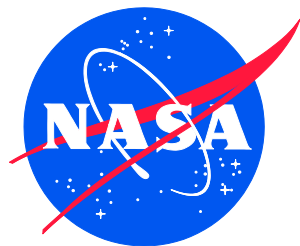


NASA/SP—2015–7602 (Rev. 2)



NASA Publications Guide for Authors

National Aeronautics and
Space Administration

June 2015

NASA STI Program . . . in Profile

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA scientific and technical information (STI) program plays a key part in helping NASA maintain this important role.

The NASA STI program operates under the auspices of the Agency Chief Information Officer. It collects, organizes, provides for archiving, and disseminates NASA's STI. The NASA STI program provides access to the NTRS Registered and its public interface, the NASA Technical Reports Server, thus providing one of the largest collections of aeronautical and space science STI in the world. Results are published in both non-NASA channels and by NASA in the NASA STI Report Series, which includes the following report types:

- **TECHNICAL PUBLICATION.** Reports of completed research or a major significant phase of research that present the results of NASA Programs and include extensive data or theoretical analysis. Includes compilations of significant scientific and technical data and information deemed to be of continuing reference value. NASA counter-part of peer-reviewed formal professional papers but has less stringent limitations on manuscript length and extent of graphic presentations.
- **TECHNICAL MEMORANDUM.** Scientific and technical findings that are preliminary or of specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.
- **CONTRACTOR REPORT.** Scientific and technical findings by NASA-sponsored contractors and grantees.

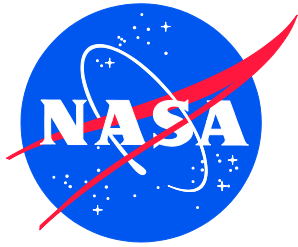
- **CONFERENCE PUBLICATION.** Collected papers from scientific and technical conferences, symposia, seminars, or other meetings sponsored or co-sponsored by NASA.
- **SPECIAL PUBLICATION.** Scientific, technical, or historical information from NASA programs, projects, and missions, often concerned with subjects having substantial public interest.
- **TECHNICAL TRANSLATION.** English-language translations of foreign scientific and technical material pertinent to NASA's mission.

Specialized services also include organizing and publishing research results, distributing specialized research announcements and feeds, providing information desk and personal search support, and enabling data exchange services.

For more information about the NASA STI program, see the following:

- Access the NASA STI program home page at <http://www.sti.nasa.gov>
- E-mail your question to help@sti.nasa.gov
- Phone the NASA STI Information Desk at 757-864-9658
- Write to:
NASA STI Information Desk
Mail Stop 148
NASA Langley Research Center
Hampton, VA 23681-2199

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Space Administration

NASA Scientific and Technical Information Program

June 2015

Acknowledgments

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Available from

NASA STI Program
Mail Stop 148
NASA Langley Research Center
Hampton, VA 23681-2199

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

This report is also available in electronic form at <http://www.sti.nasa.gov/> and <http://ntrs.nasa.gov/>

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1 Getting Started

This guide provides basic information about publishing NASA scientific and technical information (STI). For additional information, contact your center or Headquarters STI or technical publications manager and see <http://www.sti.nasa.gov>, “Publish STI.” Extensive information is given in NASA Procedural Requirements (NPR) 2200.2, Requirements for Documentation, Approval, and Dissemination of NASA Scientific and Technical Information (ref. 1).

Documenting and publishing the results of your work are part of your responsibilities as a NASA employee. The National Aeronautics and Space Act of 1958 (ref. 2) established a requirement for NASA to provide “the widest practicable and appropriate dissemination of information concerning its activities and the results thereof.” If you are engaged in NASA-funded or NASA-sponsored research and development and related efforts, it is important to publish the results of your work in the NASA STI Report Series or through other externally accessible channels, as appropriate.

STI is defined in NASA Policy Directive (NPD) 2200.1, Management of NASA Scientific and Technical Information as “the results (analyses of data and facts and resulting conclusions) of the Agency’s basic and applied scientific, technical, and related engineering research and development” (ref. 3). STI also includes management, industrial, and economic information relevant to this research.

Examples include, but are not limited to, technical papers and reports; journal articles; meeting, workshop, and conference papers and presentations; conference proceedings; and preliminary or unpublished STI, as well as any STI documents that will be posted to an internal, external, or public Internet Web site.

This guide is based not only on requirements in NPR 2200.2, but also on current professional publications standards.

Section 1, “Getting Started,” gives an overview and reminds you of your role in disseminating your work by documenting STI for NASA and the U.S. taxpayers, when appropriate.

Section 2, “General Information,” lists and describes the types of reports in the NASA STI Report Series along with other forms of publications. It also discusses the dissemination and safeguarding of STI for the future.

Section 3, “Reviews and Handling Unlimited and Limited STI,” discusses professional, technical, data quality, and dissemination reviews, including the mandatory NASA STI Document Availability Authorization (DAA) review via NASA Form (NF)–1676 for any NASA STI released external to the Agency or presented at internal meetings or workshops at which foreign nationals may be present. This section also discusses the handling of unlimited and limited/restricted STI.

Section 4, “Format Information,” provides recommended standards for document format, composition, and organization. It also gives details regarding the elements of a typical report.

Section 5, “Special Preparation Concerns,” presents additional preparation recommendations. This section is a brief explanation. For detailed information, see NPR 2200.2 (ref. 1) and <http://www.sti.nasa.gov>, “Publish STI,” or send an email to the NASA STI program, at help@sti.nasa.gov.

Please contact your center technical publications office to discuss specific preparation, review and approval, distribution, and scheduling requirements for your proposed publication.

2 General Information

The NASA Online Directives Information System (NODIS) is an excellent resource containing all of NASA’s Policy Directives and Procedural Requirements which provide additional and detailed guidance and instruction on numerous NASA processes.

2.1 Selection of Publication Type

NASA STI is published in a variety of NASA and non-NASA publication types including the NASA STI Report Series and non-NASA oral presentations, periodicals, journal articles, books, and proceedings compiled by non-NASA publishers. In addition, NASA STI is sometimes published on NASA Web sites. All releases are subject to approval as described in NPR 2200.2 (ref. 1) and the DAA.

There are two forms you need for publishing NASA STI in any NASA or non-NASA document type: the NF–1676, the DAA, and if you plan to publish in the STI Report Series, Standard Form (SF)–298, Report Documentation Page (RDP). Special Note: There are seven centers that utilize the Agency Electronic Document Availability Authorization (EDAA, NF–1676B) tool to process the NF–1676. Those centers are Ames, Armstrong, Glenn, Goddard, Kennedy, Headquarters, and Marshall. Some of these centers still have a need to process some STI using the paper NF–1676, but they are phasing out the hard copy. Johnson has their own automated tool to implement the NF–1676, as does Langley (which is called TPSAS), and Stennis. Those centers that utilize the EDAA are not required to complete the SF–298 as those data elements are incorporated into the EDAA form tool. For paper versions of the NF–1676, and for other center tools that do not capture these data elements, a SF–298 is required for submission of STI Report Series documents.

2.1.1 NASA STI Report Series

The NASA STI Report Series comprises six types of technical reports: Technical Publications (TP), Technical Memorandums (TM), Contractor Reports (CR), Conference Publications (CP), Special Publications (SP), and Technical Translations (TT). These report types are described in Sections 2.1.1.1–2.1.1.6, respectively.

Select the appropriate NASA STI Report Series type according to your document content and the needs of your readership. Make the selection based on the descriptions provided herein, with assistance from your center technical publications office, STI Manager, or DAA Representative, if needed. Appendix D.1 of NPR 2200 provides a quick-reference tool for matching manuscript contents with the appropriate NASA STI Report Series type. Your selection is subject to approval as part of your center’s review process. Appendix A is a checklist of important items to know for publishing in the NASA STI Report Series.

When a document is approved for publication, your center's technical publications office obtains a report number from the NASA STI Program Support Services, hereto after referred to as the STI Support Services. The NASA numbering scheme meets the American National Standards Institute (ANSI) standards and is in the format NASA/TM—YEAR—xxxxxx, where TM is the report series type. All STI published or released in any medium must have an approved DAA on file at the originating center and submitted to STI Support Services. If you plan to present your STI at an internal seminar, workshop, or meeting to which foreign nationals have been invited or are likely to attend, you must also have your STI approved via the DAA process prior to presentation. A copy of NF-1676 can be found at <https://nef.nasa.gov/nef/search?query=1676> and through your center forms manager and the forms server.

