) IT Security Plan – this is a FISMA requirement; see the ADL for applicable requirements.

Within 30 days after contract award, the Contractor shall develop and deliver an IT Security Management Plan. The delivery address and approval authority will be included in the ADL.

All contractor personnel requiring physical or logical access to NASA IT resources must complete NASA's annual IT Security Awareness training. Refer to the IT Training policy located in the IT Security website at https://itsecurity.nasa.gov/policies/index.html.

(d) The Contractor shall afford Government access to the Contractor's and subcontractors' facilities, installations, operations, documentation, databases, and personnel used in performance of the contract. Access shall be provided to the extent required to carry out a program of IT inspection (to include vulnerability testing), investigation and audit to safeguard against threats and hazards to the integrity, availability, and confidentiality of NASA Electronic Information or to the function of IT systems operated on behalf of NASA, and to preserve evidence of computer crime.

(e) At the completion of the contract, the Contractor shall return all NASA information and IT resources provided to the Contractor during the performance of the contract in accordance with retention documentation available in the ADL. The Contractor shall provide a listing of all NASA Electronic information and IT resources generated in performance of the contract. At that time, the Contractor shall request disposition instructions from the Contracting Officer. The Contracting Officer will provide disposition instructions within 30 calendar days of the contractor's request.

(f) The Contracting Officer may waive specific requirements of this clause upon request of the contractor. The Contractor shall provide all relevant information requested by the Contracting Officer to support the waiver request.

The Contractor shall insert this clause, including this paragraph in all subcontracts that process, manage, access or store NASA Electronic Information in support of the mission of the Agency.

(End of clause)

I.4 OMBUDSMAN (NFS 1852.215-84) (NOV 2011)

(a) An ombudsman has been appointed to hear and facilitate the resolution of concerns from offerors, potential offerors, and contractors during the preaward and postaward phases of this acquisition. When requested, the ombudsman will maintain strict confidentiality as to the source of the concern. The existence of the ombudsman is not to diminish the authority of the contracting officer, the Source Evaluation Board, or the selection official. Further, the ombudsman does not participate in the evaluation of proposals, the source selection process, or the adjudication of formal contract disputes. Therefore, before consulting with an ombudsman, interested parties must first address their concerns, issues, disagreements, and/or recommendations to the contracting officer for resolution.

(b) If resolution cannot be made by the contracting officer, interested parties may contact the installation ombudsman:

Lauri N. Hansen
Lyndon B. Johnson Space Center
Mail Code: AC
2101 NASA Parkway
Houston, TX 77058
Phone: 281-483-2823, Fax: 281-483-2200
Email: lauri.n.hansen@nasa.gov

Concerns, issues, disagreements, and recommendations which cannot be resolved at the installation may be referred to the NASA ombudsman, the Director of the Contract Management Division, at 202-358-0445, facsimile 202-358-3083, e-mail james.a.balinskas@nasa.gov. Please do not contact the ombudsman to request copies of the solicitation, verify offer due date, or clarify technical requirements. Such inquiries shall be directed to the Contracting Officer or as specified elsewhere in this document.

(End of clause)

I.5 RELEASE OF SENSITIVE INFORMATION (NFS 1852.237-73) (JUN 2005)

(a) As used in this clause, "Sensitive information" refers to information, not currently in the public domain, that the Contractor has developed at private expense, that may embody trade secrets or commercial or financial information, and that may be sensitive or privileged.

(b) In accomplishing management activities and administrative functions, NASA relies heavily on the support of various service providers. To support NASA activities and functions, these service providers, as well as their subcontractors and their individual employees, may need access to sensitive information submitted by the Contractor under this contract. By submitting this proposal or performing this contract, the Contractor agrees that NASA may release to its service providers, their subcontractors, and their individual employees, sensitive information submitted during the course of this procurement, subject to the enumerated protections mandated by the clause at 1852.237-72, Access to Sensitive Information.

(c) (1) The Contractor shall identify any sensitive information submitted in support of this proposal or in performing this contract. For purposes of identifying sensitive information, the Contractor may, in addition to any other notice or legend otherwise required, use a notice similar to the following:

Mark the title page with the following legend:

This proposal or document includes sensitive information that NASA shall not disclose outside the Agency and its service providers that support management activities and administrative functions. To gain access to this sensitive information, a service provider's contract must contain the clause at NFS 1852.237-72, Access to Sensitive Information. Consistent with this clause, the service provider shall not duplicate, use, or disclose the information in whole or in part for any purpose other than to perform the services specified in its contract. This restriction does not limit the Government's right to use this information if it is obtained from another source without restriction. The information subject to this restriction is contained in pages [*insert page numbers or other identification of pages*]. Mark each page of sensitive information the Contractor wishes to restrict with the following legend:

Use or disclosure of sensitive information contained on this page is subject to the restriction on the title page of this proposal or document.

(2) The Contracting Officer shall evaluate the facts supporting any claim that particular information is "sensitive." This evaluation shall consider the time and resources necessary to protect the information in accordance with the detailed safeguards mandated by the clause at 1852.237-72, Access to Sensitive Information. However, unless the Contracting Officer decides, with the advice of Center counsel, that reasonable grounds exist to challenge the Contractor's claim that particular information is sensitive, NASA and its service providers and their employees shall comply with all of the safeguards contained in paragraph (d) of this clause.

(d) To receive access to sensitive information needed to assist NASA in accomplishing management activities and administrative functions, the service provider must be operating under a contract that contains the clause at 1852.237-72, Access to Sensitive Information. This clause obligates the service provider to do the following:

(1) Comply with all specified procedures and obligations, including the Organizational Conflicts of Interest Avoidance Plan, which the contract has incorporated as a compliance document.
(2) Utilize any sensitive information coming into its possession only for the purpose of performing the services specified in its contract.
(3) Safeguard sensitive information coming into its possession from unauthorized use and disclosure.
(4) Allow access to sensitive information only to those employees that need it to perform services under its contract.
(5) Preclude access and disclosure of sensitive information to persons and entities outside of the service provider's organization.
(6) Train employees who may require access to sensitive information about their obligations to utilize it only to perform the services specified in its contract and to safeguard it from unauthorized use and disclosure.
(7) Obtain a written affirmation from each employee that he/she has received and will comply with training on the authorized uses and mandatory protections of sensitive information needed in performing this contract.
(8) Administer a monitoring process to ensure that employees comply with all reasonable security procedures, report any breaches to the Contracting Officer, and implement any necessary corrective actions.

(e) When the service provider will have primary responsibility for operating an information technology system for NASA that contains sensitive information, the service provider's contract shall include the clause at 1852.204-76, Security Requirements for Unclassified Information Technology Resources. The Security Requirements clause requires the service provider to implement an Information Technology Security Plan to protect information processed, stored, or transmitted from unauthorized access, alteration, disclosure, or use. Service provider personnel requiring privileged access or limited privileged access to these information technology systems are subject to screening using the standard National Agency Check (NAC) forms appropriate to the level of risk for adverse impact to NASA missions. The Contracting Officer may allow the service provider to conduct its own screening, provided the service provider employs substantially equivalent screening procedures.

(f) This clause does not affect NASA's responsibilities under the Freedom of Information Act.

(g) The Contractor shall insert this clause, including this paragraph (g), suitably modified to reflect the relationship of the parties, in all subcontracts that may require the furnishing of sensitive information.

(End of clause)

[END OF SECTION]