PROPOSAL DEVELOPMENT HANDBOOK

for Preparing Research and Technology Proposals

by Steven D. Pearson and Karen C. McTaggart

National Aeronautics and Space Administration
Marshall Space Flight Center
Engineering Directorate

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Dedicated to the memory of Mr. Sid Saucier

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The inspiration for this handbook comes from Mr. Bill Kilpatrick's current leadership and Mr. Jim Kennedy's past leadership of the Marshall Space Flight Center (MSFC) Engineering Directorate. Their commitment to excellence and providing the best resources for the people within the Engineering Directorate made us appreciate the need for a proposal development handbook for the very unique and specific needs of engineering researchers and technologists, such as those within the Engineering Directorate.

Sponsorship for this handbook came from the NASA MSFC Proposal Development Process Team. Under the leadership of the late Mr. Sid Saucier, each of the MSFC organizations involved in proposal development have come together to explore ways that we can work together to improve MSFC's opportunities to generate winning proposals.

This handbook draws upon the vast experiences of those contributing to its preparation. Of special note is previous related work by Dr. Ron Koczar and Dr. Neil Chatterton in support of the MSFC Science Directorate.

We are indebted to the Universities Space Research Association and their involvement through Dr. William Vaughan, Jr., and Mr. Nicholas Segraves, who provided various support in the development of this handbook; Cortez III Service Corporation for their involvement through Janine Roskowski and the MSFC Proposal Production Team, who made technical input and assisted in the preparation of this handbook; and Mr. Eric Yonge for his illustrations that enhanced the message we are trying to share.

We also thank the many people who contributed their detailed review of the draft revisions of this handbook. Without their experience and knowledge this handbook would have not been complete.

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PREFACE

Successful organizations do not just happen—they remain successful through a commitment and willingness to change. This is especially true of the NASA Marshall Space Flight Center (MSFC) Engineering Directorate. We find ourselves in an aggressive environment in which we compete for meaningful and challenging work. The NASA budget is facing many challenges and we must create new ways to implement the policy of "better, faster, cheaper." By law we are now required to compete for much of the work we previously were assigned to accomplish in-house. We also adhere to many full-cost accounting practices, which complicates the process even further.

In order to effectively develop advanced technologies and maintain a high standard of excellence as an organization, the Engineering Directorate must be willing to optimize its ability to obtain new and challenging work. The premise is that a growing amount of engineering research will come to the Engineering Directorate through the proposal process. In order to be competitive, our proposals need to be of the highest quality.

This *Proposal Development Handbook* outlines the steps required to create a proposal that takes advantage of the many resources MSFC has to offer its research and technology community. This handbook fills a void within MSFC and the aerospace community. Considerable information exists on how to prepare proposals for commercial business activities. These authors recommend the utilization of large, complex proposal teams and often address proposals that are composed of many volumes. This handbook assists researchers and engineers from all organizations who are involved in planning and preparing relatively low-cost engineering research and technology proposals. These proposals typically involve developing new engineering technologies costing less than $1 million and involve a workforce of less than 10 full-time equivalents.

The focus of this handbook is not to require additional steps to burden the process, but rather to provide the researcher with the tools to develop a winning proposal. This handbook begins with a section on preproposal activities. This part of the proposal development process may be the most important element. Topics focus on gaining a strategic advantage before the final solicitation is received and the bid deadline clock starts ticking. Next is a section on proposal preparation. This is the "nuts and bolts" on how to prepare a proposal, focusing on suggestions that can make the proposal a winner. The next section highlights the review and approval process. This part of the development process requires great discipline and the schedule is of utmost importance. Management review of all commitments of MSFC resources is recognized and incorporated in the proposal review and approval process defined in this section. Part of this review is to ensure that the proposed effort fits within the defined roles and missions of the MSFC organization. The final section is on postproposal activities. This section identifies activities that effectively transition to the performance of the effort if the contract is awarded. If it is not awarded, it gives information on optimizing the effort in the preparation of future winning proposals.

This handbook will be updated periodically to reflect the latest information needed by those preparing proposals.

All MSFC Engineering Directorate researchers who contemplate the development and submission of a research proposal for sponsorship should consider contacting the directorate's Engineering Technology Development Office. Assistance is readily available in terms of advice, detailed information on proposal development, and examples of successful proposals of various magnitudes and disciplinary focus. In addition, each department within the Engineering Directorate has been provided with a Proposal Development Resource Library to augment this handbook. Many of the publications and resources referred to in this handbook are available in these libraries.

Steven D. Pearson, Manager
Engineering Technology Development Office

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ACRONYMS

AO	Announcement of Opportunity
CAN	Cooperative Agreement Notice
CDDF	Center Director's Discretionary Fund
CIO	Chief Information Officer
Co-I	Co-investigator
CSC	Computer Sciences Corporation
CSOC	Consolidated Space Operations Contract
CWC	Collaborative Work Commitments
DDT&E	Design, Development, Test and Evaluation
ED	Engineering Directorate
EDTeC	Educational Technology Center
ETDO	Engineering Technology Development Office
EMS	Electronic Meeting System
EODD	Employee and Organizational Development Department
ETV	Employee Television
FAR	Federal Acquisition Regulation
FED	Facilities Engineering Department
FTE	Full-Time Equivalent
HEDM	High-Energy Density Matter
IR&D	Independent Research and Development
ISD	Information Services Department
ISO	International Organization for Standardization
IT	Information Technology

ACRONYMS (Continued)

JSC	Johnson Space Center
LCC	Life-Cycle Cost
MPG	Marshall Procedures and Guidelines
MSFC	Marshall Space Flight Center
NASA	National Aeronautics and Space Administration
NMI	NASA Management Instruction
NPD	NASA Policy Director
NPG	NASA Procedures and Guidelines
NRA	NASA Research Announcements
OCFO	Office of the Chief Financial Officer
ODC	Other Direct Cost
OIG	Office of Inspector General
PAPAC	Provide Aerospace Products and Capabilities
PCA	Program Commitment Agreement
PI	Principal Investigator
PM	Proposal Manager
PMS	Program Management Support
POP	Program Operating Plan
PrISMS	Program Information Systems Mission Services
R&D	Research and Development
RFP	Request for Proposals
RLV	Reusable Launch Vehicle
RTOP	Research and Technology Operations Plan

ACRONYMS (Continued)

SEE	Space Environments and Effects
SMO	System Management Office
SPA	Strategic Planning Agreement
TFU	Theoretical First Unit
TRL	Technology Readiness Levels

Proposal Development Handbook

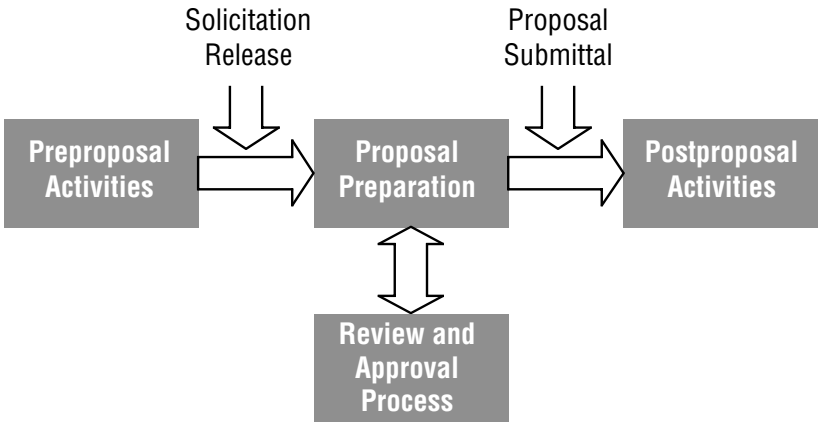
for Preparing Research and Technology Proposals

INTRODUCTION

A proposal is unique since it combines into one document individual and team strengths, weaknesses, and product knowledge, under circumstances not quite controllable. Understanding and duplicating the winning proposal process is difficult. Trying to institutionalize and codify the process is almost impossible, as we cannot understand and recreate at will a creative and synergistic process. Instead of discussing salesmanship, sales theories, and proposal war stories, this handbook focuses on developing an efficient process for writing winning proposals. As a process, proposal writing has definable and repeatable steps that will lead you closer to winning. Preparing winning proposals consistently is not luck—it is the result of utilizing a well-planned process and having a good product.

A rigorous proposal development process will be more successful in today's competitive environment. Having an easily applied process reduces time wasted in the mechanical aspects of coordinating a proposal's development.

The following four unique phases describe the proposal development process:



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Hard work is the yeast that raises the dough.

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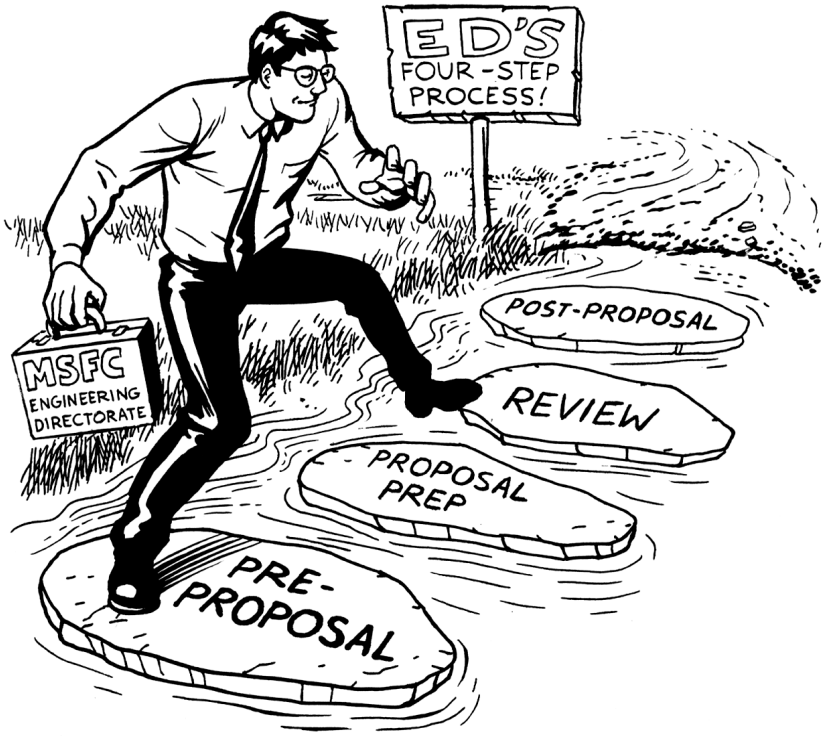
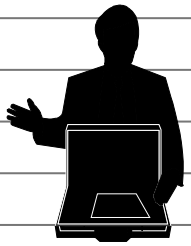


Preproposal Activities

Rarely is enough preplanning done relative to the development of a winning proposal. The more advance information gathered and/or developed on the planned solicitation, the better the opportunity to win an award. Preplanning provides better understanding of the customer's needs, develops contacts with those who may be involved or otherwise helpful in developing a proposal, and allows time to obtain needed supervisor/management support. Time and effort is essential to prepare a winning proposal. While it is difficult to quantify the effort needed to accomplish the necessary degree of preplanning, the potential Principal Investigator (PI) must have all the necessary information readily available, with appropriate analyses already performed, in order to provide a timely response to the solicitation.



"Business Development is sometimes performed years in advance of a specific solicitation."

Characteristics of a winning proposal include a thorough understanding of the customer and, to the extent possible, the competition. Discuss your project early with potential customers. This interface will establish contacts and credibility, assist in defining technical and programmatic parameters of upcoming solicitations, and will establish winning strategies. Study and analyze any draft solicitation made available by the customer. Give priority attention to the evaluation factors before beginning the development of the

proposal. Determine the need for collaboration on the proposed effort before the solicitation is received.

Proposal Preparation

A solicitation is the document that outlines a customer's need and solicits proposals to meet that need. Solicitations are released to a number of potential bidders in order to develop a competitive situation that will produce the highest quality project at the lowest price. A proposal, then, is a solution to a question—the solicitation.

The proposal is the document that details the research activity proposed in response to a customer request. The document includes specific details of the research activity as well as the resources required to perform the research. Winning in a competitive bid process involves skills in developing, writing, and selling the proposal; it is possible to lose to a better prepared proposal, even when you have a superior project and lower cost. Successful proposal writing involves understanding the solicitation including knowing the reason each solicitation is written, how each solicitation is written, and who wrote it. As the potential PI for a proposed effort, your responsibility is to understand and analyze all the solicitation requirements. Most solicitations contain specific instructions for the contents of the proposal. Every proposal is unique in content, but there are basic sections that are standard to all proposals. A winning proposal must be fully responsive, persuasive, and well written.

Review and Approval Process

Good in-house proposal reviews are indispensable to winning. A well thought-out review strategy, a sound review plan, and a bulldog tenacity about meeting deadlines will make proposal reviews useful and meaningful, reduce the stress associated with the process, and substantially increase the chances of winning. Opinions vary greatly as to why and how proposal reviews should be performed. This handbook describes in detail the steps to be followed, which can be modified as needed, when proposing to external parties. The review process needs to be flexible, but understand that once a schedule is defined, it must be followed with diligence.

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You must have a "bulldog" tenacity about meeting deadlines.

NOTES

Do not include Co-PI's for the sake of image or just to be nice to someone.

"If it's difficult we do it immediately. If it's impossible, it takes a little longer. Miracles by special appointment only."

—Unknown

Postproposal Activities

After the submission of a proposal, the PI should be aware of where the proposal stands in the review process and the final decision regarding selection. If the proposal is selected for sponsorship and notification is received by the PI, then he/she takes the necessary actions to proceed with the effort proposed, taking into consideration any instructions received from the sponsor. If the proposal is not selected for sponsorship, the PI should always request a debriefing in order to ascertain what area went wrong—technical, management, or cost. Use customer inputs as a learning exercise and apply them to your next proposal. A constructive debriefing may result in the identification of a future effort worthy of proposing.

Role of the Principal Investigator

This handbook assumes that the PI also serves as the proposal manager (PM), and leads the proposal effort. On larger proposals these are generally separate individuals. For the small proposals, such as these that are most common within the MSFC Engineering Directorate, it is usually one individual. The PI is the research focal point for the proposed effort and is responsible for the quality of its content and results. The PI is also responsible for the submission of the proposal to the review and approval process, either directly or through an assigned organizational point of contact. While functioning as the PM, this person is also responsible for managing the actual proposal development effort and usually does most of the writing.