2.1.1.1 *Technical Publication (TP)*

This series comprises reports of completed research or of a significant phase of research that presents the results of NASA programs. TPs usually include extensive data or theoretical analysis, but they may also be compilations of significant scientific and technical data or information deemed to be of continuing reference value. TPs are the NASA counterpart to peer-reviewed formal professional papers but have less stringent limitations on manuscript length and extent of graphic presentations. In addition to reports documenting research, the types of documents assigned to this series include the following:

- Bibliographies of STI literature in defined subject areas with abstracts and/or extensive annotation
- Technical handbooks, critical tables, and extensive data compilations
- Design standards. Authors should also document their design standards in the NASA Technical Standards Program (<https://standards.nasa.gov>), in accordance with NPR 7120.4 "NASA Engineering and Program/Project Management Policy" (ref. 5)
- Scientific and technical textbooks and manuals
- State-of-the-art summaries, including critical reviews or surveys of a body of scientific or technical literature
- Technical reports or monographs that provide complete and comprehensive treatment of significant contributions to scientific and technical knowledge, or a critical evaluation of selected, previously published research

2.1.1.2 *Technical Memorandum (TM)*

This series records scientific and technical findings that are preliminary or of specialized interest, e.g., quick-release reports, working papers, and bibliographies that contain minimal annotation. TMs do not contain extensive analysis. The types of documents assigned to this series include the following:

- Preliminary data (quick-release reports)
- Working papers for professional peers beyond the basic work unit or for external circulation
- Individual papers prepared for presentation at, or as preprints for, professional meetings or symposia. These papers may or may not be published later in proceedings or journals.

- Preliminary proceedings of professional meetings or symposia sponsored or cosponsored by NASA. When the proceedings are not complete, indicate the extent of the content: e.g., “abstracts only” or “primarily viewgraphs” in the “Supplementary Notes” block of SF-298.
- Theses or dissertations that relate to Agency work, written by NASA employees only
- Bibliographies that are written by NASA employees, contractors, and grantees, and that present listings of STI literature with minimal annotations
- Computer program application documentation in an STI report or item (actual computer programs fall outside the STI program)
- Limited-use data compilations
- Reports to other agencies or non-NASA-sponsored research results

2.1.1.3 *Contractor Report (CR)*

This series comprises reports of scientific and technical findings by NASA-sponsored contractors, grantees, and cooperative agreement recipients and dissertations or theses by NASA contractors or grantees (if funded by NASA).

CRs may contain findings of completed or significant scientific and technical work or findings of preliminary or specialized interest and may include final reports as well as progress reports that contain significant technical content. All CRs are subject to the minimum review requirements listed in reference 6.

A NASA contracting officer’s representative (COR) or technical management can select a final report or non-required report authored by a contractor, grantee, or cooperative agreement recipient for publication as a NASA SP, TP, or as part of a CP in lieu of publication as a CR. You may publish a given report in one series only. Such reports must meet all criteria for the selected series and must be reviewed and approved at the level(s) required for that series.

2.1.1.4 *Conference Publication (CP)*

This series contains collected papers from scientific and technical conferences, symposia, seminars, or other meetings sponsored or co-sponsored by NASA.

2.1.1.4.1 *Preprints of Conference Proceedings*

Preprints are defined as the draft versions of your STI. You may publish a preprint as a TM and distribute it to attendees at conferences even though you intend to distribute it as a CP.

2.1.1.4.2 *Release of Conference Proceedings in Both Series.*

You may wish to publish conference proceedings in both series, for example, if a significant amount of time will elapse between presenting the abstracts and illustrations as a TM and the full proceedings as a CP, or if you need handouts of the abstracts for the conference and you have not yet collected the papers. When you publish abstracts as a TM and the proceedings are subsequently published as a CP, note in the “Supplementary Notes” block of SF-298 for the CP that the CP supersedes the TM.

2.1.1.5 *Special Publications (SP)*

This series, which records scientific, technical, or historical information from NASA programs, projects, and missions, is most often concerned with subjects having substantial public interest.

Examples of topics covered by this series, and the ranges of numbers assigned to the various topics, include the following:

- General series (numbered below 3000), e.g., NASA/SP—2010–2999
- Handbooks and data compilations (numbered in 3000 series), e.g., NASA/SP—2010–3000
- History and chronology series (numbered in 4000 series), e.g., NASA/SP—2010–4000:
 - 4000: Reference works
 - 4100: Management histories
 - 4200: Project histories
 - 4300: Center histories
 - 4400: General histories
 - 4500: Monographs in Aerospace History
 - 4600: Electronic media (compact discs (CDs) and digital video discs (DVDs))
 - 4700: Historical conference proceedings
 - 4800: Societal Impact of Spaceflight

Publications in the history and chronology series (SP–4000) are controlled by the NASA History Program Office, Office of Communications, NASA Headquarters. Potential authors are strongly encouraged to make contact with the History Program Office at hq-histinfo@nasa.gov before starting work in order to gain an understanding of the requirements and processes for inclusion in the history and chronology series.

- Numbers in the 5000 range were originally assigned to technology utilization information, but this type of information is now published outside the STI Report Series.
- Management publications series (numbered from 6000 to 6999), e.g., NASA/SP—2010–6000. This series documents requirements, plans, theories, or techniques for the management or administration of NASA-sponsored scientific and technical work. It includes NASA projects or programs that have application to more than one center, to other U.S. Government agencies, or to partnerships with industrial or international organizations. Although reports discussing methods of scheduling, funding, or staffing may be included, reports containing specific costs or labor figures are not appropriate. When the primary content of a report is scientific findings or technical development, such as a TM or TP, you should use another series.
- Bibliographic series (numbered from 7000 to 7999), e.g., NASA/SP—2010–7000. This series includes regularly published abstracts, continuing bibliographies, indexes, publication guides, and announcement journals

2.1.1.6 *Technical Translation (TT)*

This series consists of English-language translations of non-English scientific and technical material pertinent to NASA's mission. A translation of material protected by copyright is a derivative work, distribution of which is constrained by international copyright law. However, TTs are retained by the STI Support Services for U.S. Government use subsequent to the initial request for the translation.

2.1.2 Publication of NASA STI through Non-NASA Channels

Appropriate non-NASA publications for NASA STI include professional society journals, trade journals, and similar periodicals produced by professional, technical, or academic organizations; proceedings of scientific and technical conferences, symposia, and workshops; oral presentations; and books. These types of manuscripts must have NASA approval via the DAA before they are submitted for publication, presented, or posted on an internal, external, or public Web site.

Presentations at society meetings and other professional gatherings ensure the timely dissemination of NASA scientific and technical findings to appropriate audiences. You may also obtain a TM number for your presentation; this allows you to distribute copies to attendees and ensures that the paper is included in the NASA Technical Report Server–Registered (NTRS-Reg) and, if the document is unclassified, unlimited, and there are no copyright or distribution restrictions in the information, the NASA Technical Report Server–Public (NTRS). Such TMs may be published in proceedings published by the meeting sponsor.

2.1.3 Duplicate Publication

Publication of STI through non-NASA channels does not preclude the publication of equivalent information by NASA. For example, you can report significant findings in a journal and more detailed documentation of these findings as a NASA TP. You should not publish identical material through different channels, with the following exceptions for the TM series:

- Preprints of presentations at professional meetings
- Preprints of journal articles

2.2 Dissemination

Regardless of the type of publication, your NASA STI is distributed to the widest practical and appropriate audience possible. This audience may be restricted if the information must be protected (e.g., due to national security, export control, trade secret, restrictions/limitations, patent, other proprietary status, or Privacy Act consideration information). Before you release or distribute your NASA STI to the public, including on internal, external, or public Web sites, you must have a signed and approved DAA form on file at your center. Your center's technical publications office will send the DAA form with your STI to STI Support Services.

STI Support Services is responsible for initially disseminating NASA STI for the STI program, based on the release categories indicated on the DAA form. For example, if the STI is unclassified and unlimited, it may be disseminated by STI Support Services to the National Technical Information Service (NTIS), the Government Publishing Office (GPO) and Depository Libraries, and other U.S. Government agencies. If the STI is limited, it will be distributed by STI Support Services only in accordance with the limitations on the DAA form. NASA STI sent to STI Support Services is added to the NTRS-Reg which enforces the access limitations specified on the individual document's DAA Form. Only NASA and U.S. Government agencies and their contractors and grantees are eligible for obtaining access to the NTRS-Reg system. Appropriate unclassified and unlimited NASA STI is also made available to the public through the public instance of the NTRS (non-restricted).

As an author, you may also choose to have a center distribution to known authors in your field, conference registrants, members of organizations or groups known to have an interest in your field, and persons who have requested similar prior papers. Check with your center’s STI Office for required approvals for release of all STI.

2.3 Safeguarding and Archiving STI

The advantages of publishing and disseminating your report in the NASA STI Report Series are not only that it gains wide dissemination, but also that it is archived (i.e., recorded for posterity) at the National Archives and Records Administration (NARA) through STI Support Services

All NASA STI submitted to STI Support Services is backed up and safeguarded both on-site at Langley Research Center, STI Support Services and off-site according to NASA requirements specified in NPR 2810.1, “Security of Information Technology” and NASA Interim Directive (NID) 1600.55, “Sensitive but Unclassified (SBU)” (refs. 7 and 8).

3 Reviews and Handling Unlimited and Limited STI

3.1 Professional, Technical, and Data/Information Quality Reviews

Professional reviews (also called editorial and content reviews) are performed by individuals or groups (outside of the DAA process) with technical knowledge or backgrounds tempered by interdisciplinary expertise in program management, history, and/or education. Such reviews assess the quality of the document content in terms of its readability, communication of information, and suitability for a particular audience without focus on technical content. See also Appendix B, “Publications Review Checklist.”

Technical reviews are performed by peers (outside of the DAA process) with expertise within the technical discipline of the activity or research being documented. Such reviews assess the technical integrity and merit of the activity or research being performed and the results being documented without regard to the effectiveness of the document at communicating the information. See Table 1 for guidance on required reviews.

Table 1. NASA STI Report Series/Publication Type

Document Type	Review Requirement
TP	Technical review by committee of peers or expert single reviewer
TM	Review by technical management
CR	Review by NASA technical management or expert reviewer
CP	Review by technical management
SP	Professional review controlled by originating HQ Office or NASA center
TT	No technical review; some printing authorization required; permission to use copyrighted information shall be obtained
Non-NASA Publications	Review by technical management and proofreading review

Data/information quality reviews (ref. 9) are inherent in technical reviews. NASA accepts and encourages technical and data quality review by qualified external reviewers or committees of external reviewers for its typical STI. The Agency also accepts technical review by qualified internal reviewers or committees of internal reviewers who are selected on the basis of technical expertise and who do not have (or have disclosed) prior situations or personal or funding concerns that would affect their technical review. Peer reviews must be conducted in an open and rigorous manner. Peer reviews must also ensure that the data are reliable, unbiased, accurate, complete, and have full documentation, and they must ensure that circumstances that could affect data quality are identified and disclosed. For information on NASA's data quality guidelines that implement reference 6 see <http://www.sti.nasa.gov>, STI-Related Information.

NASA also abides by the Office of Management and Budget (OMB) "Final Information Quality Bulletin for Peer Review," December 16, 2004, available at <http://www.whitehouse.gov/sites/default/files/omb/assets/omb/memoranda/fy2005/m05-03.pdf>. In extremely rare circumstances, NASA may publish publicly available STI that falls within the OMB definition of "influential" information or, in even more rare circumstances, "highly influential" information. If you believe that your work may fall within one of these categories, OMB requires an additional level of peer review beyond that indicated in table 1, including public notification prior to publication. Contact your center technical publications office or the NASA Office of the Chief Information Officer at NASA Headquarters (see <http://www.nasa.gov/offices/ocio/qualityinfo/index.html>) for additional information on requirements for the more extensive level of peer review.

3.2 Dissemination Reviews

NASA's dissemination reviews are handled through the mandatory DAA review. The DAA review is NASA's compliance review for the release of NASA STI by or for NASA through any channel or media. It also applies to the presentation of NASA STI at internal meetings or workshops at which foreign nationals may be present. The DAA review not only encourages technical approval but also requires reviews for restricted access STI, such as national-security-classified information, export-controlled information, proprietary/sensitive STI, and documents disclosing an invention. A copy of the latest version of the DAA form can be found at <https://nef.nasa.gov/nef/search?query=1676>.

3.3 Handling Publicly Available and Limited STI

3.3.1 Publicly Available STI

Publicly available STI is STI that is unclassified, does not contain export-controlled or proprietary/sensitive information, and has no distribution limitations. If it contains information disclosing an invention, that information has been cleared by the patent or intellectual property counsel of NASA Headquarters or the NASA center. If it is intended for use on a public Web site, it must also meet the NASA Internet guidelines discussed in Section 3.3.2.1.

All NASA STI that does not meet any of the criteria for distribution limitations described herein will be considered approved for public release. Information approved for public release will be made available by STI Support Services to any and all pertinent distribution channels, in keeping with the policy set forth in OMB Circular A-130 (ref. 10).

3.3.2 Limited STI

The following section discusses types of limitations that pertain to NASA STI. If you electronically transmit limited STI (via email or the Internet, including within a NASA center), you must encrypt it. See reference 7 and <http://www.sti.nasa.gov>, “Publish STI.”

3.3.2.1 NASA Internet Guidelines

NASA has additional guidelines if you plan to release your document on a public Web site. NASA Internet publishing content guidelines can be found in NID 1600.55, “Sensitive But Unclassified (SBU) Controlled Information” (ref. 8). These guidelines identify and categorize information that can and cannot be posted on the Internet. If OMB Circular A–130 (ref. 10) indicates that restrictions apply, include the corresponding notice from Appendix I of NPR 2200.2 (ref. 6).

3.3.2.2 Sensitive But Unclassified (SBU)

Guidelines for determining and marking Sensitive but Unclassified (SBU) information (also referred to as “Controlled Unclassified Information” (CUI)) are given in NPR 1600.1 “Security Program Procedural Requirements” (ref. 11), NID 1600.55 (ref. 8), and NF–1686. For more information about CUI that does not fall within the categories indicated on the DAA form, contact the NASA Headquarters Office of Security and Program Protection.

3.3.2.3 National Security Reviews

Your STI must undergo a DAA review to determine whether the information is subject to security classification (refs. 7 and 11). It must also be reviewed if it is intended for release to a foreign government and/or for publication, dissemination, and presentation when such material contains information pertaining to the Department of Defense (e.g., aeronautics programs, space launches, or space operations), regardless of the source of the materials.

3.3.2.4 Export Control Reviews

Export control limitations are applied to information subject to the following regulations:

- Arms Export Control Act, 22 U.S.C. 2778 et seq. (ref. 12)
- Export Administration Act of 1979, Pub. Law 96-72 Stat. 503, 50 U.S.C. app. 2401 et seq. (ref. 13)
- International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120–130 (ref. 14)
- Export Administration Regulations (EAR), 15 CFR Parts 730–774 (ref. 15)

These regulations establish lists or categories of technical data subject to export control that may not be exported or disclosed to foreign nationals without proper authority. The term “exported” includes providing information, or making information available, to a foreign national (including a U.S. citizen representing a foreign national if that individual intends to provide the information to a foreign national) either within the United States or abroad. Information placed on the Internet in an unrestricted manner is deemed an export.

The export limitations and other limitations (proprietary/sensitive STI, Limited Rights Data, Small Business Innovation Research (SBIR) Data, trade secret/confidential commercial information, information produced under the Space Act Agreement and subject to 303(b) of the National Aeronautics and Space Act, copyrighted STI, and documents disclosing inventions) are

defined in Sections 4.5.6 to 4.5.19 of NPR 2200.2 (ref. 1). The limitation notices that must be used are provided in Appendix I of NPR 2200.2 (ref. 6), and the document distribution limitations are given in Section 4.5.17 of NPR 2200.2 (ref. 1).

The export control review is required to ensure that NASA STI Report Series; conference, meeting, and symposia presentations; abstracts; and external publications containing information subject to control under pertinent United States export laws or regulations are suitably protected. Each such report, presentation, abstract, or publication must be reviewed and approved by or in conjunction with the NASA Headquarters or center Export Control Administrator prior to the release, in any media, to audiences that may include foreign nationals. Examples include the following:

- Presentations at internal meetings at which foreign nationals are likely to attend
- Presentations at “open” meetings in the United States that may include foreign nationals
- Presentations at meetings held in foreign countries
- Publications intended for public dissemination and/or distribution
- Unrestricted releases over the Internet

The abstract, complete report, and presentation must be approved prior to release.

Under certain conditions, officials overseeing specific contracts or projects may, on a case-by-case basis, be granted limited delegations of authority to approve publications when the contracts or projects are restricted to topics exempt from export controls. These limited delegations are coordinated through the NASA Office of International and Interagency Relations (OIIR) and the cognizant NASA Headquarters Mission Directorate.

3.3.2.4.1 International Traffic in Arms Regulations (ITAR–22 CFR 120–130)

The ITAR implements the Arms Export Control Act, and contains the United States Munitions List (USML). The USML identifies articles, services, and related technical data that are designated as “Defense Articles” and “Defense Services,” pursuant to Sections 38 and 47(7) of the Arms Export Control Act (ref. 12). For details about the ITAR, see Section 4.5.8 of NPR 2200.2 (ref. 1).

3.3.2.4.2 Export Administration Regulations (EAR–15 CFR 730–744)

The EAR implements the Export Administration Act and contains the Commerce Control List (CCL). The CCL lists commodities, technology, and software subject to the export control authority of the U.S. Department of Commerce. The items on this list are export controlled for reasons of national security, foreign policy, proliferation, and/or short supply. For details about the EAR, see Section 4.5.9 of NPR 2200.2 (ref. 1).

3.3.2.5 *Proprietary/Sensitive STI*

Proprietary information refers to information that is owned by someone. The owner has proprietary rights (i.e., a legal property right) to the information which allows the owner to exclude others from using, selling, reproducing, displaying, or distributing the information. As defined in NPR 1600.1A (ref. 11), sensitive information is information determined to have special protection requirements to preclude unauthorized disclosure, to avoid compromises, risks to facilities, projects or programs, threat to the security and/or safety of the source of

information, or to meet access restrictions established by laws, directives, or regulations. For more details about proprietary/sensitive STI, see Section 4.5.11 of NPR 2200.2 (ref. 1).