MSFC PI
"Could this be you?"

Additionally, there are other tangible roles the PI/PM must play in the proposal development process. The first role is to be a good recruiter. It helps to find proposal development team members who are qualified, articulate, experienced, and can spend sufficient time supporting the preparation of the proposal. To state it simply, find people with the "right stuff." Proposal talent is not synonymous with experience or technical smarts. You might enlist your Co-investigator's (Co-I's) to recruit people they trust and with whom they work well.

As you add proposal development and project team members, stop and reflect on team weaknesses that future team members might strengthen. Once you find these special individuals, your next role is to keep them motivated during the proposal writing process. You must realize, as they will, that a proposal writing team is a temporary team supporting a short-lived goal in a paper environment. It is hard to make this sound exciting and there are probably few carrots that you can toss them. You should begin building cohesiveness and camaraderie by ensuring that there are no secrets and making everyone on the team realize that the success of the proposal effort depends on their ability to work together and utilize each other's talents. Remind them that they were all placed on the team because you believed they had something important to contribute. It is important to give them continuous feedback, to praise them, and celebrate interim milestones in your proposal development process.

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With smaller proposals, the PI may serve alone and be a proposal team of one.

"It has been stated that proposal writing is one of the most heinous tortures that can legally be inflicted on a human being."

—Unknown

"Remember to celebrate your interim accomplishments—A little pizza can go a long way . . ."

—Steven Pearson

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It is also critical to identify the most efficient means of communication to be used by the team members in the proposal development process. The need for rapid and simple communication among proposal team members is obvious, yet it is often taken for granted with disastrous results.

Types of Proposals

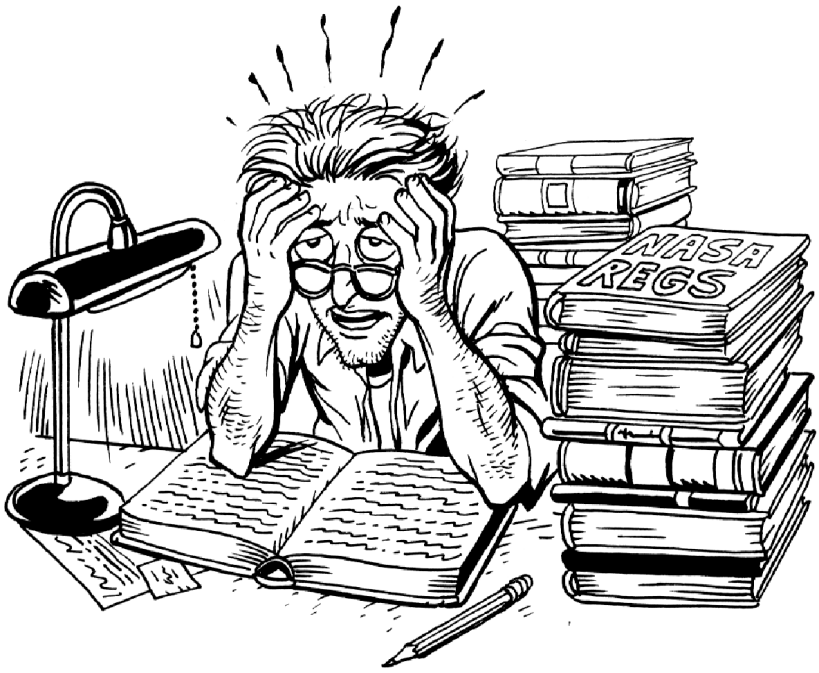
There are essentially two types of proposals: (1) Those that are solicited by the customer, and (2) those that are submitted to a potential customer but were not solicited by that customer.

Obviously, the solicited proposal is welcomed by the customer and will receive attention in accordance with the solicitation requirements and instructions. Unsolicited proposals will require much more background work and interaction with the potential customer to ensure you understand the need that your services will fulfill. However, unsolicited proposals are just that—unsolicited by the customer. Some customers do not like or encourage unsolicited proposals and may simply ignore them. Others welcome them and will respond accordingly.

The types of formal proposal solicitations encountered most often at NASA include, but are not limited to, the following:

- Announcement of Opportunities (AO)
- Request for Proposals (RFP)
- NASA Research Announcements (NRA)
- Cooperative Agreement Notices (CAN)
- NASA or MSFC Program/Project Solicitations
- NASA Enterprise Solicitations

The format of these solicitations is normally dictated by law as documented in the Federal Acquisition Regulation (FAR). While this handbook focuses on the above types of solicitations, its guidelines and suggestions can be applied to internal solicitations as well; e.g., Independent Research and Development (IR&D) solicitations, and Center Director's Discretionary Fund (CDDF) solicitations.



The contents of this handbook are intended to complement the information given in MPG 7100.1 "Proposal Development Process." All those considering the development and submission of a research proposal should evaluate these guidelines, and other International Organization of Standardization (ISO) guidelines, to determine their applicability (see Appendix A).

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PREPROPOSAL ACTIVITIES

The PI's and the proposal development team's commitment and dedication to preproposal activities is the most important factor that determines whether or not the proposal is a winner. Generating a winning proposal is the result of a lengthy, arduous job that begins long before submitting a formal bid. The final proposal is the product of all the activities that preceded its submission. During the course of a full proposal development process, over 50 percent of the effort should be expended before the customer even releases the solicitation and before a single word is written in the actual proposal. This is a time to focus on preparing a truly high-quality, well-coordinated proposal without the added pressure of the very time-demanding environment that accompanies the actual proposal preparation. A well-planned and executed preproposal effort is vital to the success of the proposal effort and is at least as important to winning the job as the proposal itself. Recognize the customer's need and develop a plan to provide a potential solution. This is how many unsolicited proposals evolve.

Developing Win Strategies

Along with developing the mechanics necessary to make the proposal effort successful, it is also important to start early on the proposal strategy and what is often referred to as the "win strategies". The strategy can be as simple as low-balling or buying the opportunity, or as complex as positioning your product as the best solution. These strategies and ideas are generally developed in a brainstorming session with people who are aware of and understand the solicitation and know the team's strengths and weaknesses as well as those of the competition. Emphasize your team's strength versus the competition's weak areas. Identify all steps required to develop and articulate the management, technical, and cost strategies for winning the procurement. Define any weaknesses that must be addressed and prepare a plan for eliminating them. A win strategy later gets confirmed from a close reading of the solicitation once it has been released.

Remember that proposals are not technical reports—they are sales presentations. Use these sales presentations to offer technical and management capabilities to prospective customers. The development and submission of a proposal must be a well-thought-out process in order to be successful. Convey a unique message relative to your competitors.

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For additional guidance in developing win strategies refer to *Writing Winning Business Proposals* by Richard C. Freed.

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Brainstorming is often an effective way to develop win strategies. Refer to *TRW Proposal Operations: How to Plan and Write Winning Proposals* for guidance in this area. (TRW proprietary—for NASA employee use only)

The role of the proposal writer is to convince the evaluators that this proposal best meets the customer's requirements. It is the evaluator who assesses what is written and how effectively it is written. Thus, the evaluators are the target audience whose absolute confidence must be secured to win support for a proposal. Never underestimate the evaluators by assuming they are less sophisticated or less intelligent than yourself. You should try to anticipate evaluator objections and answer them fully.

Each project-specific issue should be addressed thoughtfully, professionally, and without a false sense of technical superiority. The writers of a proposal must clearly express their message to the evaluators and influence them favorably. The evaluators must be moved to three actions: (1) To read the proposal, (2) to understand the proposal, and (3) to accept or buy the proposal.

Understanding the Characteristics of a Winning Proposal

While every proposal is a unique creation, here are common characteristics of winning proposals:

- Thorough understanding of the customer and, to the extent possible, the competition
- Focussed preproposal effort
- Focussed win strategies implemented throughout the proposal
- Rigorous schedule for everything
- A group effort with all the right specialists involved
- Decisive leadership with proposal experience
- A team that knows the job and offers the best value
- Fully responsive, persuasive, and well–written proposal with a clearly expressed message.

"Clearly expressed message?"

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For additional guidance on developing a proposal plan, refer to *TRW Proposal Operations: How to Plan and Write Winning Proposals* (TRW proprietary—for NASA employee use only).

While everybody examines this list and nods their head in agreement, it might serve us well to look at the other side of the coin. Most proposals fail not because of lack of effort or a bad idea, but because of—

- Failure to understand what the customer wants
- Failure to give customers what they want at best-value prices
- Failure to address competitors' strengths and weaknesses
- Failure to complete needed programmatic work during the preproposal phase
- Inexperienced proposal personnel and failure to apply proven proposal development principles and techniques
- Failure to follow instructions
- Failure to meet deadlines
- Exceeding page or budget limits
- Missing information
- Duplicated effort
- Illogical organization of proposal
- Lack of detail
- Failure to anticipate evaluator's objections
- Poor or no strategy
- Unrealistic work/cost ratio
- Unclear product/deliverable definition
- Failure to provide a **clear** solution to the customer's needs.

Developing a Proposal Plan

While a proposal plan is a good idea, the necessity of a formal plan is somewhat optional. The need will often depend on the complexity of the proposed effort, the number and relationships of the organizations involved, and the number of members on the proposal writing team. If a draft solicitation is available before the solicitation is released, it can serve as an excellent tool for preparing the proposal plan. A well-written proposal plan will—

- Define the job so that nothing falls through the cracks—make a list and check it twice
- Fix responsibility so that everyone knows who is doing what
- Conserve resources by ensuring that there is a time and place for everything with no wasted effort
- Guide the team by ensuring that everybody is on the same page
- Leave as much time for rewriting as writing and allow sufficient time for production.

Avoid letting things fall through the cracks ! ! !

Develop a rigid proposal schedule including interim and final milestones and the required reviews. The schedule is the heart of the proposal plan and should always be developed. This helps organize the process. The solicitation is the driver of the schedule. The schedule depends on the length of the proposal and the due dates of the proposal as stated in the solicitation. An example of a 30-day schedule is attached in Appendix B for reference.

Qualifying the Customer

Knowing the background reasons for the solicitation, who is involved and at what level, and whether the project is funded are key points to qualify the solicitation. A decision not to respond to a solicitation could save the organization significant time and money in proposal preparation. Knowing the political environment and business reasons behind a solicitation will give the PI insight into the customer and help them write a more responsive proposal. It is helpful to understand the customer's hot buttons, or what they are passionate about. These hot buttons are usually generated from some strong concern, deep-rooted anxiety, or prior failure. Remember that their issues can be truly real, reasonably possible, or purely imagined. It does not matter because to the customer they are real—and thus must be real to you as well. It is also useful to know what types of efforts the customer has funded in the past. This helps the proposal team to orient their proposal toward the types of efforts to which the customer is accustomed.

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The schedule is the engine that drives your proposal plan.

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Identify all known potential competitors.

"No business opportunity is ever lost. If you fumble it, your competitor will find it."

—Unknown

Preparing a Competitive Analysis

Prepare a competitive analysis before making the decision to respond to a particular solicitation. Treat it as a true competition—or be ready for a rude awakening. A competitive analysis should:

- Determine competitor's probable level of interest in the program
- Determine competitor's likelihood of bidding
- Identify strengths and weaknesses
- Describe current relationships with the customer
- Describe current relationships with potential users
- Identify company's funded or contractual projects underway or completed that are related to the procurement.

Know your competition

For each category compare yourself to the competition. Perhaps your competitors have existing relationships with the customer. It is still reasonable to bid on the solicitation. Incumbents frequently have older technologies and their response to a solicitation might be to simply incrementally upgrade their existing technologies. This may not be a good long-range solution. Incumbents may not put effort into their proposal, thinking that they have the edge. Your proposal development team should consider these possibilities when establishing your own win strategies.

The most difficult thing to do is to confront your own strengths and weaknesses. Make every effort to be brutally honest.

In summary, a competitive analysis will tell you where your products stand in comparison to the competition and lets you emphasize your strong points, minimize your weak points, counter or neutralize the competition's strengths, and exploit their weaknesses. While you probably know the competition better than you think, sources of competitive data include current program documents, industry conferences and papers, colleagues who worked with or for the competition, and organizational Web sites that link you to industry data.

Performing an Industry Survey

Before beginning a research and technology development effort, or proposing to do so, it is imperative that the PI or the proposal development team perform a full analysis of NASA's current activities and relevant investments by other Government agencies and industry in the generic area to be addressed by the proposal. This should involve consultation with the leaders in the field. This effort will allow the PI to clearly identify gaps and shortfalls between the customer's visions of the future and current or emerging capabilities. It gives the PI the opportunity to convince the customer that this team fully understands the current technology readiness level (see Appendix C) and ensures that resources will not be expended repeating efforts that others have already undertaken. This survey also enables you to determine which features of the products or services you offer are superior to those of your competitors in terms of performance, cost, and schedule.

Performing a Commercialization Assessment

If the proposed effort might lead to commercialization, it should be vigorously explored and noted in the proposal. Describe how the assets (technologies, discoveries, innovations, tools, processes, or software) developed by the proposed effort can be infused into industry.

For example, tax dollars spent in space continue to result in Earth-bound technology used to improve everyday life in homes and communities. Home and industrial safety products are being produced using memory metal alloys created by the Engineering Directorate for the *International Space Station*. These metal alloys can change from shape to shape, depending on temperature fluctuations, then return to their original shape. A valve made of this memory metal is making bathing safer. The valve resets the water temperature and restricts flow to a trickle if a scald hazard

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Performing an industry survey could also uncover an opportunity to submit an unsolicited proposal to another customer.

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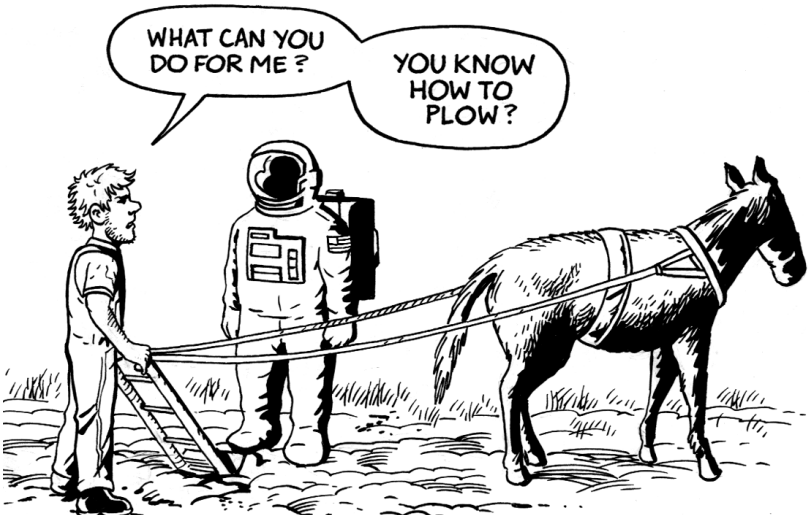
occurs. When the water temperature returns to a safe level, the unit returns to normal flow.

The MSFC Technology Transfer Department can guide and assist you in the performance of a commercialization assessment.



Analyzing Draft Solicitation Requirements

It should be obvious that if you anticipate responding to an upcoming solicitation, you should take advantage of every opportunity to study and analyze any draft solicitation made available by the customer. While drafts are sometimes released piecemeal on an erratic schedule, and they can be an unreliable predictor of the final solicitation, they do provide you with a better understanding of technical and management requirements. Usually the key elements and requirements of a draft solicitation remain in the final solicitation. As part of this endeavor, even if the customer does not make a draft solicitation available, a potential respondent should make every effort to learn from the customer what their needs are. This will help in planning for the receipt of, and response to, the formal solicitation.

If given the opportunity to make inputs to a draft solicitation, take this opportunity to seek clarification of any requirements that are unclear. The solicitation may be poorly written with vague requirements. It is imperative that the PI suggest changes so that the content of the proposal matches the customer's real needs. You may even take advantage of this opportunity to suggest changes that favor your position. Unfortunately, you normally do not know the disposition of your comments, suggestions, and questions until the final solicitation is released.

Take every opportunity to interact with the solicitor. This allows you to better understand what they want and builds recognition. BEWARE!!! This could be a two-edged sword.

Highlighting Evaluation Factors

Give the evaluation factors high-priority attention before beginning the development and writing of a proposal. Whether from a draft solicitation, a final solicitation, a best guess, or from prior experience with the customer, these factors are the keys to what a proposal evaluator will address in making a recommendation. Carefully read the evaluation factors and be sure to understand them. **Be sure the proposal addresses each evaluation factor in such a way that the evaluator can readily identify your response.** Remember that this is what the evaluator looks for after reading the cover page and executive summary of your proposal. Do not make it difficult for the evaluator to locate the information needed to complete an evaluation in a timely manner, especially if there are many proposals submitted in response to the solicitation.

Qualifying the Evaluators

Keep in mind that your proposal will probably be one of several being read by individual evaluators in a very limited period of time. Evaluators may be overloaded and may not even be an expert in the field. If this is possibly the case, keep technical jargon to a minimum and substitute words or phrases with concrete, widely shared meanings. Unfortunately there is no one, single type of proposal evaluator. The team that evaluates your proposal can have any and all types of evaluators. Proposal evaluators can be classified into three distinct types—

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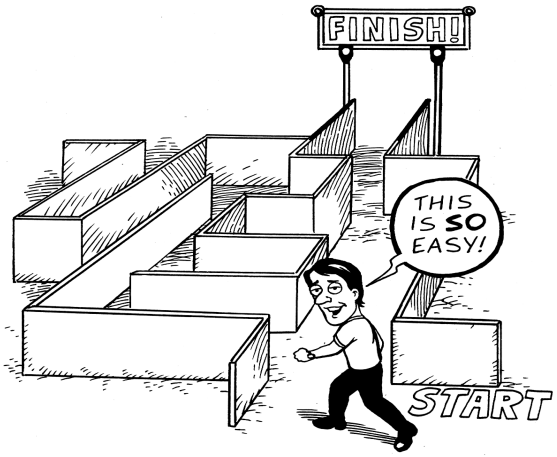
Before the solicitation is released, or even after the solicitation is released, it is sometimes difficult to determine exactly who the evaluators will be. Do the best you can because every little bit of intelligence information helps.

NOTES

For additional guidance in qualifying the evaluators, refer to *Writing Winning Business Proposals* by Richard C. Freed.

Don't try to be too cute or fancy. Make sure the evaluators have all of your facts.

- *The real expert*—This is your peer on the customer's side. He or she knows your subject well and will read and understand all the details of what you are saying. This person will probably be the major scorer of your proposal. For this kind of person, you must supply a good, accurate, and convincing write up, backed up with detailed data.
- *The alleged expert*—This person knows the subject, but not as well as the real expert. Maybe he or she has moved up in the organization and has not had time to keep up on advances in your subject area. The head of the evaluation team may be this kind of person. For him or her, your proposal must skim well because this kind of reader wants to get smart fast and is unlikely to read every sentence.
- *The nonexpert*—This is the unsuspecting innocent who gets put on the evaluation team because no one else is available. He or she has limited knowledge of your material and must be taught—but in a subtle way so as not to offend this person or the real expert.



Why is it important to realize there are three types of evaluators? Because your proposal must be written in such a way that all three types can easily obtain the information they need and have a positive feeling about the manner in which the information was given to them. This is the way you attain a winning proposal. Make sure the evaluators have all the facts. They are probably focusing on mistakes, omissions, and objections.

Evaluators, who are probably not even being compensated for this thankless task, love proposals that make their job easy. This means that if your proposal follows the solicitation instructions, it will most likely be looked upon more favorably. The more time it takes an evaluator to find the answer to a requirement, the less time they have to understand whether the response is compliant or not.

Establishing Collaboration

You need to determine the need for collaboration on the effort to be proposed before the solicitation is received. It should be emphasized that collaboration with an outside organization should only be considered when a teaming relationship strengthens a perceived or actual weakness and therefore substantially improves your competitive position. Always consider the advantages and disadvantages of teaming and do an assessment of the associated risks. Many solicitations also look favorably on a proposal that includes collaboration with universities, other NASA Centers, and other Government Agencies. This is especially true when you can show that you can leverage additional resources which your proposed effort is not required to fund.

Make contact as soon as is practical to ascertain whether necessary, dependable collaborations can be developed. While formal agreements or letters of commitment are unnecessary at this time, one should feel comfortable that such formal agreements will be easily forthcoming once the solicitation is received. Specify the contributions the collaborators will make on the effort. This must be clearly understood.

Anticipating Illustrations

In a proposal, illustrations can be a powerful means of communication. Illustrations can make the difference between a drab, but technically accurate proposal and a sharp, clearly stated, lively document. Good supporting illustrations clarify your text and ensure that what is being read is also being understood. Of course, illustrations add a professional touch to your proposal, but their real function is to help the reader understand complex technical concepts. Illustrations help bind text and concepts into comprehension.

It should be understood that graphics and illustrations oftentimes require a lot of time to conceive and produce. Therefore, it is imperative that careful advance planning take place in this critical area. If not managed wisely, illustrations can either consume all available time and energy, or be neglected and receive too little attention too late, and result in a dull, unconvincing proposal. The PI should attempt to anticipate the major illustrations that will help them tell their winning story and begin to prepare the

NOTES

Team with other organizations only when the partnership makes you stronger.

Co-investigators at universities normally operate in a less formal mode than most NASA activities. Be clear in defining exactly WHAT you expect of the university and WHEN!

Good graphics that help illustrate how your proposal answers the solicitation can replace several pages of text.

Engineers often underestimate how long it takes to develop effective illustrations.

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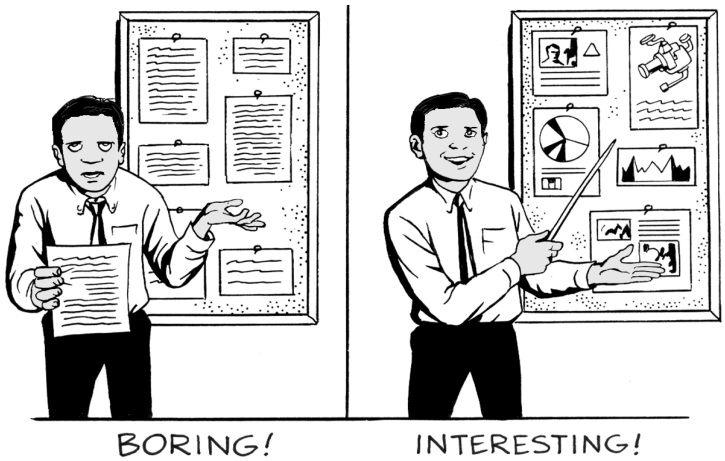
Never underestimate the importance of good graphics. Many successful proposal experts develop their graphics first and then use text to reinforce the illustrations.

Don't be proud. Ask for help!!!

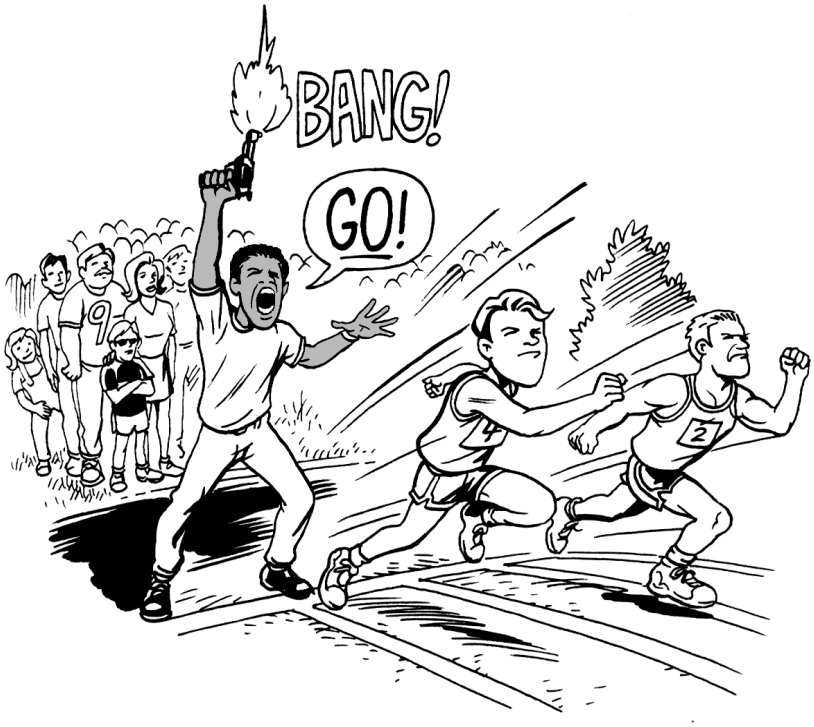


illustrations and/or work with the MSFC Information Services Department as soon as practical before the solicitation is released.

Anticipating Needed Support

Most inexperienced proposal writers wait too long before they seek help in the proposal development process. When they do realize that they need support, it may be too late to optimize their chances of preparing a top quality, winning proposal. There are multiple organizations available at MSFC to support the development of a winning proposal (see Appendix D). It is critical that the need for their involvement be considered and dialogue initiated early during preproposal activities. These organizations are professionals who can often offer suggestions on how to improve your chances of preparing a winning proposal.

PROPOSAL PREPARATION



You may be an experienced writer and may have produced technical reports, memoranda, articles, publications, and perhaps even books. If you have also worked on proposals, you know that the proposal writing process is different from that of writing technical or management reports. In part, this difference results from the team-oriented, time-constrained pressure environment in which you must operate; it also results from the nature and purpose of your proposal. Your proposal is a stand-alone document that must convince a group of evaluators that you have the best solution to a set of customer needs. Furthermore, your proposal must be convincing, not only in itself, but also compared to competitors' proposals. It must also be persuasive. This demands narrowing your focus to selecting key messages that convince the evaluator your proposal is best.

The proposal you submit should be well organized. Information should flow naturally from one subject to the next, and it should be understandable and supportable. The proposal you write will be one of several being read by evaluators in a very short period of time. Evaluators like proposals that make their job easy, which means that if your proposal follows the solicitation instructions, it will be looked upon favorably. When in doubt about the amount of writing needed, keep it on the light side—often proposals are so bloated that the real story never gets through.

NOTES

For additional guidance in proposal preparation refer to *Proposal Development: How to Respond and Win the Bid* by Bud Porter-Roth.

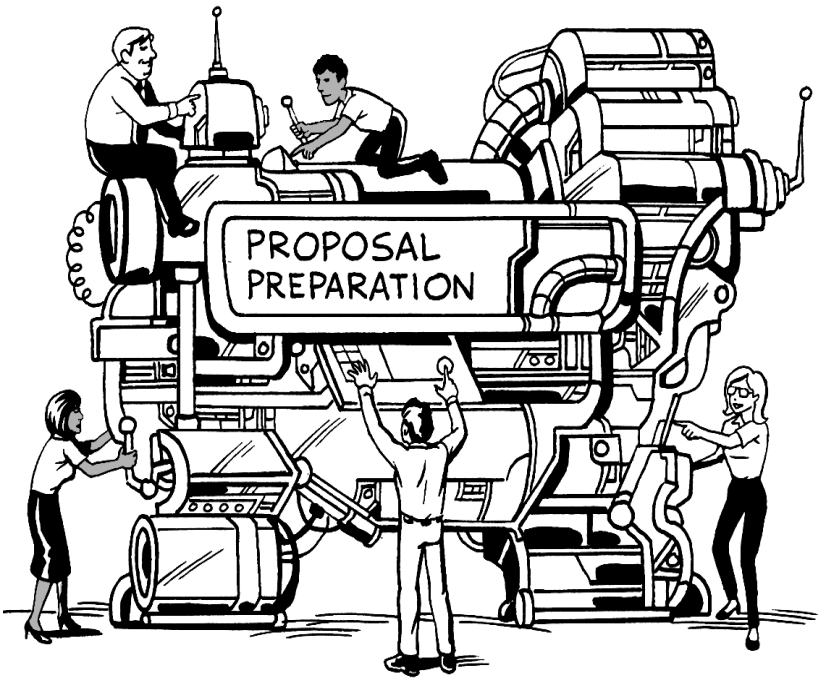
NOTES

"There is no job so simple that it cannot be done wrong."