3.3.2.6 Limited Rights Data

Limited Rights Data are data developed at private expense and delivered to the U.S. Government under a government contract that embody trade secrets; that are commercial or financial and confidential or privileged; or that pertain to items, components, or processes developed at private expense. For more details about Limited Rights Data, see Section 4.5.12 of NPR 2200.2 (ref. 1).

Documents containing Limited Rights Data must bear the Limited Rights Notice shown in Appendix I of NPR 2200.2 (ref. 6) and one of the document distribution limitations listed in Section 4.5.17 of NPR 2200.2 (ref. 1), along with any appropriate expiration date.

3.3.2.7 Small Business Innovation Research (SBIR) Data

SBIR Data are defined as data first produced by an SBIR contractor that are not generally known; have not, without obligation as to their confidentiality, been made available to others by the contractor; or are not already available to the U.S. Government. Information that constitutes Limited Rights Data shall be marked with the Limited Rights Notice provided in Appendix I of NPR 2200.2 (ref. 6) in accordance with Federal Acquisition Regulations (FAR) clause 52.227-14 when delivered to the Government. If such data are not marked with the Limited Rights Notice, the Government has no obligation to withhold the data from public release. For more details about SBIR Data, see Section 4.5.13 of NPR 2200.2 (ref. 1).

3.3.2.8 Trade Secrets/Confidential Commercial Information

Under certain limited circumstances, NASA employees may be provided access to third-party trade secrets or confidential commercial information other than Limited Rights Data or SBIR Data for inclusion in NASA STI. A “trade secret” is information that is used in a business, is secret, or gives a competitive advantage to the person with knowledge of it. The party delivering such information must include a proprietary notice that indicates the restricted nature of the information when delivered to the U.S. Government. For more details about trade secrets or confidential commercial information, see Section 4.5.14 of NPR 2200.2 (ref. 1).

3.3.2.9 Information Produced Under Space Act Agreement and Subject to 202(b) of National Aeronautics and Space Act

Under certain limited circumstances, NASA employees may produce technical information that may be treated as trade secret information. Section 303(b) of the National Aeronautics and Space Act, as amended, provides that information or data produced by NASA employees in carrying out NASA’s participation in agreements entered into under the Space Act may be protected for up to five years, if such information would constitute a trade secret or confidential commercial information if it had been produced by the nongovernment party. This provision is generally applicable to agreements that have the objective of developing commercial products or processes. Such data must be properly marked by the cognizant NASA project office. NASA agrees to protect the data for the period of time established in the agreement between NASA and the other party, up to five years. For more details about information produced under the National Aeronautics and Space Act, see Section 4.5.15 of NPR 2200.2 (ref. 1).

3.3.2.10 *Copyrighted STI*

A copyright owner is the owner of the exclusive rights comprised in a copyright. A copyright provides the copyright owner the exclusive right to—or to authorize others to—reproduce the copyrighted work, prepare derivative works based upon the copyrighted work, distribute copies of the copyrighted work to the public, perform the copyrighted work publicly, and display the copyrighted work publicly. Others are restricted from exercising the exclusive rights reserved to the copyright owner without the copyright owner’s permission. More information about copyrighted STI is provided in Section 4.5.16 of NPR 2200.2 (ref. 1).

3.3.2.10.1 Use of Copyrighted Material in NASA STI

If you include copyrighted material in your STI, you must include a credit line. In the case of copyrighted source material, you are responsible for securing permission from the copyright holder to use, reproduce, and distribute the copyrighted material. In addition, you are responsible for ensuring that an appropriate copyright notice or acknowledgment (as directed by the copyright holder) is included within the text of the NASA STI Report Series. Use the copyright holder’s preferred credit line, if provided. You or the initiator of the DAA review must enter the copyright status on the DAA form and should also provide information regarding NASA’s permission to use copyrighted material. (You do this on the DAA form: check “Copyrighted” in Section 3.c and include a distribution limitation, if appropriate, in Section 3.d. You must also attach a copy of the permission obtained). Also enter the copyright status on SF–298 (block 12), if used.) Any questions regarding obtaining such permissions or for acknowledging a copyright must be referred to the patent or intellectual property counsel of NASA Headquarters or the NASA center.

When NASA is granted permission by the copyright holder to use copyrighted material in connection with a NASA-sponsored meeting or conference, the following copyright notice should be used (if the copyright holder does not provide a notice):

“Copyright © (*year of first publication*) (*Name of copyright owner*). NASA has been granted permission to publish and disseminate this work as part of (*name of conference publication*). All other rights retained by the copyright owner.”

More information about Copyrighted STI is provided in Appendix D of NPR 2200.2 (ref. 4), Section D.6.3.

3.3.2.11 *Documents Disclosing Inventions*

Information that is otherwise approved for public release may be withheld if it discloses an invention. For information about documents disclosing inventions, see Section 4.5.19 of NPR 2200.2 (ref. 1).

When STI discloses an invention, the invention must also be formally disclosed to NASA via eNTRe, the NASA electronic New Technology Reporting Web site at <http://invention.nasa.gov>, or using NF–1679, “Disclosure of Invention and New Technology,” also available at the eNTRe Web site.

3.3.2.11.1 Notification

The party making and disclosing or reporting the invention is responsible for notifying the Agency as to the nature of the information and the invention to which it relates. In the case of

reports submitted under contract or grant, notification should be made to the Contracting Officer (CO) or Grant Officer, the designated Patent Representative, and the STI manager. In the case of NASA-prepared documents, notification should be made to the Project Officer, the Center Patent or Intellectual Property Counsel, and the STI manager.

3.3.2.11.2 Notification Response

Regardless of availability category and any blanket availability authorization that may have been granted on NF-1676, all documents that disclose an invention (except security-classified documents that disclose an invention) for which notification has been made must be withheld by the originating office, with notice to the center technical publications manager, until the patent applications process is complete (that is, an application is filed with the U.S. Patent and Trademark Office or a decision not to file an application is made, and release is approved by the center Patent or Intellectual Property Counsel). Such withholding does not require NASA Program Office approval. Security-classified documents that disclose an invention must be withheld until approved for release under applicable security guidelines.

3.3.2.12 Document Distribution Limitations

Document distribution limitations are determined during the DAA review and indicated on the NF-1676. The types of document distribution limitations are provided in Section 4.5.17 of NPR 2200.2 (ref. 1).

3.3.2.13 Limitation Notices

The limitation notices to be included in appropriate documents are listed in Appendix I of NPR 2200.2 (ref. 6).

4 Format Information

The authorizing documents and standards for this guide are listed here. If you experience conflicting guidance, the sequence of the following list governs selection of the appropriate standard:

- NPR 2200.2, “Requirements for Documentation, Approval, and Dissemination of NASA Scientific and Technical Information” (ref. 1)
- NPR 2810.1, “Security of Information Technology” (ref. 7)
- This document, NASA/SP—2005–7602 “NASA Publications Guide for Authors” (Rev. 2)
- NASA/SP—2006–6114, NASA “Scientific and Technical Information Standards” (ref. 16)
- NASA/SP—2006–7084, “Grammar, Punctuation, and Capitalization—A Handbook for Technical Writers and Editors” (ref. 17)
- Public Law 105-220
- NASA center instructions that implement NPR 2200.2
- *U.S. Government Printing Office Style Manual* (GPO, ref. 18)
- Industry-standard style manuals

4.1 Templates (NASA STI Report Series)

You can see samples of NASA STI Report Series covers and title pages in NPR 2200.2 (ref. 1). You can access the templates for the NASA STI Report Series at <http://www.sti.nasa.gov>, “Publish STI.”

Although you must use the basic elements of these templates (such as cover and title page elements), you may adapt the layouts as needed for STI produced in alternative media (such as CD, DVD, or video).

4.2 Sections of a Report

4.2.1 Covers

Use the standard elements given on the NASA STI Report Series templates to format the front and back covers of your document.

4.2.1.1 Front Cover

The front cover should include the following information:

- Report number(s). (If another agency’s, center’s, or contractor’s report or document number is added to the NASA report number, it must be positioned to the right or below the NASA report number.)
- NASA insignia (the “meatball”); other logos as appropriate
 - When NASA partners with or jointly funds work with another agency, noncommercial organization, or a university, the logo or seal of the cosponsor may appear on the cover to the right or below the NASA insignia and must be in accordance with the NASA guidelines for the use of logos and insignia at <http://www.nasa.gov/offices/ogc/ip/logo.html>. The NASA insignia cannot appear with the logos of private companies on publications. In rare exceptions, such as certain partnership situations, the Office of Public Affairs, Public Service Division at Headquarters may approve a proposed use. NASA program organizational logos are not acceptable for use on covers unless a waiver has been approved.
- Title of report. Select words that distinguish the report from similar reports. Delete words like “Report on ...” or “Investigation of”
- Author name(s), affiliation, and location
- Optional one-color line art or black-and-white photo or image
- Distribution notices, if applicable. Distribution notices, including limitations and restrictions, such as ITAR, EAR, SBIR, proprietary information, and copyright notices, must be placed on the cover, title page, and SF–298 (if used). See Appendix I of NPR 2200.2 (ref. 6).
- Conference information. Authors may choose to add conference information, such as conference name, location, dates, and sponsor.
- Joint project or sponsorship information, if appropriate
- Rule (meaning a graphic straight line)
- Month/year

4.2.1.2 *Back of Front Cover*

The back of the front cover should include the NASA STI program profile and nothing else.