—Unknown

Proposals often contain "boilerplate" material that can contain important requirements that might be overlooked in a cursory reading.

Proposals should be prepared simply and economically, providing a straightforward, concise description of your ability to satisfy the requirements of the solicitation. There is no need for proposals to be overly elaborate or use extensive embellishments, such as color illustrations. Emphasis should be on completeness and clarity of content. Avoid frivolity since a proposal is a serious business offer. There is no place in a proposal for jokes, cartoons, or anything of a frivolous nature.



Analyze Solicitation Requirements

Before the solicitation arrives, plan for the acquisition, delivery, and reproduction of the proposal, and distribution to proposal development team members. Once a copy of the formal solicitation is received, the most important action to take is to carefully and thoroughly read the entire solicitation as quickly as possible. Do not depend on someone else to summarize it or to tell you what it contains. You, as the PI, are in charge. You will get the credit whether you win or lose. Reward without risk is uncommon, and proposals involve risk.

Sometimes solicitations are poorly written with ill-defined requirements, and a casual reading of the requirement section will simply not suffice. Remember that inexperienced people may be trying to buy your product; it is up to you to help them.

As the PI for the proposed effort, you are responsible for understanding all the solicitation requirements. In particular, emphasis must be placed on why the customer issued the solicitation, what the customer expects, the evaluation factors the customer will use to evaluate your proposal, and whether what you have to sell fits within the requirements of the solicitation. If there are any contents of the solicitation that you do not understand, request an explanation as quickly as possible. A point of contact for requesting clarification or further information on the requirements is usually contained in the solicitation.

If the solicitation instructions are numerous or complex, you may want to develop a proposal compliance matrix. This tool will allow you to map the solicitation instructions/requirements into your proposal content. The purpose of this mapping is to ensure that all topics requested by the solicitation are covered in the proposal. The following is an example of a simple compliance matrix:

Compliance Matrix

The following compliance matrix serves as a cross-reference to major paragraphs in the solicitation and demonstrates your adherence to the requirements.

RFP Section	Proposal Section	Compliant (Y/N)	Comments
2.1	3.1	Y	See App. B for additional details
2.2	3.2	Y	
2.3	3.3	N	External modem not required
2.4	3.4	Y	
2.5	4.1	N	External memory not optional

NOTES

There is no step more important than carefully reading the solicitation.

On larger solicitations, one may elect to include the compliance matrix with the proposal to make the evaluator's job easier.

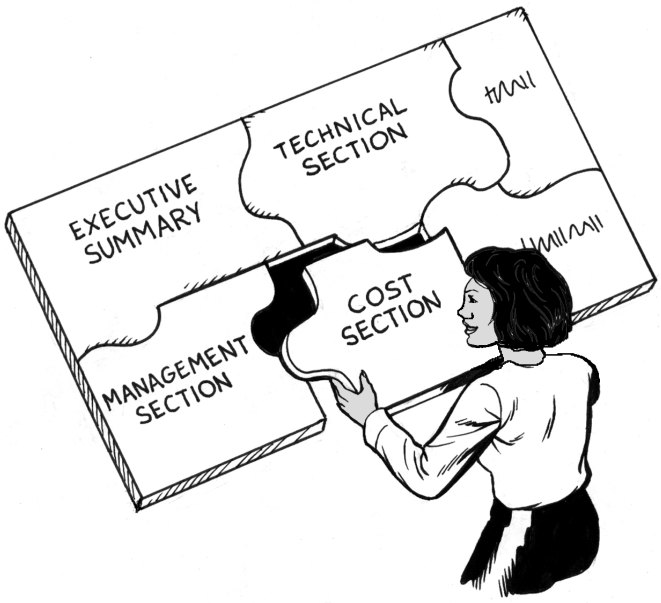
NOTES

Don't try to improvise on what is requested. Follow the instructions exactly.

The PI may choose to initiate a kickoff meeting for those expected to be a member, technical or nontechnical, of the proposal team. For small efforts, the kickoff meeting may be a rather informal get-together of the PI and Co-I's. In any event, the purpose of such a meeting is to ensure that all those concerned understand the solicitation requirements and their relative roles in the preparation and writing of the proposal. At this time, any issues concerning responsibilities or understanding of the solicitation requirements need to be discussed and, to the degree practical, resolved.

Proposal Content

Most solicitations for proposals usually contain specific instructions for the proposal contents, including length and format. **If instructions are given in the solicitation, it is absolutely mandatory that the instructions be followed in detail.** Do not try to improve on what is requested relative to the proposal content, major headings, format, or length. Present information in the same order that it appears in the solicitation instructions. This makes it easier for the evaluators to find the answers they are looking for. Match the names of the section headings in your proposal to the section headings in the solicitation instructions. Make sure that all required components are included and are easy to find.



For those solicitations that do not provide instructions on what they want for the proposal content, or for an unsolicited proposal for submission to a potential sponsor, the following items provide an excellent guideline.

You should pay particular attention to—

- Eligibility requirements
  - The type of organization that may submit
    - Foreign or domestic
    - For profit or not-for-profit
    - Educational (at what level?)
    - Limit on the number of proposals that may be submitted by one organization
  - Requirements for scientific and engineering personnel
    - Educational requirements
    - Citizenship
    - Security clearances

- Budgetary limits
  - Maximum support ($$$) per year
  - Maximum number of years
  - Requirements for leveraging or cost-sharing funds
  - Limitations on how funds may be spent
  - Auditing requirements
  - Budget justification
  - Budget restrictions
    - Salaries and wages
    - Equipment and computer purchases
    - Travel (domestic and foreign)
    - Consultants and subawards
    - Indirect costs
    - Ineligible expenses
    - Page limits
  - Limits for the entire proposal package
  - Limits for individual proposal components

- Formatting requirements
  - Minimum or maximum font and margin sizes
  - Page numbering
  - Ordering of sections
  - Inclusion of figures, tables, graphs
  - Bound or not

- Deadlines
  - Is there a hard deadline?
  - Is the deadline submitted by or received by?
  - Allow time to obtain—
    - Required signatures and authorizations
    - Certifications
    - Price quotations
    - Letters of intent or collaboration
    - Details of subcontracts

Every proposal is unique in content, however, there are basic sections that are standard to most proposals. The letter of transmittal and cover page includes the material that makes up the front matter and determines how the proposal as a whole is formatted. The executive summary, technical section, management section, cost section, and an appendix are the key elements that allow you to effectively share your solution to the customer's need.

NOTES

NOTES

Write your own proposal.
Do not get someone to
front for you.

Item No. 1—Letter of Transmittal

If permitted, the letter of transmittal should be bound into the proposal to prevent it from being lost. The letter sets the tone for the proposal and is your chance to do something that is not as objective as the executive summary or the main body of the proposal. Use only official NASA letterhead. These are some key ideas that should be covered—

- An opening statement or summary sentence that concisely presents your marketing strategy. The opening sentence should be stronger than a thank you for the chance to bid—it must be a positive statement about your product or service. This statement is your selling theme and the reason the customer will award you the contract.

- Any special or unique ideas presented in your proposal that save money, time, and that guarantee a risk-free implementation which the customer did not expect or ask for in the solicitation.

- Special efforts you have undertaken to identify and resolve critical requirements indicated in the solicitation.

- The letter's closing statement should include the following: References to the solicitation number (if there is one) and project name, how long the proposal is valid, a statement indicating the person signing the proposal is authorized by your organization, and the name, address, phone number, and e-mail address of the person responsible for the proposal.

Use the letter of transmittal to help sell your proposal by getting the attention of the evaluators and directing them to compelling reasons for buying.

Ideally the letter should be signed by someone in as high a position as possible, but at the minimum a MSFC person having the executive authority to legally commit the MSFC resources required by the proposed effort. Since NASA policy changes frequently, proposal preparers should check with their department management to define the level at which each proposal will be transmitted.

Item No. 2—Cover Page

A cover page adds a degree of professionalism to the proposal when the customer is identified along with the solicitation's project name. This can be easily upgraded using some simple graphics and a word processor. See Appendix E for a sample cover page. The information printed on the cover page must include, as a minimum, all of the following:

- Title of the project
- PI and any Co-I's
- Submitting organization's name (and logo if you desire)
  National Aeronautics and Space Administration
  Marshall Space Flight Center
  Engineering Directorate
- Name of the customer
- Name of the customer's program offering the solicitation
- Date of submission
- Full contact information for questions.

A professional–looking cover and approach enhance your image with the customer. Regardless of how silly we think it is, a customer always beams with pride when he sees that you have taken the effort to recognize their program on your cover. When it gets down to being very close in competition, perceptions of your product may be one of the things that tip the balance.

NOTES

Keep in mind that the more proposals the soliciting office receives, the more dramatic effect a professional cover will have to set you apart from the crowd.

Be aware that some solicitations require a standard cover page provided by the customer.

Note: Do not include secret or proprietary information unless it is essential for understanding the proposal. If you must include this type of information, put a warning label on the cover page and on the pages containing confidential information.

NOTES

Be specific about what you will do, how you will do it, and how your results will meet the customer's need.

"Avoid claims that are not backed up."
— Neil Chatterton

Never call out your competition by name.

Item No. 3—Executive Summary

The executive summary is an abstract of your proposal. It is best written before you begin writing the full proposal. It presents a summarized view of each major section, contains the strategies and messages you want to convey to the customer, reviews any unusual features and benefits contained in your proposal, and provides any pertinent information not requested in the solicitation. The executive summary not only summarizes the proposal but it educates people not familiar with your products and directorate, translates complex technical concepts into understandable benefits, and sells those benefits to the reader.

The executive summary must do the following:

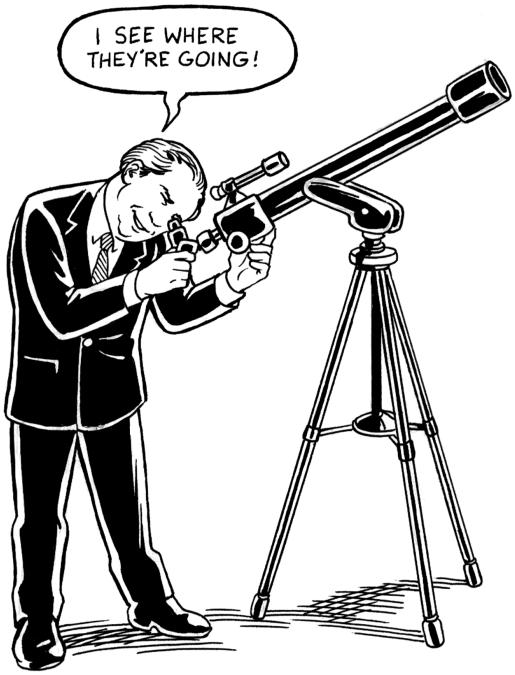
- Tell the reader what he/she is buying in simple, understandable terminology.
- Explain technology concepts in terms that will be grasped by the nontechnical reader (see Appendix F).
- Explain the technology readiness levels (TRL) of existing technology and the proposed TRL at the completion of the proposed effort (see Appendix C).
- Convert complex technical concepts and features into understandable benefits.
- Present the reader with any internal development work (i.e., IRAD projects, CDDF projects) that have been successfully accomplished by your organization to advance the technology to where it is today.
- Present the reader with the benefits of the proposed solution.
- Present your solution over the competition's solution, features, and (perceived) benefits.
- Clearly delineate what the specific deliverable products are and when they will be delivered.

The executive summary is a real workhorse for your proposal. As one of the most important sections of your proposal, the writing should be clear, concise, and relevant to the issues at hand. Above all, the executive summary is meant to sell successfully by capturing the readers' interest with good writing and strong selling themes.

Although read by a variety of people, the primary audience for the executive summary is the high-level decision maker. The evaluator reads the executive summary to gain a working knowledge

of all proposals submitted in order to understand the primary differences between the proposed solutions and determine relative values of products versus price. This person is interested in what results will be achieved by your product, not so much how they will be achieved.

The executive summary, and the proposal at large, should avoid saying that you are the best team with the best solution. This insults the evaluator's intelligence. Such conclusions should come from the evaluation.



Item No. 4—Technical Section

The technical section serves as the cornerstone for all other parts of the proposal. The technical section describes the product that is being sold—it explains what is being purchased and provides sufficient evidence that the claims made can be verified. This section specifically defines the product in relation to the requirements in the solicitation. In addition to providing a detailed description of the solution and the products that make up that solution, the technical section must demonstrate your knowledge of the customer's needs. It is also useful to highlight any trade studies that your organization may have performed to lead them to the concepts and approaches being proposed.

The technical portion of a proposal must be simple and straightforward, proceeding from the most critical to the least critical

NOTES

Be sure you understand technically what you propose to do and know how you will get it done.

points without overwhelming the reader with detail. The proposal writer must decide on a level of detail that matches what they know about the anticipated evaluators' knowledge, expertise, and preferences and must then move the minute details to an appendix. While this section contains the technical nuts and bolts of the proposal, you must remain persuasive as well. An important part of being persuasive is addressing alternative approaches and demonstrating how and why your approach is best.

The basic technical section should contain the following:

- Section overview—Provides a short explanation of how the section is organized and may provide some additional information
- Introduction—Contains a technical discussion of the problem along with your interpretations of the solicitation requirements
- Technical solution—Explains how you propose to solve the problem
- Product descriptions
- Implementation
- References—Adds authority and makes the evaluator aware that you are aware of the latest developments in the technical field being proposed
- Assumptions—Explicitly state and justify your assumptions.

It is very important that all deliverables, both interim and final, be clearly delineated, both in the technical write up and in the project schedule. It is often appropriate to give the customer a chance to review a draft of the final product if it is a written report. If this is the case, be sure to emphasize it in your technical section and be sure to allow for it in your schedule. It is also appropriate to plan to disseminate the results of your efforts as a presentation and/or paper at conferences and symposia. It is best to plan to schedule these unofficial peer reviews before the end of your projects so that feedback can be incorporated into the final product, if appropriate.

Item No. 5—Management Section

The management section is written to assure the potential customer that you do have the experience, facilities, and ability to carry through with what has been proposed. The management section also demonstrates insight into what physical resources will be required and who is responsible for supplying those

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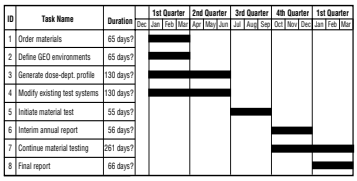
Be positive. Your proposal may be the key to what the customer needs for success.

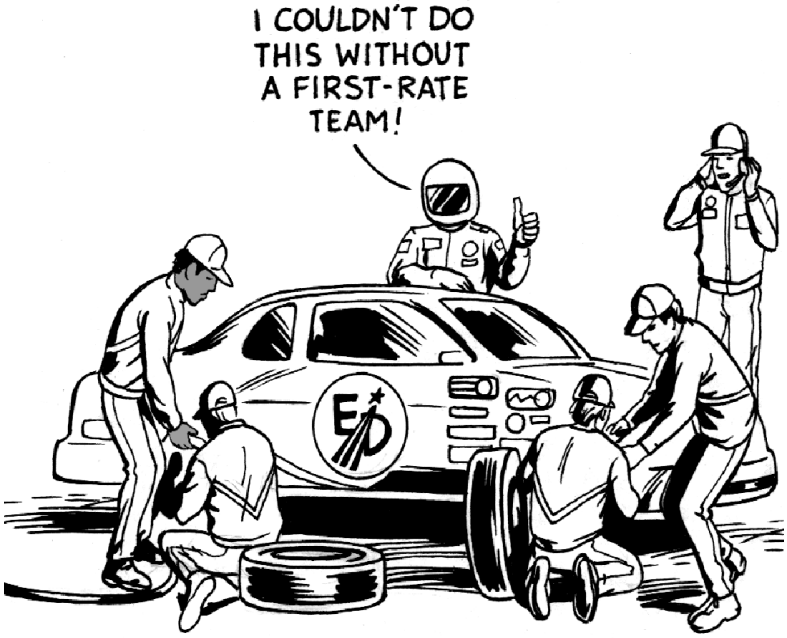
References help establish your credibility.



If you use graphics to describe your technical approach, be sure to identify ALL deliverables on the graphic.

resources. At a minimum, the management section should contain an introduction to the proposed management plan and should state your capabilities, who is responsible for acceptance, and the customer's responsibilities. Below is a possible outline for a management section. This outline is generic but does represent the basic sections of a complete management section. Some items may not be applicable to your proposal. The basic management section contains, the following:

- Introduction
- Project management—Larger projects should be managed in accordance with NPG 7120.5A (see Appendix A), and this should be clearly stated in the proposal
- Project organization and responsibilities
- Key project personnel—Include personal resumes of PI's, Co-I's, and appropriate key project personnel (see Appendix G)
- Management of subcontractors
- Project schedules (see Appendix H)
- Risk management/mitigation
- Capabilities and facilities to be utilized
- Potential for commercial technology transfer



Project management is the management of risk. Describe the risk management process with appropriate flow charts and text. Identify the top program risks. This best demonstrates that you

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Submit a proposal only if you will actively lead or participate technically. Do not submit a proposal where you are simply a "figurehead."

"The closest to perfection a person ever comes is when he writes a resume."

—Stanley J. Randall

NOTES

follow the proposed risk management process. Ensure that the top risks that are identified are consistent with those described in the technical section. All projects have risks. Don't be afraid to admit this, just be sure to demonstrate how you plan to manage and mitigate the risk.

Proposals that involve multiple partners must carefully address the division of responsibilities, lines of authority, and methods to be used to resolve technical and programmatic issues between the partners. Often, proposals that involve multiple partners are perceived to be more risky than proposals from single entities due to potential breakdowns in communication and ill-defined responsibilities and authority between the partners. This perception can be overcome with a clear definition of responsibilities and lines of communication.

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"A billion dollars isn't what it used to be."

—Nelson Bunker Hunt

Just as you have technical strategies, you also need a cost strategy.

Item No. 6—Cost Section

The cost section should have realistic and reasonable estimates with credible methodology and a presentation that is evaluator friendly and traceable. If you have determined that you will need between $18,000 and $20,000 to purchase needed equipment, don't estimate $20,000 and give no breakdown of how you arrived at that figure. Be specific as to how the funds you are requesting will be used. If you are not sure what you need, you probably have not spent enough time in preproposal activities preparing for the proposal opportunity. For more costly items, you might want to provide detailed information such as the manufacturer's names, model numbers, and detailed specifications in an appendix.

To clarify your proposal, always start with a summary of total costs whether it is requested or not. The following table identifies what customers often do and do not want in a cost section.

Quality Distinctions They Want	Features They Do Not Want
Good top-level summary	Too complicated
Self-contained, self explanatory	No traceability
Clear traceability	Does not follow solicitation instructions
Responsive	Lack of support for cost detail
Substantiated information	Arithmetic errors
Ties to the technical section	Inconsistencies
Clear summaries of major cost elements	

A good cost estimate should include the following, if not otherwise stated in the solicitation:

- Show that the proposal will provide the best value
- Validate proposal assertion of innovation, cost effectiveness, and productivity
- Quantify the labor, materials, and other direct cost (ODC) required to implement the proposal as presented in the technical and management sections
- Utilize narratives throughout the cost estimate when necessary. Numbers do not speak for themselves. If the cost estimate details are not clear to the evaluator, they may think you are trying to hide something
- Demonstrate cost realism, reasonability, traceability, and credibility, as well as the bottom-line number.
- Highlight all cost-sharing activities and resource leveraging of other tasks. Do not overlook your world-class facilities and its unique capabilities, which may be available at a fraction of the cost of your competitor's facilities and capabilities.

You should consult with your department's business office early during the proposal development process. These individuals can assist in determining appropriate rates, particularly concerning program management support (PMS) and potential institutional charges; i.e., computer support charges, if applicable. **The PMS is a charge unrelated to employee salary** that MSFC collects to support the infrastructure such as electricity, heating and cooling, communications, computing facilities, etc., that are common to many MSFC efforts.

NOTES

Be sure you are comfortable with the budget, regardless of who helps prepare it. You will be the one held accountable, not them.

Cost sharing and resource leveraging may well be what sets you apart from your competitors. Everybody likes to get more bang for their bucks.

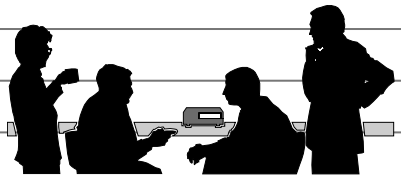
"If you are expecting certified cost data from outside groups, you need to allow enough time for their internal reviews. This is always a killer, because our people seem to think it will just get here whenever we ask for it. Not!"

— Ron Koczar

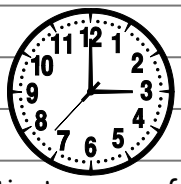
NOTES

PMS charges normally apply to MSFC developed proposals.

NOTE: Some directorates have different institutional charges!



Attention to detail, such as letters of commitment, demonstrates the careful attention you will exhibit managing a task, if selected.



Co-investigators are often at the mercy of their accounting, purchasing, and legal departments. ALLOW SUFFICIENT TIME!

More recently, NASA policy is changing toward a more comprehensive calculation of indirect charges. NASA is more closely approaching the full-cost accounting practices used traditionally by businesses. Further complications may arise when determining which indirect charges are assessed against a particular proposed effort, because Government customers are charged differently than commercial ones.

Every proposal must address these issues and the best source of current guidance on these issues is the MSFC Office of the Chief Financial Officer (OCFO). It is highly recommended that you contact your department's business office as early as possible so that they can work with the OCFO to determine the particular set of cost parameters to be applied to a given proposal. A sample cost template is shown in Appendix I.

Total cost could be the deciding factor and it will definitely be a major part of the proposal scoring. The proposed cost should have a clear cost strategy. The cost activities should be planned as an integral part of the overall proposal.

Item No. 7—Letters of Commitment

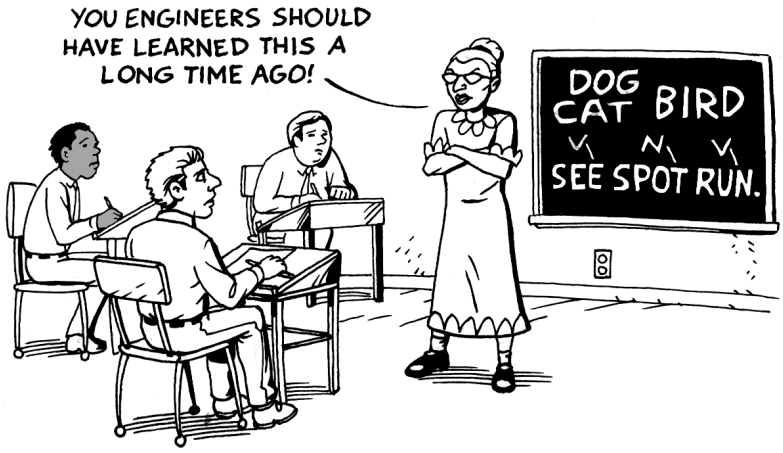
Obtain letters of commitment from all organizations, whether internal or external to MSFC, where you expect support from outside your own immediate organization. Never should PI's estimate manpower or resources to be consumed by an organization other than their own. These letters should specifically state what will be done and who will do it and should also state that if an award is made, the parties involved are committed to providing the support as required. Without such letters of commitment, the outside parties who are beyond the immediate supervisory control of your organization may have good intent, but may be overridden by their supervisor on work efforts and priorities. This could then leave you without the necessary technical or other support to accomplish what you have proposed. Sometimes it is appropriate to include some or all of these letters of commitment with your proposal, especially if the commitment is key to accomplishing the proposed effort. Normally, these letters of commitment are directed to the PI and are signed by an appropriate supervisory-level manager who is authorized to commit the resources to be provided. The letter of commitment should state the services to be provided and should provide any cost estimate necessary for inclusion in the proposal.

Item No. 8—Appendices

An appendix is a separate section of your proposal that contains supplemental information. Generally this information is considered to be of value to an evaluator, but is too detailed to include in the main body of the proposal. Some solicitations will require an appendix and will outline what material goes into the appendix. Most solicitations do not require an appendix and its use is optional if the page count allows for it. Like the other sections in your proposal, the appendix should be organized early to minimize confusion. Although the appendix will help you organize material for your proposal, it should not contain material that is not directly related to your proposal. The appendix should be referenced in the proposal and provide information that enhances or supplements the topic being discussed. Appendices should not be used as dumping grounds for excess material. Material should be relevant and accessible. You should not depend on material in an appendix to satisfy requirements in a solicitation. Therefore, any material that is needed to satisfy a requirement in the solicitation should be in the main body of the proposal.

General Writing Guidelines

Dynamic and direct prose is fundamental to winning proposals because it demonstrates a carefully conceived approach to a customer's needs. Muddled writing turns off evaluators. They are looking for sincerity that expresses your ability to do the job correctly and for creditability that the project will be completed as promised in the proposal. They are looking for specific information that demonstrates that you are proposing the optimum approach to meet their needs.



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For additional general writing guidelines, refer to *Clear Technical Writing* by John A. Brogan and *Effective Business Writing* by M.V. Piotrowski.

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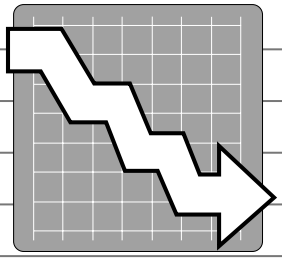
Do not use complicated technical terms or equations. This will turn off most reviewers.

Define all symbols, acronyms, and discipline-peculiar terms.

A well done graphic can be a tremendous aid in helping the reader fully understand.



Writing dynamic and direct prose demands that you use only those words that convey your message. Needless words cause confusion and detract from the overall presentation. Some suggestions on how to write dynamically and directly include the following:

- Do not be too self-conscious about grammar. Think of these rules as aids to effective communication. They are always subordinate to getting the message across to that flesh-and-blood reader who is evaluating the proposal. The message should be simple and straightforward in its reasoning, without lots of unnecessary padding or homage to the sometimes rigid rules of grammar.

- Do not deal in generalities and/or sweeping statements. Such statements weaken an otherwise acceptable proposal. By being specific, writers convey to the reader that there is a real person who will assume responsibility for managing the project, the person has successfully managed a similar project, and the organization has given serious thought to the proposed effort.

- Use the active voice more than the passive voice. The active voice gives the narrative vitality and forward movement, whereas the passive voice plods along. There are, of course, advantages to each. For example, the active voice is a more natural dynamic order for the English language and is one that we are more familiar with because we use it when we speak. Also, it is more functional because it is more readable and more easily understood. Sentences written in the passive voice are less dynamic and direct because the subject merely receives the action rather than performing it. The key is to write to express, not to impress.

- Use pronouns. Pronouns will not detract from the message. Give the evaluators the impression you are writing directly to them. Although pronouns should be used in proposals, they should not be overused, especially “your” which crops up too often.

- Select words the evaluators can readily understand. It is great to have an extensive vocabulary. But having a large inventory of words is of little value when an evaluator has a different inventory. In such instances, writers must use words the evaluators are more likely to understand. Thus, avoid words that hinder or stop the reader’s progress.

- Use sketches, charts, photos, or tables whenever these can help make a point. Captions or labels should be hard-hitting,

convincing, and informative. If you cannot say something meaningful about an illustration, revise it. If you still cannot write a meaningful caption for the revised illustration, do not use it.

- Provide the most important information first. Nowadays, readers have less patience and prefer to receive the most important point first, the so-called descending or anticlimactic order. This is the order of presentation that is becoming the norm rather that the exception today.

- The first paragraph of a section should introduce the main topic and sets the tone for the narrative. The paragraphs that follow the opening describe and discuss the topic. The closing paragraph summarizes the section or subsection's major points. Remember that the final portion of the section is what remains with the reader.

Finally, after writing the initial or subsequent drafts for a proposal, the writers should ask and answer these questions:

- Does the narrative demonstrate a clear understanding of the requirements?
- Is each requirement and evaluation criteria addressed clearly and directly?
- Are the win strategies woven into the text?
- Is the approach persuasive enough to influence the evaluators to accept the message being conveyed by the proposal?

If the answer to any of these questions is negative to any degree, you probably do not have a winning proposal and should critically review the content of the proposal.