4.2.2 *Front Matter*

The subsections that follow identify standard elements for pages that precede the body, or text, of a NASA STI Report Series document.

4.2.2.1 *Title Page*

The title page should include the following information:

- Title
- Author name(s), affiliation(s), and locations
- Editor name and affiliation, if applicable (for edited CPs, TPs, or TMs when the editor has contributed scientific and technical expertise and judgment)
- Agency name and address (corporate source)
- Contract statement and number, if applicable
- Joint project or sponsorship information, if appropriate
- Conference information (name of conference, location, dates, sponsors, etc.), if applicable
- Distribution information (even unlimited distribution)

4.2.2.2 *Back of Title Page*

The back of the Title Page should include the following information:

- Acknowledgments, if applicable
- Disclaimers, if applicable
- Statement announcing that the document is available from NASA STI Support Services. In some cases, the document may also be available from the NTIS. Documents that are marked to be available from NTIS must be unlimited and unclassified (no restricted-access data). See the sample back of title page in NPR 2200.2 (ref. 1), Appendix F, figure F.5.
- International Standard Serial Number (ISSN), International Standard Book Number (ISBN), and/or Library of Congress Control Number (LCCN), if applicable
- Level of technical or professional review

4.2.2.3 *Optional Front-Matter Elements*

- Foreword (by someone other than you as the author) and/or preface (by you as the author) (SPs, CPs, and reference works may contain either or both.) If both are used, the foreword precedes the preface.
- Table of contents (recommended for longer reports, though shorter reports may not need one)
- List of tables (recommended for reports with many tables, but may not be necessary for those with only a few)
- List of figures or illustrations (recommend for reports with several figures or illustrations, but may not be necessary for those with only a few)

4.2.3 Body

4.2.3.1 Introduction

The primary function of an introduction is to define the subject, significance, purpose, objectives, and scope of the work. The introduction may also include background information. Introductions will vary to some extent, depending on the nature of the material in the report. An introduction should not contain conclusions.

4.2.3.2 Abbreviations, Acronyms, and Symbols Lists

An alphabetical-order or logical-order list of abbreviations, acronyms and symbols (with definitions and units) may directly follow the introduction if they are short, or in an appendix if the lists are long. Definitions should be capitalized according to usage. If the lists include symbols from both the Latin and Greek alphabets, the symbols in the Latin alphabet precede those in the Greek. Subscript and superscript symbols are usually listed after the main symbols list, but they may be included in the main list (for example, when a primary symbol and subscript or superscript are defined as a unit or when a symbol is used as both a primary symbol and a subscript or superscript).

4.2.3.3 Main Text

The central theme of a scientific and technical paper is developed in the main text. The overall organization of a report varies according to its subject and complexity. For example, experimental investigations contain comprehensive descriptions of specimens, apparatus, and procedures. Theoretical investigations, on the other hand, emphasize the application of new information to the state of the art. Typical report subsections are “Procedure,” “Tests,” “Discussion,” and “Results.” The main text should not include findings, recommendations, or conclusions.

4.2.3.4 Concluding Section

Most NASA STI Report Series publications have a concluding section, such as “Concluding Remarks,” “Conclusions,” or “Summary of Results.” This section contains findings, recommendations, and/or conclusions. It should be self-contained because many people will read it first to determine whether to read the entire report. No material that has not already been presented in another section of the report should be presented in this section.

4.2.4 Back Matter

4.2.4.1 Index

An index may be helpful in longer reports, but it is unnecessary for shorter works.

4.2.4.2 Appendixes

Appendixes present supplementary information that might otherwise interfere with an orderly presentation of the text. You must refer to each appendix in the text and give each a title. When you use more than one appendix, identify each by a capital letter in the order mentioned in the report. Appendixes may include a list of abbreviations and acronyms used in the text.

When an appendix is written by someone other than you as the author of the main report, that person's name and affiliation should appear after the title of the appendix proper and after the

appendix title on the contents page. A credit such as “With appendix [number and title] by [author]” should be placed on the report title page, in the contents, and in block 6 of the SF–298.

Information essential to the purpose of the report should be provided in the main text, not in an appendix.

4.2.4.3 *References and Bibliography*

- *What to Cite.* Cite all works consulted in the preparation of a paper—particularly those from which you take information—in the text where appropriate and in the reference list.
- *Responsibility for Citations.* Styling and accuracy of references are your responsibility as the author. Some center publications offices and libraries can assist with reference verification.
- *Style and Format.* Follow the accepted practice in your discipline, or contact your center technical publications office for examples of standard basic formats. For additional guidance, see the *NASA Scientific and Technical Information Standards* (ref. 16), the *GPO* (ref. 18), and the *Chicago Manual of Style* (ref. 19).
- *References to Unpublished Information.* Unpublished sources may include pending publications, oral meeting papers, interviews, email, or personal communications. Clearly identify these as such in the text of the report and in the reference list. Provide information that will make these sources as accessible as possible to the reader, either in a note to the text or in the reference list. Any of the citation methods used in various disciplines may be used. Always begin the reference list entry with the name of the source (person or entity), and provide as many reference citation elements as are available.
- *References to Electronic Documents.* See Appendix C for examples of current citation styles, or refer to the *NASA Scientific and Technical Information Standards* (ref. 16), the *GPO* (ref. 18), or the *Chicago Manual of Style* (ref. 19).
- *Limited Distribution.* In publicly available works, citing documents with limited distribution is not recommended but is permissible as long as the citation itself does not contain restricted information. However, the fact that a document is limited in distribution should not be mentioned in the reference citation. At the end of the citation, place the words “Available from” and the name of the organization responsible for the control and distribution of the document. However, remember that many readers will be unable to access the limited distribution references that you cite.

4.2.4.4 *Report Documentation Page (RDP)*

The RDP (SF–298) is required for all NASA STI Report Series documents that are reviewed via the paper-based DAA. The Web-based DAA form (NF–1676B) includes much of this information. Contact your center’s STI or technical publications office to find out if you should use the RDP. Directions for preparing the SF–298 are given on the back of the form. Further guidance is offered here:

- Place appropriate funding number in blocks 5a–f.
- *Symposium Presentation Preprinted as a Technical Memorandum or Published as a Conference Publication.* Identify the symposium in block 13, “Supplementary Notes.”

- *Authors with Different Affiliations.* The affiliation of each author should be listed in block 13, “Supplementary Notes,” if they are different.
- *Subject Categories.* Required; STI Support Services uses these categories to distribute reports to subscribers. See the NASA Scientific and Technical Information Scope and Subject Category Guide (ref. 31) for a selection of categories; place the corresponding number of the category you selected in block 12, “Distribution/Availability Statement.”
- *Abstract.* Enter an abstract of no more than 200 words in block 14, “Abstract.” Compose the abstract to be informative rather than descriptive. Include the following elements:
 - Objectives of the investigation
 - Methods used (e.g., simulations, experiment, or remote sensing)
 - Results obtained
 - Conclusions reached
- *Subject Terms.* Required; provide at least three subject terms. Select terms from the NASA Thesaurus (ref. 20) and place them in block 15.
- *Classified Reports.* Ensure that all elements of SF–298 are unclassified and marked as such in blocks 16a, b, and c, and in block 17.
- *Placement of SF–298 in the Report.* Except for NASA SPs, position the completed SF–298 as the last page of the report, facing the inside back cover. For SPs, the SF–298 is sent to STI Support Services as a separate file.

4.3 Information to Know

4.3.1 Acknowledgement of Contributors

4.3.1.1 Authors

With the exception of NASA histories, the authorship of NASA publications is reserved for persons who perform the work from which the STI results and who can effectively defend the main technical content of the publication to a peer group.

When a publication has multiple authors, the authors’ names should appear in order of their relative contribution to the reported results (that is, the first author is the chief contributor and writer, and the other names follow in order of their contribution to the work).

NASA employees may not be listed as coauthors of NASA CRs. When NASA employees contribute to rather than monitor contract or grant work, such work should be published in another series, such as NASA TMs.

4.3.1.2 Sources

Credit statements or citation of sources should be included for material from other publications appearing in a NASA report. If substantial changes have not been made, “Source” precedes the citation. If substantial changes have been made, “Adapted from” precedes the citation.

As the author of a NASA publication, you should provide adequate information for your references so that users can identify and locate the reference.

For copyrighted source material, you are responsible for securing written permission to reprint from the copyright holder and for including copyright acknowledgment in the manuscript on the back of the title page. Also mark this information on the DAA form.

For copyrighted figures, add the applicable statement to the end of the caption. Use what the copyright holder or the publisher prefers, if specified. If not specified, use one of the following statements:

- “Copyright [company name]; used with permission”
- “Copyright [company name]; prepared under contract to NASA”

4.3.1.3 *Sponsors*

When NASA works with or for another agency or organization, you should report your scientific and technical findings in the NASA STI Report Series and indicate joint project or sponsorship on the cover, title page, and SF–298. (Such publication does not preclude the other agency or organization from publishing the work in its own series.)

When NASA is the sponsoring agency, contractor and grantee authors must ensure that publications clearly indicate the support of NASA. In NASA CRs, this is done on the cover, title page, and SF–298. In non-NASA publications, support is preferably acknowledged in a footnote to the publication title.

When NASA work is sponsored or funded by one center and performed by another center, the scientific and technical findings should be reported in the NASA STI Report Series. The center performing the work is responsible for approval, production, and issuance of the technical report. Appropriate indication of the sponsorship is given on the cover, title page, and SF–298.

4.3.1.4 *Editors and Compilers*

Recognition of editorship in cover, title, and SF–298 information is justified only when an editor has contributed scientific and technical expertise.

Compilers who manage the work through the production and printing process may also be acknowledged on the cover, title page, and SF–298.

Editing and production of the report by publications personnel do not constitute scientific and technical assistance, but may warrant mention in an acknowledgment section.

4.3.1.5 *Other Contributors*

Contributions by individuals other than the authors to the technical content of NASA STI should be mentioned in an acknowledgment on the back of the title page. The contributions would include voluntary scientific or technical help received from outside NASA. When an acknowledgment is warranted in a NASA STI Report Series, it appears on the back of the title page.

Normal assistance furnished by NASA personnel, however, including professional help from groups or individuals not directly related to the research, is usually not acknowledged. If an acknowledgement of contribution is warranted, it should be included in a paragraph on the back of the title page. This should be factual and specific enough so that readers understand the expertise provided. Supervisors or technical committees whose comments and advice result from regular work assignments are generally excluded from these acknowledgments. Credit may be given to creators of original illustrations and other research art.

4.3.1.6 *Conference Sponsors and Editors*

Conference sponsorship is indicated on the title page of any proceedings published by NASA. The guidelines that follow are intended for use in preparing papers for the NASA STI Report Series. However, they may also be applied to NASA-authored works prepared for release through other channels. Your center technical publications office can provide center-specific guidelines and information about software for preparing reports.

4.3.1.7 *Mechanics and Layout*

4.3.1.7.1 Recommendations for Usage

Refer to the appropriate NASA template for style and usage guidance on the NASA STI Web site (<http://www.sti.nasa.gov/>, "Publish STI.")

4.3.1.7.2 Requirements for Text Placement

A column of text may not end with a section heading alone, a heading and only one line of text, or a short line that is not the last line of a paragraph. A column may not begin with the last line of a paragraph. A page may not end with a hyphen.

4.3.1.7.3 Page Numbering

Use lowercase roman numerals to paginate front matter. Reserve page i for the title page, but do not show the number on the page.

Number main text pages sequentially throughout with Arabic numerals (preferred style). If a long report has multiple sections or parts, it may be necessary to number by section with sets of numbers that indicate both section and page (e.g., 1-1, 4-2).

Number back matter (such as appendixes) sequentially with main text (preferred style). If necessary, appendixes may be numbered separately, with the appendix designator followed by a hyphen, then the page number (e.g., A-1, A-2).

Assign an implied page number to blank pages or pages that have a special layout which prevents the number from being shown.

4.4 Tables and Figures

After data have been acquired, a decision must be made as to which data are to be presented in tabular (table) form and which in graphic (figure) form. Graphs are more useful for showing trends and comparisons; tables are more useful if readers will want to know exact numerical results. Similar data should be presented in the same form throughout a report.

4.4.1 Placement of Tables and Figures

When inserting a table or figure into a document, consider the following guidelines to determine exact placement:

- *On a Page.* Place all tables and figures as close as possible to their first citation in the text. It is permissible to place them before a citation, if necessary, as long as they are on the same or facing page.

- *In a Section.* Place tables and figures as close as possible to their first citation in the text unless it is necessary to group them at the end of the report. It is preferable to place figures and tables within the section in which they are mentioned.
- *At the End of a Report.* Grouping figures and tables at the end of a report is appropriate only when such placement facilitates speedy publication or when large groups of figures or tables create reading or layout problems. In these cases, place figures and tables at the back of the document, following the references.
- *In an Appendix.* If tables and figures contain only supplementary information, place them in an appendix, and leave the text to carry a discussion of the data and summary graphs.
- *Orientation.* Orient figures upright (portrait), rather than broadside (landscape, side-reading) whenever feasible.
- *Foldouts.* Avoid foldouts if possible. Instead, rearrange and spread the figure or table horizontally across a two-page layout.

4.4.2 *Titles for Tables and Figures*

When creating a title for a table or figure, bear these rules in mind:

- Never give two tables or figures the same title within the same document.
- Be as brief as possible, but also be descriptive. Include purpose and content.
- Craft titles so that readers of the table of contents can understand the nature of the illustration before they look at it. For example, instead of “Comparison,” use “Cost Comparison of Two Launch Options in FY99 Dollars.” Or, instead of “Graph of Results,” use “Results of Performance Testing A, B, and C.”

4.4.3 *Tables*

Preparation of useful tables requires careful attention to detail:

- *Organization.* Arrange the table so that the values are in columns topped by column labels (in the following form: concept, symbol, and unit of measure, e.g., Change, D , m/s) and the constants or independent variables are given in the first column. In addition, organize the first-column entries in the way that will be most helpful to the reader. Ensure structural uniformity. If column labels change in the middle of a table, divide the table into two tables.
- *Footnotes.* Use table footnotes to present information concerning special conditions relating to an entry or a class of entries. Identify each footnote by superscript nonitalic letters. If letters are confusing, use asterisks, daggers, or other symbols.

4.4.4 *Figures*

Examples of figures are photographs, artwork, graphs, drawings, and diagrams.

4.4.4.1 *Photographs*

For compatibility, ensure that photographs of similar subjects are of similar size.

4.4.4.2 *Graphs*

- *Consistency.* For easy comparison by the reader, present similar data in the same type of graph drawn to the same scale, using the same symbology throughout the report.

- *Lines.* Make lines as simple as possible. It is advisable to have no more than six types of lines and data points on a graph; it is better to have only four. Use different line patterns or labels in addition to color to differentiate lines so that the graph will make sense when printed in black and white or when viewed by someone with color blindness. Alternatively, colors that vary in brightness may be used to ensure that the lines show as different, discernable shades of gray when displayed or printed in black and white. The lines and data points should refer to the same condition in related figures.
- *Scale.* Ordinate (vertical axis) and abscissa (horizontal axis) scales and proportions should be the same on similar figures (thus allowing overlays).

4.4.4.3 *Drawings and Diagrams*

When adding drawings or diagrams to a document or a figure in a document, keep these rules in mind:

- *Labels.* Capitalize the first word of the label. When space is very limited, use letters or numbers rather than words, arranging them in some spatial order (for example, clockwise around the drawing). Identify these letters or numbers in a key.
- *Leaders.* Leaders from a label to an item in a figure go from the beginning of the first word (if it is from the left of the label) and from the end of the last word (if it is from the right of the label). Arrowheads are not used on leaders, only on dimension lines.
- *Shading.* When it is necessary to differentiate parts of a drawing, use shading rather than color. It is also acceptable to use spaced black dots or lines for this purpose. Alternatively, colors that vary in brightness could be used to ensure that shaded areas show as different shades of gray when displayed or printed in black and white.
- *Captions.* Describe the content of the figure in the caption, but provide background information, results, and comments about it in the text instead of the caption. We recommend that the caption be part of the text file instead of part of the figure.

4.4.4.4 *Text in Figures*

When you prepare figures

- limit the text in figures to letters, numbers, symbols, words, and short phrases;
- identify the letters, numbers, and symbols in a key or legend;
- provide details and explanations in the body of the document where the figure is discussed;
- place equations in the body of the document;
- display tabular material in a separate table.

4.4.4.5 *Use of Color*

Although there are no restrictions on the use of color in documents posted on the Web, NASA has limitations on the use of color in printed documents. The use of color increases preparation and printing costs and may delay the publication date. Color is used in printed NASA STI Report Series documents only when necessary to convey scientific and technical material clearly and unambiguously. The use of color must be justified and authorized on a case-by-case basis using center-specific procedures. For further assistance, contact your center technical publications office or printing officer.