There are many approaches to producing winning proposals, but there is no substitute for clear, effective writing. Persuasive communication is the key to selling, and selling is what proposals are all about!

Format and Style Guidelines

These format and style guidelines present writing, graphic, and publication standards designed for proposals. Whether you are a PI, writer, or editor you will find them helpful for producing consistent and correct proposal text and graphics. These guidelines give practical guidance for effective proposal writing. A style for proposals has evolved as a direct result of evaluator needs—

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"Old salesmen never die—they just get out of commission."

—Unknown

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simplicity, clarity, consistency, and responsiveness. The physical look and feel of a proposal should be such that the evaluator wants to pick it up and read it. Illustrations help the reader to easily understand parts of the proposal that may be difficult to comprehend and make the proposal more pleasing to the eye.

Proposal graphics are different and more specialized than other types of art. The overriding focus is on the concise communication of technical ideas. The relationship between graphics and text can best be summarized as follows:

Graphics	Text
• Present information • Prove assertions • Show results of technical and programmatic work • Show proof of superiority • Convey more information in less space than text • Reach many readers faster than text	• Clarifies, amplifies, and focuses relevance and importance • Maintains the thread of continuity and organization • Delivers the message

Graphics and text must play together, but effectiveness increases as each becomes capable of standing alone. As we shared earlier, it is wise to develop your graphics early in the proposal development process because some graphics require a lot of time to conceive and produce, and graphics often contain the proof to assertions made in the text, thereby simplifying text writing.

Use of publication staff to produce final graphics and to edit and format text is strongly recommended. At MSFC the Proposal Production Team within the Technical Illustration and Publications Office provides the capability for systematic technical editing; page assembly; incorporation of tables, figures, and photographs into the document; and production of the complete document for reviews and final submission (see Appendix J). Graphics are normally developed separately from text and as much as 50 percent of a proposal may be graphic in nature. Care should be taken that the text relates directly to the graphic content. The PI, or a designated document coordinator, should be the single point of contact to transmit proposal material back and forth from publications. Editing of proposal material by a technical editor is not done until the material is near the final state in terms of content. After technical editing, changes to text must be done using a hardcopy and markup. An exception to this rule occurs if a major rewrite of a section is done. Then an electronic submission can be made with subsequent editing of the new material.

If improperly used, complex images can be confusing. Keep it simple.

The following are suggested guidelines for proposal formats:

Font

- Suggested fonts—Arial, Courier, Palatino, Times, Times New Roman
- When using Times and Times New Roman, use no smaller than 11 point
- Text font should not be any smaller than 10 or larger than 12 point
- Do not use different fonts throughout the text, but different fonts for tables and figures are good
- For tables and figures, use no smaller than 8 point but do use a font smaller than the font of the text
- Use **bold** letters when emphasizing instead of underlining, *italics,* or all CAPITAL LETTERS
- **Bold** only key words to avoid over emphasizing.

Margins

- Nothing needs to be on the outside of the margins
- Margins should normally be:
  - Left—1.5 inches (to allow for binding)
  - Right—1 inch
  - Top—1 inch
  - Bottom—1 inch.

  When space is an issue, margins could be:
  - Left —0.75 inch (to allow for binding)
  - Right—0.5 inch
  - Top— 0.5 inch
  - Bottom—0.75 inch (to allow for page number)

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Remember that basic format guidelines are often specified in the solicitation, and should be followed precisely.

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"Be sure to spell check and proof-read the proposal carefully. Proposals with errors suggest that the team may be sloppy and not attentive to details. Would you want this type of team to perform your research?"

— Don Perkey

Avoid the use of foldouts if possible.

Spacing

- Do not begin each section on a new page (this avoids large blank spaces).
- Do not leave a heading at the bottom of a page without any text.
- Use two or three spaces between tables and figures with text.
- If a table uses up at least 3/4 of a page, do not begin anything else under it.

Page Numbers

- Page numbers should be aligned at the bottom center or right of the page.
- Do not number the first page.

Headings

- Headings and subheadings should be used as main ideas for what the reader is about to read.
- One or two spaces are suggested between a heading and preceding text.
- Make sure your headings and subheadings go with your proposal.
- Use one space between subheadings and text.
- Do not use italics or underline in headings and subheadings.
- Bold is preferred in headings and subheadings.

Lists

- Lists are easy and quick to read and are not wordy
- Use a numbered list when certain items are more important than others
- Use a bulleted list when all items are just as important
- Place a period at the end of the last item in the bulleted list, unless the bullets are complete sentences
- When paragraph lists are necessary, use numbers. For example: The four characteristics are (1) solid (2) blue (3) heavy, and (4) expensive. Paragraph lists are harder to read and not preferred.

Tables

- A table is a list of details or facts arranged in an orderly sequence—usually rows and columns—and are not considered an illustration since they are typed rather than reproduced from artwork.
- Tables are placed after the first time called out, as close to the first callout as possible.

- Do not divide a table on two separate pages unless it is too large to fit on one entire page.
- Do not separate a table from its caption.
- Capitalize the first letter of table when referring to a specific one or if it starts a sentence.
- Tables can be placed vertically or horizontally on the page.
- Tables must fit inside the margins.
- The caption is centered at the top of the table.
- Number the tables and figures sequentially throughout the proposal as—Table 1, table 2, table 3, etc.

Graphics/Figures

- Graphics are referred to as figures in a proposal.
- The term graphics refers to a variety of forms of line drawings, diagrams, clip art, paintings, or photographs.
- Figures may also be charts, graphs, or maps.
- Figures must be referenced in the text before it appears.
- Figures in your proposal should stay within the margins.
- Figures can be placed vertically or horizontally on the page.
- The number of the figure should appear under it and to the left.
- The title should be found next to the number and should be centered under the figure.
- Graphics help the reader easily understand parts of the proposal that may be difficult to comprehend and make the proposal more pleasing to the eye.

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For additional guidance on developing effective illustrations, refer to: *The Visual Display of Quantitative Information, and Envisioning Information* by Edward Tufte.

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Seek clarification if you are not sure about the submission instructions.

Proposal Submittal Guidelines

Before the final proposal has been completed and prepared for submission, there are a number of matters that need to be addressed. A careful and experienced PI understands the value and importance of sustaining the proposal effort beyond completion of the proposal itself, and for preparing for this time as much in advance as possible. Most solicitations contain simple item-by-item submission instructions such as how many copies are required and where they should be sent. Unfortunately, these requirements are often read at the last minute. It is imperative that you, as the PI, understand the submission requirements as early as possible and plan for them accordingly. If proposal submission instructions are not provided, the following information should be requested from the customer:

- Response due date and time: If not given, contact the person who released the solicitation. Early submission of your proposal may not be beneficial. Some sponsors do not open the proposals or start the evaluation until all proposals are received.
- Number of copies: The number of copies required will vary according to each solicitation. Some sponsors will ask for one master and then make their own duplicates of your proposal, and some will request as many as 15 or more.
- Address: A common question is, "To whom do we address the proposal?" Some PI's have been in contact with a particular individual but received the solicitation from another individual (often in the procurement organization). Even if you received the solicitation because of your conversations with the solicitation leader, *send the proposal to the name listed in the solicitation*.
- Packaging: Depending on the size of your proposal and the number of copies requested, it may be possible to use a large envelope or you may need to use multiple boxes. In all cases, the proposal must be sealed; do not submit open binders with your business card stapled to the corner.
- Markings: Because most proposals are submitted to a procurement organization and held there until the solicitation manager is ready to receive them, it is important to properly mark the proposal package with the solicitation number and project name. This will help prevent a proposal from becoming lost or misplaced, as it is possible that proposals for other projects are being submitted to the same office at the same time.

Delivery dates are always taken seriously. There have been instances when weeks of hard work was in vain because an inexperienced bidder thought the deadline was negotiable. Most customers clock proposals in and refuse to accept proposals that are late. **Assume that no proposals will be accepted after the delivery date and time and that there will be NO exceptions allowed.**

Your proposal should be delivered in a sealed envelope or box. There are many reasons why customers often ask that all proposals be delivered in sealed packages. One obvious and primary reason is to prevent accidental loss or disclosure of materials submitted in open packages.

Finally, consider where the proposal is to be delivered and how you will get it there. For proposals that are strategic opportunities and very important to your organization, consider delivering it in person. This ensures that your proposal is signed in and you receive a receipt. If you do not ensure that your proposal has arrived on time and has been signed in, you may be disqualified for missing the deadline. Another way of sending your proposal is via an overnight express company. If your proposal does not warrant personal delivery, overnight express services usually provide a safe and convenient method for transporting your proposal. In addition, they offer the ability to trace a shipment if it has not arrived. Also, be aware of the check-in time. If proposals are due at 10:00 a.m., and your delivery is afternoon at 3:00 p.m., you may be disqualified. However, even though these services guarantee delivery or your money back, twenty-five or fifty dollars will not compensate you for an effort that you did not win because your proposal was lost en route or delivered late.

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Proposal delivery is not the time to save pennies at the expense of losing a proposal

On-time delivery is critical—don't blow it—plan for the unexpected ! ! !

REVIEW AND APPROVAL PROCESS

Good proposal reviews are indispensable to winning. They are troublesome and ineffective only if we allow them to be. A well-thought-out review strategy, a sound review plan, and bulldog tenacity about meeting deadlines will make proposal reviews more useful and meaningful, reduce the stress associated with the process, and substantially increase the chances of winning.

Opinions vary greatly as to why and how proposal reviews should be performed. While we could write a complete chapter on why it is helpful to have a formal review process, in the interest of time we will assume that it is accepted that the proposal review can be the most critical step in the proposal development effort. Formal review teams can be a big help or a big waste. Given the time and effort formal reviews consume, your organization should be committed to ensuring that the reviews will heavily influence proposal results in a positive manner, and therefore will be a big help. It must be recognized that interminable and indecisive reviews demotivate and destroy the morale of the proposal team.

This section will describe the process the MSFC Engineering Directorate plans to follow on larger proposals that are submitted to external parties. Other organization may choose to adopt/modify any or all of this process. On solicitations that involve multiple parties within the Engineering Directorate, the Engineering

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For additional guidance on conducting format reviews, refer to TRW Proposal Operations: *How to Plan and Write Winning Proposals.* (TRW proprietary—for NASA employee use only).

This handbook focuses on developing a written proposal and does not attempt to implement a detailed review process. The Engineering Technology Development Office should be consulted for advice in this area.

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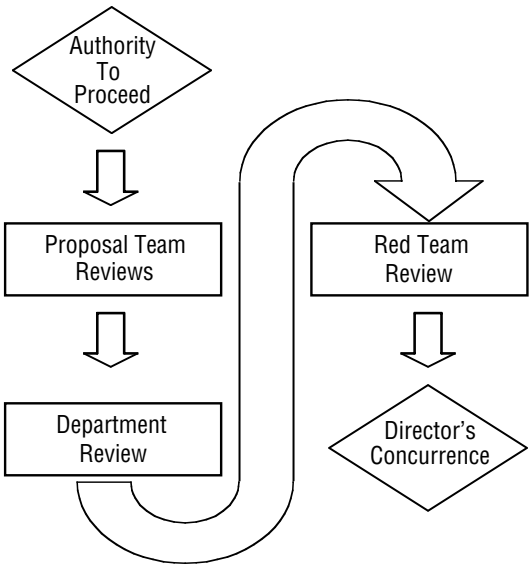
Wouldn't it make life easier if we could only delay these reviews until after the proposal is delivered.

Technology Development Office will normally manage and facilitate this process for the Engineering Directorate. While it is essential that proposal reviews be performed, the process must be flexible and may vary greatly. **This handbook does not intend to provide the minute details of how to conduct the various reviews, but rather how to adequately prepare for the reviews.**

The Engineering Technology Development Office will publish a formal review plan for each major solicitation as soon as the details of the solicitation schedule are known. This plan will list all proposal reviews, identify the objectives of each review, present the review schedule, and describe the process by which each review will be accomplished. Everybody on the proposal development team should know how, when, and why reviews will happen. Impending reviews are great motivators for those who might otherwise be slack about getting their work done on time.

As PI, even if you have done everything else right, the review will flop if the team does not stick to the schedule. You cannot have a review without anything to review. A partial draft is little better than no draft. **Demand that schedule deadlines be met!** Every slip in the schedule reduces the quality of proposal drafts and threatens the ability to achieve completeness for review. Enforce the schedule on a daily basis. Any slips ought to cause a demand for immediate recovery. Mean business and let everyone know it.

Parts, or all, of this process may be adopted for internal proposals at the discretion of the proposing organization.



Authority to Proceed

This is a key step in the process that is often taken for granted. It is essential that each PI present the following to department/group management before proceeding with development of the proposal:

- Proposal themes
- Resource plans
- Budget estimates
- Draft schedules
- Proposed personnel assignments and teaming arrangements
- Proposal writing and review plans.

At this stage, the PI and the proposal development team should expect department management to ask the following questions:

- Does the Engineering Directorate have the available manpower to prepare a winning proposal in the given time?
- Does the Engineering Directorate have the available appropriate expertise and adequate resources to accomplish this effort if selected?
- Is the proposed effort within our mission area?
- Has my organization done the necessary preproposal homework to be prepared to start the proposal development on a timely basis?
- Have the appropriate teaming arrangements been made?
- Have we done an analysis of the competition?
- Why us?
- Do we think we can win?

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You may also want to get colleagues who are not a part of your proposal development team to review your proposal.

If management concurs with proceeding with the proposal, they have a responsibility to assist in offloading other assignments of the proposal team, if required, to allow the proposal team the time necessary to prepare a quality proposal that has a good opportunity to be selected. Management, or the department's Technology Representative, will notify the Engineering Technology Development Office immediately of the intent to propose so that appropriate proposal planning can be executed.

Remember that the review schedule is an integral part of the overall proposal development schedule. If reviews are too early, there is not enough time to produce a good draft. If the reviews are too late, productivity drops, the team loses interest, and time for making the proposal better slips away.

Proposal Team Reviews

Once the decision has been made to proceed with the proposal, the PI and the proposal development team members must continuously review the proposal. During proposal team reviews, the following should be evaluated:

Graphics
- Clearly compliant and consistent with solicitation
- Support assertion, prove the point, and offer specific evidence
- Are simple and easy to follow
- Key messages stand out—titles and captions lead to conclusion
- Details are relevant.