5 Special Preparation Concerns

Attention to editorial details, such as clear, concise sentences and paragraphs, well-constructed headings and outlines, and consistent use of abbreviations and symbols, increases reader confidence in your work. Whether or not you choose to use the editorial expertise provided by your center's technical publications office, following a style guide can improve your writing. In addition to the information in this guide and guides from your center's technical publications office, the following publications are recommended for use in preparing NASA STI reports. The style guides published for specific scientific and technical disciplines are also acceptable for use in NASA STI Report Series and other papers by NASA authors:

- McCaskill, Mary K.: *Grammar, Punctuation, and Capitalization—A Handbook for Technical Writers and Editors*, NASA SP-7084, 1990. <http://ntrs.nasa.gov> (ref. 21)
- American National Standards Institute: *Scientific and Technical Reports—Preparation, Presentation and Preservation*. ANSI-NISO Z39.18-2005, 2005
http://www.niso.org/apps/group_public/download.php/12038/239_18_2005_R2010.pdf (ref. 22)
- Swanson, Ellen: *Mathematics Into Type: Copyediting and Proofreading of Mathematics for Editorial Assistants and Authors*. Updated Edition. American Mathematical Society, 1999 (ref. 23)
- NASA Scientific and Technical Information Program: *NASA Scientific and Technical Information Standards*. NASA/SP-2006-6114, 2006 (ref. 16)
- Sabin, William A.: *The Gregg Reference Manual: A Manual of Style, Grammar, Usage, and Formatting*. 10th ed. McGraw-Hill. Boston, MA. 2005.
- The NASA Thesaurus (ref. 20) (<http://www.sti.nasa.gov/sti-tools/>)
- U.S. Government Printing Office *Style Manual: An official guide to the form and style of Federal Government printing*. U.S. Government Printing Office, Washington, DC, 2008.

5.1 Titles and Headings

Titles should

- convey maximum information as succinctly as possible;
- involve careful word selection because much indexing and abstracting is based only on the title.

Headings should

- be brief and descriptive;
- not contain verbs;
- not start with an indefinite article or contain many indefinite articles (e.g., a, an, the);
- be numbered only when cross-referencing is needed and in longer reports;
- be paired with at least one other heading under the same order level heading;
- be ranked in no more than three levels or sublevels, unless the publication is long or complex.

5.2 Cross References

Be sure to check cross-references in the following items each time your manuscript is revised, even if you use an automated feature to track and update them. Inattention to these details can cause errors and reduce the confidence of the reader in your conclusions:

- Text
- Figures
- Tables
- Symbols list
- Acronyms and abbreviations list
- Glossary (not in most papers)
- Appendixes
- References (must be cited in order of use)
- Index
- Table of Contents

5.3 Trade Names and Trademarks

A trade name, or commercial name, is any name used by a person to identify his or her business or vocation. Generally, these names are not registered. A trademark is a word or symbol that is used to identify a particular product or service in a way that distinguishes it from other similar products or services. A trademark may be registered.

Use generic names whenever possible and avoid using trade names or trademarks because it is improper to advertise, endorse, or criticize commercial products or services in NASA publications. If use of a trade name or trademark is the only way to specify the material or equipment that is necessary to reproduce the results, follow these guidelines:

- Use trademarks only as a proper adjective (i.e., capitalized and modifying the generic term). At the first appearance of a trademark in the text, include the name of the registered owner of the trademark.
- State in a disclaimer that trade names or trademarks are used in the report for identification only and that this usage does not constitute an official endorsement, either expressed or implied, by NASA. Place this disclaimer on the back of the title page of NASA STI Report Series documents or as a footnote to other documents (such as journal articles and conference proceedings) with information concerning the trademark or trade name.
- Never compare commercial products. Present the data and let the reader make the comparison.

5.4 Spacecraft Designations

Piloted spacecraft are designated with Arabic numerals, both before and after launch (e.g., Apollo 17).

Unpiloted spacecraft are designated with capital letters before launch and with Arabic numerals after successful launch.

Rockets and launch vehicles are designated by name and Roman numeral, including stages of multicomponent vehicles (e.g., Saturn V, S-IVB stage, and Delta III).

5.5 Abbreviations

Use the following rules and guidelines when using acronyms and abbreviations:

- Abbreviate units of measure after numbers.
- Follow the *GPO* (ref. 18) for standard forms of Inch-Pound (I-P) units.
- When using SI units, follow the International System of Units (SI) conventions (see refs. 24 and 25).
- Remember that singular and plural units carry the same abbreviation (e.g., 1 in and 3 in).
- Introduce acronyms and abbreviations (for less used terms) in parentheses after the first use of the complete term to avoid repetition and conserve space (e.g., root mean square (rms)). For a list of abbreviations that do not need to be defined, see Section 9.4 of the *GPO* (ref. 18).
- Include an abbreviation, symbols, and/or acronym list in the front or back matter, after the introduction, or in an appendix of the report to avoid repetition and conserve space.
- In reference lists, use abbreviations for source material cited after the title.
- Abbreviate periodicals and meeting titles according to style sources, such as the American Chemical Society's *CAS Source Index (CASSI) Search Tool* (ref. 26) and the *Abbreviations Dictionary* (ref. 27).

5.6 Numerals

Consider the following rules and guidelines when incorporating numerals into a document:

- Use numerals at all times with units of measure.
- If values are used without units, use numerals for values of 10 and greater. For exceptions to this rule, see Section 12 of the *GPO* (ref. 18).
- Separate numbers of more than four into groups of three from the decimal point with a comma.
- Close up four-digit numbers unless they are in aligned columns with numbers of five or more digits.

5.7 Mathematical Presentation

For a better quality publication,

- use the standard symbols established in your discipline;
- define each symbol where it first appears in the document;
- include an alphabetical symbols list in the document where appropriate (in front matter, after the introduction, or in an appendix);
- close up numbers and letter symbols in expressions and equations, but, leave a space before and after mathematical functions (such as sin and lim) and mathematical operations (such as +, −, and ×); before differentials d and ∂ and after their arguments; after the arguments of trigonometric and logarithmic terms; and before and after functional notation;
- number equations in the main text continuously as (1), (2), (3), etc.;

- number equations in appendixes by restarting the numbering in each appendix as (A1), (A2), (B1), (B2);
- use the same number for any repeated equation;
- use identifiers such as (1a) or (C3a) for equivalent or derivative equations;
- use a brace to connect groups of equations with the same number;
- place equation numbers at the right margin, leaving at least an em space (—) between the equation and the number; if there is not enough room for the number on the line with the equation, place it on the line below the equation aligned with the right margin;
- refer to equations in text as equation (6) or (eq. (6)).

5.8 International System of Units

As stated in NPD 7120.4, “NASA Engineering and Program/Project Management Policy” (ref. 28),

It is NASA policy for all new programs and projects subject to NPR 7120.5 [ref. 28] to use the International System of Units (commonly known as the Systeme Internationale (SI) or metric system of measurement) for design, development, and operations; in preference to customary U.S. measurement units, for all internal activities, related NASA procurements, grants, and business activities. Exceptions to this policy may be granted by the NASA Chief Engineer based on program/project recommendations by the responsible Mission Directorate Associate Administrator:

- If you performed your scientific and technical activities using SI measurements, document or report your findings using SI units.
- If you performed your scientific and technical activities using I–P measurements, document or report your findings using I–P units, we recommend that you include SI units in parentheses.
- Clearly indicate in the introduction and on the title page of your STI which form of unit you use. For more detailed instruction on this please see Section 5.2 of NASA/SP—2006–6114 (ref. 16).
- If you need additional information on SI units, symbols, prefixes, and usage in both U.S. and international documents, refer to the *SI (Metric) Handbook* (ref. 30) and SI standards (refs. 24 and 25)

5.9 Proofreading

We recommend that you

- proofread your publication for accuracy and consistent quality;
- proofread after each revision cycle;
- use the checklists in Appendix A and Appendix B before the document is published;
- refer to the frequently asked questions and answers provided in Appendix D.

Appendix A

Author Checklist for Publishing Documents in the NASA STI Report Series

_____ Determine if the NASA STI Report Series is appropriate for your needs (NPR 2200.2 and <http://www.sti.nasa.gov/>)

_____ Determine the appropriate report type (NPR 2200.2, App. D.1 (ref. 6)) and the level of technical review (NPR 2200.2) with your center's technical management and technical publications office.

_____ Contact your center's technical publications office to determine the following:

- Information about what publishing services are available, turnaround times, and costs (if applicable)
- Help using the Agency templates at <http://www.sti.nasa.gov>, "Publish STI."
- Information about what is required if you need printed copies. (NASA always requires that electronic copies be sent to NASA STI Support Services.)
- The type of electronic file required if you want to add your document to the NASA Technical Report Server (<http://ntrs.nasa.gov>)
- Tips on how to complete the Scientific and Technical Information Document Availability Authorization form (NF-1676 or NF-1676B). NASA requires an approved DAA form before STI is released in any form.
- Advice on how to complete SF-298 (Report Documentation Page), which is the last page of any NASA STI Report Series document processed with the paper DAA form (NF-1676). This form facilitates correct indexing into the worldwide STI and other databases and accurate subsequent dissemination

_____ Complete the draft of your document.

_____ Complete SF-298 and add it as the last page of your document or have your publications office do this for NASA Report Series documents processed by the paper DAA. If your document is an SP, complete SF-298 and send it with your document but do not include it as the last page.