Text
- Clearly compliant and consistent with solicitation
- Text directs evaluator to the graphics
- Writing is straightforward, easy to understand
- Key messages are evident
- Assertions are supported by proof.

Overall
- Drafts are fully responsive to solicitation requirements
- Sections are consistent with themselves and with cost
- Graphics are used effectively
- Story is complete, logical, persuasive, and easy to understand
- The story supports the win strategies.

The proposal team review members must also ensure that technical, management, and cost approaches are properly positioning the team to win. The team must also ensure that the win strategies are being articulated responsively and persuasively.

It is especially valuable to evaluate your proposal from the customer's point of view. You can gain valuable insight into what the customer's real requirements are and how to best meet them. In order to do this, you must be able to answer questions such as—

- How will the proposal be evaluated?
- Who will evaluate it?
- What criteria will be used?
- How can you be sure one area is most important?
- Is there anything that can be done to help the evaluation?

Storyboard walls are highly recommended if there are multiple proposal writers. This is an excellent place to conduct proposal team reviews. Storyboarding is a technique adapted from Hollywood movie planning to give visibility to and to ensure a flowing, coherent story. All materials, including text and graphics, are pinned to walls. The material on the walls is the proposal at any point in time—if it is not on the wall, it does not exist. This permits early and frequent review and feedback to authors.

During a typical proposal team review, the PI issues review instructions and the coauthors would take complete drafts of their sections and pin them to the wall in the appropriate space. All team members are given an opportunity to review the entire proposal and make comments on comment sheets. A review meeting is then convened at the wall, the authors respond to reviewer comments, and the team reaches agreement on the appropriate way to respond to the comments.

The use of storyboarding builds consistency and coherence into the proposal. It also encourages collaboration and minimizes confusion and unexpected surprises by making everyone aware of the status at all times.

Iterative reviewing is necessary to keep the proposal team working together in the same direction. All proposal activities from early planning through drafts should be reviewed iteratively.

Department Review

The next step in the process, the department review, should happen approximately half-way through the review process and should be executed by the individual department. The specifics of this

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If there are Co-investigators from outside organizations, you may want to include representatives from those organizations in the overall review process.

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Do not wait until the last minute to complete your proposal write up.

"A proposal sent in without a Red Team Review will automatically be marked down by 20–40 percent."

—Art Stephenson

execution will be left to the individual department, but the following issues must be addressed:

- Evaluate technical feasibility/viability of the proposed effort
- Evaluate clarity, coherence, and responsiveness of the proposal to the solicitation
- Evaluate credibility of the schedule
- Evaluate the adequate definition of the cost estimates and determine their credibility
- Evaluate the definition of clear, concise, and periodic deliverables
- Evaluate whether risks are under control
- Evaluate whether the proposal is well organized and flows well
- Evaluate whether knowledge of both the competition and the state of the technology is demonstrated
- Evaluate whether MSFC Engineering Directorate organizational discriminators have been highlighted; i.e., why should we be selected?
- Recommend specific improvements.

After the Department Review Team has addressed each of these issues, the PI will be given an opportunity to implement the recommended changes before the Red Team Review begins. The department manager should appoint an individual to verify that the PI addressed changes recommended by the Department Review Team. This individual shall notify the Engineering Technology Development Office that the department manager has concurred with the proposal and it is ready to proceed to the next step in the process—The Red Team Review.

Red Team Review

The Red Team Review, which is a review by outside senior managers, engineers, and business people, should occur approximately two-thirds of the way through the review process and should be executed by the directorate, with facilitation provided by the Engineering Technology Development Office. If the review process has been followed diligently up to this point, the Red Team Review should uncover only minor problems. However, allow adequate time for corrections and recommendations to be implemented. The specifics of the Red Team Review are tailored to the individual proposal effort, but the following issues are always addressed:

- Emulate the Source Evaluation Board or Selection Review Team
- Assess adequacy of the solicitation compliance
- Ensure that what the customer is asking for is being offered
- Review consistency, compliance, and persuasiveness
- Recommend specific improvements.

Proposal teams need Red Team Reviews for many reasons. One of these is control. By their very nature, proposals are sometimes complex and collaborative projects. The process needs to be stopped to allow an uninvolved critical eye to look at the proposal to verify compliance, consistency, and clarity. Despite the PI's and the team's best efforts, proposals tend to drift. Authors may tend to slowly, step by step, move away from the solicitation and proposal themes. Another reason for a Red Team Review is scheduling. Experience has shown over and over that we do not get a complete draft of the proposal until the Red Team Review. The anticipated arrival of the Red Team on a certain date shapes the proposal effort. The authors recognize that the Red Team is the first hard date that needs to be met without exception. The final reason, and the strongest reason, is that a good Red Team Review improves the proposal and increases your chances of

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For additional guidance on conducting a Red Team Review, refer to *TRW Proposal Operations: Standards for Red Team Excellence.* (TRW proprietary—for NASA employee use only).

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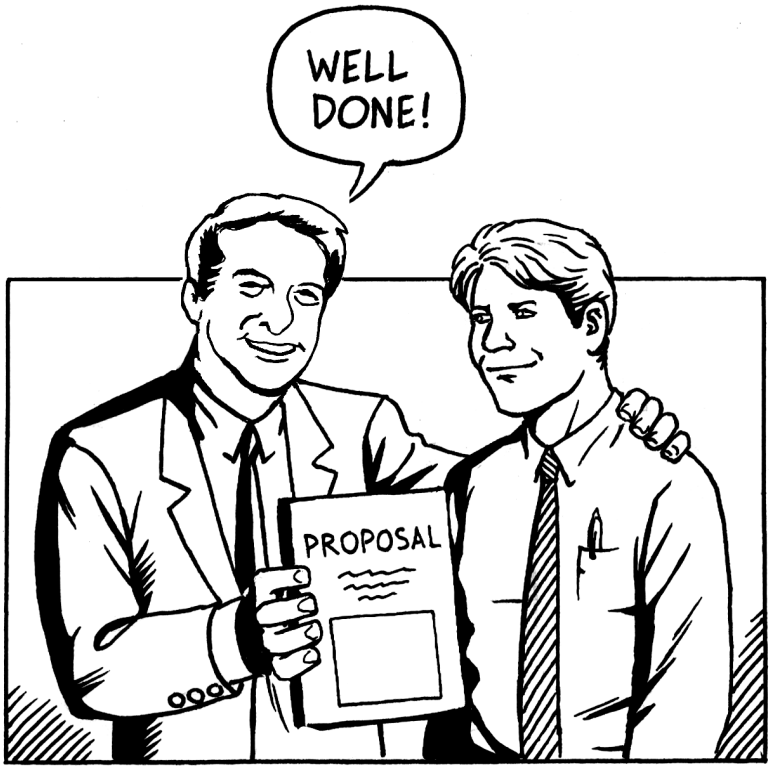
winning. The more time and energy you have invested in your proposal, the more your objectivity declines. A cold hard look is necessary to make sure that you have not been misled by your own sales job. Although the results of a Red Team evaluation can be absolutely devastating, there is an excellent chance that the customer would approach the proposal in the same way, find the same problems, and offer the same opinions.

Director's Concurrence

While the final step in the process is not a formal review, it is the culmination of all the previous steps. In this final step, the PI, accompanied by the review facilitator and Red Team Review Captain, present their proposal to the Engineering Director for his signature and concurrence. This presentation should take no more than 30 minutes and should be executed a day or so before the proposal is to be submitted. The purpose of this presentation is to ensure that all functional elements of the Engineering Directorate are included and that required Center-level coordination has been accomplished. The Director will also review the proposal to ensure that it fits within the Engineering Directorate's Strategic Plan and within the Center's roles and missions charter.



POSTPROPOSAL ACTIVITY

After the submission of a proposal, there is a natural tendency for people to sit back, take a few days off, or work on other tasks that were neglected during the proposal preparation period. But the job is not over yet.

When the proposal is submitted, keep the solicitation and a copy of the final proposal together in one file. Add any addenda, supplements, questions, answers, or other written communications between you and the customer. One of the main reasons for organizing these files is to facilitate any ongoing proposal evaluation activities before the effort is awarded. In many cases, there will be preaward steps such as questions and answers, oral presentations, and demonstrations that will require information from the proposal or even make use of parts of the proposal itself. Quite often, illustrations from the proposal are used in the oral presentation instead of being redrawn.

Even before learning if your proposal has been selected for award, the entire proposal team should conduct a lessons-learned brainstorming session. Make note of the following:

- Unexpected difficulties in conveying a particular message
- Your perceived weaknesses and strengths of the proposal
- Unexpected time-consuming proposal preparation activities.

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Don't turn out the light—the party isn't over.

NOTES

The PI should be aware of the proposal selection schedule, where the proposal stands in that process, and the decision regarding selection. This schedule is often given in the solicitation or response to receipt of the proposal. There is not much more that you can do once the proposal is submitted and the review process has begun.

Sometimes the customer will choose to exercise a question and answer period. In this phase of the proposal process, the customer is looking seriously at your proposal and may begin to develop a list of questions that you will need to answer. By analyzing these questions, you will be able to determine what section of your proposal is giving the evaluation team problems, and therefore what section you should be prepared to defend. This knowledge will direct you in preparing for an oral presentation, formal presentation, or a demonstration.

Oral presentations, if required, allow the evaluators to ask questions about your proposal before making a final decision. Before the oral presentation, ask the customer what is expected and who will be present for the presentation. The presentation should be customized to the specific opportunity and should reemphasize your strong points and counter any weaknesses. Don't underestimate orals, many proposals are won and lost at the podium.

While it is highly unlikely with research and technology proposals, but in conjunction with the oral presentation, a demonstration of the proposed technology may be required. This request by the customer may require a demonstration of the concept or related technology developments. During the demonstration there will be constant interaction between you and the customer. This interaction should provide you with some awareness of your position and whether the customer is accepting your proposal and demonstration. A successful demonstration may allow you to move to the negotiation phase.

If you are preselected, negotiations may be the final step before you are awarded the effort. The purpose of this step is to get agreement as to the exact cost and specific work to be done. The key to successful negotiations is to be prepared to explain and defend your solution and cost. The customer may be naïve and still may not fully understand the technology and the solution you are proposing.

Obviously, if your proposal is selected for sponsorship, you take the necessary actions to proceed with the effort, taking into consideration any instructions received from the sponsor. Maintaining good contact by phone or through personal meetings with the sponsor is important. The manner and frequency of this contact varies and should be discussed with the sponsor as soon as is practical.

If the proposal is not selected for sponsorship, consider requesting a debriefing concerning the proposed effort to ascertain what went wrong either with the technical, management, or cost content. Use these inputs as a learning exercise to apply to your next proposal. Oftentimes there are opportunities to submit a revised version of the same proposal at a later date or to another customer. Above all, do not engage in any debates with the person providing you the debriefing. This will serve no good purpose since that person cannot do anything about the decision by this point. However, a positive debriefing can result in the identification of a future effort worthy of proposing the next time an opportunity permits.

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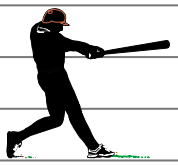


Even Babe Ruth didn't hit a home run every time.

Don't be afraid to ask, "What went wrong?"

SUMMARY

Regardless of the technical quality or value of the effort being proposed, you will probably win or lose on the proposal package alone. The proposal evaluation process does not normally give you a second chance to correct your mistakes or make additional points, so you have to make the most of every opportunity. If the time and resources are not available to put forth your best effort, you are wasting your time in preparing a second-rate proposal. It is also critical that your management be committed to providing you with every opportunity to succeed in preparing a winning proposal.

While all phases of proposal development are critical, the activities neglected by most proposal writers are the preproposal activities. In the past, many of these activities have rarely been performed within the MSFC Engineering Directorate, but they could be the difference in the future between winning and losing a proposed effort. There are so many critical items that can be taken care of in the weeks and months that precede the release of a particular solicitation. You must follow an incremental process, start early, and not try to do everything at once. Appendix K of this handbook provides the PI with a checklist to use throughout the entire process of proposal development. This checklist should be modified to fit your particular situation. Use this handbook to assist in your proposal development activities and to lead you to many successes in preparing winning proposals.

NOTES

Rome was not built in a day and a winning proposal normally cannot be developed in a week.

APPENDIX A
Overview of International Organization for Standardization (ISO) Guidelines

Applicability of MPG 8220.1 “Marshall Procedures and Guidelines for the Conduct of Research and Technology Activities”

This document defines the minimum requirements and guidelines for conduct of scientific and engineering research at the Marshall Space Flight Center. It establishes the procedures necessary to ensure that the products of a research activity meet all requirements. The actions defined are generic in nature, recognizing the wide variety of research activities covered by the document. In many cases the customer of the activity defines the review and validation activity required to meet their needs. For the purposes of this document, research activities are defined as efforts not specifically designated by a program and not requiring a project manager, systems engineer, or project scientist.

Applicability of MPG 7100.1 “Marshall Procedures and Guidelines for the Proposal Development Process”

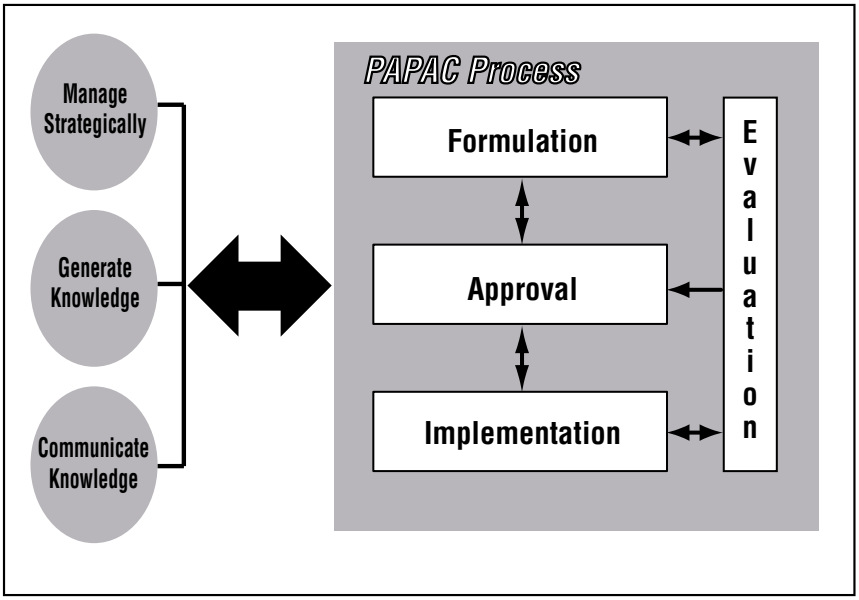
This document formulates a Center-wide process that enables the Marshall Space Flight Center to prepare proposals that will win new work in a competitive environment. This process is intended to help ensure that MSFC proposals address customer requirements with the aim of enhancing customer satisfaction. This procedure is required for all proposals with resource levels that meet or exceed the Program Management Council (PMC) threshold defined in the PMC charter. For the vast majority of proposals for research and technology (R&T) tasks within the Engineering Directorate, this document is not applicable due to the minimum PMC threshold levels. However, the document does contain a well-defined process that could aid the smaller R&T proposal developer.