_____ Have appropriate technical personnel review and approve your document. Section 3.1 of this document and Section 4.3 of NPR 2200.2 guidance about technical reviews. See Appendix B for information on items to check prior to publication.

_____ Revise the document, if necessary, and produce the final document.

_____ Send your document through the appropriate channels at your center (appropriate channels are defined on the DAA form or your center's equivalent). You may not publish STI in any medium unless the DAA form or equivalent is approved and on file at your center.

_____ Send your document to your center's technical publications or printing office.

_____ If your document is unclassified and unlimited, indicate this so that it can be added to the NASA Technical Report Server (<http://ntrs.nasa.gov>).

_____ Coordinate your publication with your center's publications office, who will send it to
NASA STI Support Services: Attention: Acquisitions
NASA STI Support Services, Mail Stop 148
NASA Langley Research Center, Hampton, VA 23681-2199 email: help@sti.nasa.gov

Appendix B

Publications Review Checklist

Check the following items before you release your document. Contact your technical publications office to see what services are available to assist you.

- _____ Report is written clearly.
- _____ All numbered or lettered items (figures, tables, equations, references, and appendixes) are introduced in the correct order.
- _____ All numbered or lettered items are numbered or lettered correctly and referred to accurately.
- _____ No incorrectly or inconsistently spelled words or obvious grammar or punctuation errors exist.
- _____ No statements that will embarrass NASA or the U.S. Government are included.
- _____ Any conclusions presented are supported by the text.
- _____ Every reference cited is available with sufficient information to identify the correct document.
- _____ Graphic and tabular data are clearly presented and are consistent.
- _____ The document complies with policies for restricted, proprietary, or classified information.
- _____ An appropriate technical review has been done.
- _____ Appropriate release review requirements have been met prior to releasing the document external to NASA or at internal workshops or conferences at which foreign nationals may be present. This is done via the DAA. (Refer to Sections 1 and 3.2 and contact your center's technical publications office to find out what the specific requirements are.)

Appendix C

References to Web Documents in NASA STI Reports

Citations of Web documents appear in the “References” section of this report along with citations of paper documents. The citation should include the following:

- Name of the author (if specified) or name of organization
- Title of the document
- Title of the main document, if applicable
- Web address
- Date document was written or posted, if available
- Revision number, if applicable
- Paragraph numbers, if applicable
- Date of accession

Web documents can be revised or become inaccessible without warning. You are encouraged to save a copy of the referenced document either on paper or electronically on disk or hard drive.

When printing Web addresses in citations, ensure that extra punctuation or characters are not included in the address and that all characters of the address are included. If it is necessary to break a Web address because of available line space, do not add a hyphen. Instead, break the address after a slash (preferably), an existing hyphen (part of the address), a dot, or a colon. Avoid placing a Web address at the end of a sentence. Restructure the sentence to set off the address as you would an equation.

Note that documents in the NASA STI Report Series are published electronically if they have unlimited distribution. We recommend that <http://ntrs.nasa.gov> (instead of the full Web address) be placed at the end of their citations. Because internal or nonpublished documents are difficult, if not impossible, to access, reference to these is discouraged. If the information must be referenced, it should be treated similar to an informal personal communication. Clearly identify the reference as such, and place the following identification in a parenthetical note in the reference list, with an appropriate notation: “unpublished,” “to be published,” or “personal communication.” Personal communications should include the name and affiliation of the person who provided the information.

The following references are cited in the suggested style. Information in quotation marks should be italicized. Some line returns are forced to illustrate concepts for breaking lines.

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Appendix D

Frequently Asked Questions

Q: If I have a question that is not covered in this document, what other sources of information are there?

A: For more information about the NASA STI program and NASA publications, you can contact any of the following sources:

- Access the NASA STI program home page (<http://www.sti.nasa.gov>).
- E-mail your questions to the NASA STI program (help@sti.nasa.gov).
- Fax your question to the NASA STI Information Desk (757-864-6500).
- Telephone the NASA STI Information Desk (757-864-9658).
- Write to

NASA STI Program
Mail Stop 148, NASA Langley Research Center
Hampton, VA 23681-2199

- Contact your center's technical publications office.

Q: I've been invited to give a talk at a scientific conference on my research findings. Should I publish my presentation?

A: Yes. Oral presentations of scientific and technical findings are one way to ensure the timely dissemination of information to audiences at society meetings and other professional gatherings. NASA and NASA-sponsored authors who take this approach should distribute copies of the presentation to attendees and publish their presentation in the appropriate NASA STI Report Series, if appropriate, to include their work in NTRS-Reg, and its public interface, the NTRS (if the document is unclassified and unlimited).

Q: What approvals are required to publish my findings through a foreign publisher or distribute my document to a foreign audience?

A: Export control review and approval to release STI are required for domestic and foreign publishing. Complete, have approved, and have your center maintain your file copy of the NASA Scientific and Technical Information Document Availability Authorization (NF-1676 or -1676B) or your center's equivalent to this form prior to release to any audience.

Contact your center's technical publication office and export control office for more information.

Q: What is an "external publication"?

A: An external publication is defined as a document that reports on NASA research and that is submitted by a NASA employee, contractor, or grantee for publication through a non-NASA channel.

Q: How is the NASA STI Report Series defined?

A: There are discrete report designations that characterize NASA and NASA contractor STI reports. These include Technical Publications, Technical Memorandums, Contractor Reports,

Conference Publications, Special Publications, and Technical Translations. See Appendix D.1 of NPR 2200.2 (ref. 4) for more details about these designations.

Q: Please clarify the roles of a “technical monitor.”

A: A technical monitor is the NASA employee appointed to monitor or manage technical progress, referred to in grant instructions as the technical officer. In contract instructions, this employee may be identified as the project manager or the contracting officer’s representative.

Q: What is the basis for selecting a suitable series category for a NASA publication and who decides?

A: Selection of the correct series in which a document is published should be based on the content of your manuscript and the needs of an identifiable readership. Make the preliminary determination in conjunction with your center’s technical publications office. It is subject to approval as part of the NASA Headquarters Office or the originating center’s review process.

Q: What approvals are required to release STI in hard copy or via the Internet?

A: You must have an approved copy of NF–1676 or your center-specific version of this form on file to release STI in any media.

Q: I need to use color in my document. What approvals are required?

A: First consider how your document will be disseminated. Color is useful if you will disseminate via the Internet; however, remember that readers may print to black and white printers. For hard (paper) copies, U.S. Government-wide restrictions exist on the use of color because color increases the cost of printing, so discuss your options with your center’s technical publications and printing offices early in your planning process to determine what restrictions may apply or what approvals may be required.

Q: What is the best format source for creating an STI document?

A: Templates of typical NASA STI Report Series are available from the STI Web site <http://www.sti.nasa.gov>, “Publish STI.” These include suggested typefaces, font sizes, standard covers, title pages, heading styles, and interior column formats for publications released in the NASA STI Report Series.

Appendix E

Acronyms and Definitions

Acronyms:

ANSI	American National Standards Institute
CCL	Commercial Control List
CD	compact disc
CFR	Code of Federal Regulations
COR	contracting officer's representative (formerly known as COTR, contracting officer's technical representative)
CP	Conference Publication
CR	Contractor Report
CUI	Controlled Unclassified Information
DAA	NASA Scientific and Technical Information Document Availability Authorization (DAA) (NF-1676 and NF-1676B)
EAR	Export Administration Regulations
EDAA	Electronic DAA (NF-1676B)
FAR	Federal Acquisition Regulation
GPO	Government Printing Office
ISBN	International Standard Book Number
ISSN	International Standard Serial Number
ITAR	International Traffic in Arms Regulations
LCCN	Library of Congress Control Number
NARA	National Archives and Records Administration
NASA	National Aeronautics and Space Administration
NF	NASA Form
NID	NASA Interim Directive
NODIS	NASA Online Directives Information System
NP	NASA Publication (nontechnical, general information that is not part of the STI series)
NPD	NASA Policy Directive
NPR	NASA Procedural Requirements
NTIS	National Technical Information Service

NTRS-Reg	NASA Technical Report Server (Registered)
NTRS-Public	NASA Technical Report Server (Public)
OMB	Office of Management and Budget
RDP	Report Documentation Page
SBIR	Small Business Innovation Research
SBU	Sensitive But Unclassified
SF	Standard Form
SI	International System of Units
SP	Special Publication
STI	Scientific and Technical Information
TM	Technical Memorandum
TP	Technical Publication
TRS	Technical Report Server
TT	Technical Translation
USML	U.S. Munitions List

Definitions:

Front matter	Written material preceding the main text of a book or report. Examples of front matter are table of contents, preface, and foreword.
Rule	Line or bar (1/4 in for the NASA cover) added to a page for emphasis or decoration; also a thin line either vertical or horizontal, often used to separate parts of a table or columns of text.
Sans serif	Category of type that has no serifs. Serifs are the tiny crossbars on the ends of the strokes on letters in some type designs. Example of sans serif types are Arial and Helvetica.
Serif	Category of type that has serifs. Examples of serif types are Times Roman and Garamond.

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