Applicability of NPG 7120.5A “NASA Program and Project Management Processes and Requirements”

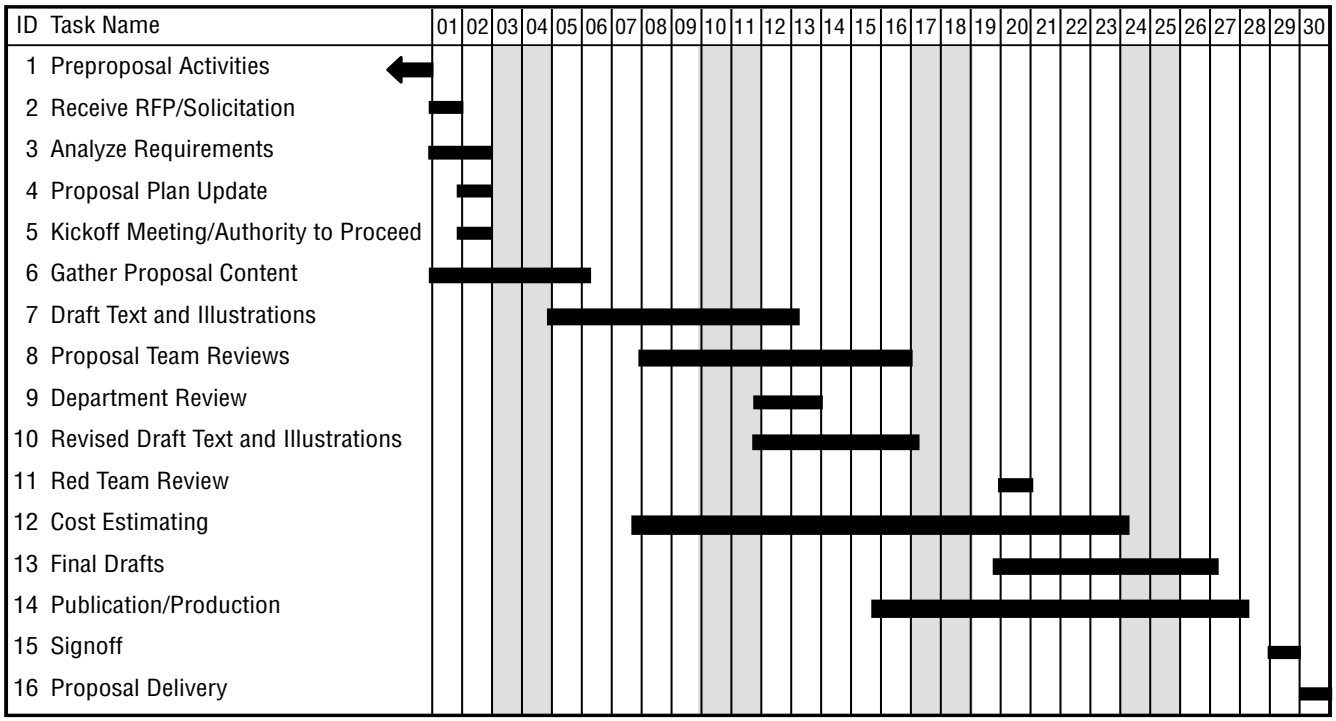
This document establishes the management system for processes, requirements, and responsibilities for implementing NPG 7120.4A “Program/Project Management.” This management system governs the formulation, approval, implementation, and evaluation of all Agency programs and projects established to provide aerospace products and capabilities (PAPAC). It is applicable to all programs and projects that provide space and aeronautics flight and ground systems, technologies, and operations. It is not required, but may be used, for research tasks associated with projects that report to major programs. A research proposal is not expected to address all the detailed requirements expressed in NPG 7120.5A, rather, the proposal should reflect an awareness of the program commitment agreement (PAC), as well as the program plan or project plan for the program or project to which the proposal is being submitted for sponsorship.

NASA’s process to PAPAC consists of four subprocesses necessary to accomplish activities for both programs and projects. They are equally applicable to the accomplishment of activities for which a research proposal is being developed. They are especially relative to supporting the technology requirements to enable NASA

to provide the national and international leadership in aerospace that is expressed by the NASA Strategic Enterprise Goals. The four subprocesses are: (1) Formulation, (2) approval, (3) implementation, and (4) evaluation. The interrelationship of these four PAPAC subprocesses with each other as well as with the Agency's three other crosscutting processes is illustrated in the following figure.



APPENDIX B
Example Proposal Development Schedule



APPENDIX C
Description of NASA Technology Readiness Levels

Technology readiness levels (TRLs) are a systematic metric/measurement system that supports assessments of the maturity of a particular technology and the consistent comparison of maturity between different types of technology. The TRL approach has been used in NASA space technology planning for many years. A summary view of the technology maturation process includes—

- Basic research in new technologies and concepts (targeting identified goals, but not necessarily specific systems)
- Focused technology development addressing specific technologies for one or more potential identified applications
- Technology development and demonstration for each specific application before the beginning of full system development of that application
- System development (through first unit fabrication)
- System launch and operations.

Technology Readiness Levels Summary*

TRL 1 Basic principles observed and reported

TRL 2 Technology concept and/or application formulated

TRL 3 Analytical and experimental critical function and/or characteristic proof-of-concept

TRL 4 Component and/or breadboard validation in laboratory environment

TRL 5 Component and/or breadboard validation in relevant environment

TRL 6 System/subsystem model or prototype demonstration in a relevant environment

TRL 7 System prototype demonstration in a space environment

TRL 8 Actual system completed and flight qualified through test and demonstration (ground or space)

TRL 9 Actual system flight proven through successful mission operations

The following paragraphs provide a descriptive discussion of each TRL, including an example of the type of activities that would characterize each TRL.

TRL 1 Basic principles observed and reported

This is the lowest level of technology maturation. At this level, scientific research begins to be translated into applied research and development. Examples might include studies of basic properties of materials (e.g., tensile strength as a function of temperature for a new fiber).

TRL 2 Technology concept and/or application formulated

Once basic physical principles are observed, then at the next level of maturation, practical applications of those characteristics can be invented or identified. For example, following the observation of high critical temperature (Htc) superconductivity, potential applications of the new material for thin film devices and in instrument systems (e.g., telescope sensors) can be defined. At this level, the application is still speculative—there is not experimental proof or detailed analysis to support the conjecture.

TRL 3 Analytical and experimental critical function and/or characteristic proof of concept

At this step in the maturation process, active research and development (R&D) is initiated. This must include both analytical studies to set the technology into an appropriate context and laboratory-based studies to physically validate that the analytical predictions are correct. These studies and experiments should constitute proof-of-concept validation of the applications/concepts formulated at TRL 2. For example, a concept for high-energy density matter (HEDM) propulsion might depend on slush or supercooled hydrogen as a propellant: TRL 3 might be attained when the concept-enabling phase/temperature/pressure for the fluid was achieved in a laboratory.

TRL 4 Component and/or breadboard validation in laboratory environment

Following successful proof-of-concept work, basic technological elements must be integrated to establish that the pieces will work together to achieve concept-enabling levels of performance for a component and/or breadboard. This validation must be devised to support the concept that was formulated earlier, and should also be consistent with the requirements of potential system applications. The validation is relatively low fidelity compared to the eventual system: It could be composed of ad hoc discrete components in a laboratory. For example, a TRL 4 demonstration of a new fuzzy logic approach to avionics might consist of testing the algorithms in a partially computer-based, partially bench-top component (e.g., fiber optic gyros) demonstration in a controls lab using simulated vehicle inputs.

TRL 5 Component and/or breadboard validation in relevant environment

At this level, the fidelity of the component and/or breadboard being tested has to increase significantly. The basic technological elements must be integrated with reasonably realistic supporting elements so that the total applications (component level, subsystem level, or system level) can be tested in a simulated or somewhat realistic environment. One or several new technologies might be involved in the demonstration. For example, a new type of solar photovoltaic material promising higher efficiencies would at this level be used in an actual fabricated solar array blanket that would be integrated with power supplies, supporting structure, etc. and tested in a thermal vacuum chamber with solar simulation capability.

TRL 6 System/subsystem model or prototype demonstration in a relevant environment (ground or space)

A major step in the level of fidelity of the technology demonstration follows the completion of TRL 5. At TRL 6, a representative model or prototype system, or system that would go well beyond ad hoc, patch-cord or discrete component level breadboarding, would be tested in a relevant environment. At this level, if the only relevant environment is the environment of space, then the model prototype must be demonstrated in space. Of course, the demonstration should be successful to represent a true TRL 6.

Not all technologies will undergo a TRL 6 demonstration. At this point the maturation step is driven more by assuring management confidence than by R&D requirements. The demonstration might represent an actual system application, or it might only be similar to the planned application, but using the same technologies. At this level, several-to-many new technologies might be integrated into the demonstration. For example, an innovative approach to high-temperature/low mass-radiators, involving liquid droplets and composite materials, would be demonstrated to TRL 6 by actually flying a working, subscale (but scalable) model of the system on a Space Shuttle or *International Space Station* pallet. In this example, the reason space is the relevant environment is that microgravity plus vacuum plus thermal environment effects will dictate the success/failure of the system—and the only way to validate the technology is in space.

TRL 7 System prototype demonstration in a space environment

TRL 7 is a significant step beyond TRL 6, requiring an actual system prototype demonstration in a space environment. It has not always been implemented in the past. In this case, the prototype should be near or at the scale of the planned operational system and the demonstration must take place in space. The driving purposes for achieving this level of maturity are to assure system engineering and development management confidence (more than for purposes of technology R&D). Therefore, the demonstration must be of a prototype of that application. Not all technologies in all systems will go to this level. TRL 7 would normally only be performed in cases where the technology and/or subsystem application is mission critical and relatively high risk. Example: The Mars Pathfinder Rover is a TRL 7 technology demonstration for future Mars's microrovers based on that system design. Example: X-vehicles are TRL 7, as are the demonstration projects planned in the New Millennium spacecraft program.

TRL 8 Actual system completed and flight qualified through test and demonstration (ground or space)

By definition, all technologies being applied in actual systems go through TRL 8. In almost all cases, this level is the end of true system development for most technology elements. Example: This would include Design, Development, Test, and Evaluation (DDT&E) through theoretical first unit (TFU) for a new reusable launch vehicle.

This might include integration of new technology into an existing system. Example: Loading and testing successfully a new control algorithm into the onboard computer on Hubble Space Telescope while in orbit.

TRL 9 Actual system flight proven through successful mission operations

By definition, all technologies being applied in actual systems go through TRL 9. In almost all cases, the end of last bug-fixing aspects of true system development. For example, small fixes/changes to address problems found following launch (through 30 days or some related date). This might include integration of new technology into an existing system (such as operating a new artificial intelligence tool into operational mission control at JSC). This TRL does not include planned product improvement of ongoing or reusable systems. For example, a new engine for an existing RLV would not start at TRL 9: Such technology upgrades would start over at the appropriate level in the TRL system.

* Extracted from a NASA white paper by John C. Mankins, April 6, 1995.

APPENDIX D

Supporting MSFC Organizations
Institutional Functions and Capabilities

Engineering Directorate

MSFC's Engineering Directorate (ED) provides highly skilled crosscutting engineering services for the MSFC product line directorates and offices, and provides Agency leadership of selected crosscutting engineering functions. To facilitate its assigned crosscutting engineering functions, ED is organized into two offices and four departments as follows:

ED02—Business Management Office

ED03—Engineering Technology Development Office

ED10—Avionics Department

ED20—Structures, Mechanics, and Thermal Department

ED30—Materials, Processes, and Manufacturing Department

ED40—Engineering Systems Department

ED takes a leading role in coordinating with other directorates for proposal development at the Center. ED holds the approval authority for their proposal budgets, selections, and reviews.

Business Management Office—The Business Management Office of ED functions to enable the departments to efficiently perform assignments/missions by consolidating the business aspects of the departments and standardizing those processes within ED. The resource/business leads from each department and office coordinate the proposal budget inputs and also support their department with any cost/budget related needs to the proposal development within their respective departments. The Business Management Office also supports the director in planning for process resources requirements to facilitate proposal efforts throughout the directorate.

Engineering Technology Development Office—The Engineering Technology Development Office (ETDO) has been established by ED to facilitate and coordinate the development of advanced technologies within the ED departments to support the MSFC product lines needs, other NASA programs, and other Government agencies. A structured and proactive technology department program will keep ED on the leading edge of technology advances. In addition, ETDO manages NASA's Space Environments and Effects (SEE) Program that is chartered to develop advanced SEE technologies across the Agency in support of NASA missions. The manager of ETDO serves as the new business point of contact for the directorate and manages the proposal development process for ED for larger proposal efforts.

Center Operations Directorate

Office of the Chief Information Officer—The Office of the Chief Information Officer (CIO) directs NASA CIO initiatives at MSFC; advises the Center Director on information technology (IT) issues; establishes IT policy, standards, and architecture; oversees execution of IT security program; defines MSFC IT strategic plans; and chairs the MSFC IT council. The CIO can assist with IT-related issues that one might have during the proposal development process.

Environmental Engineering Department—The Environmental Engineering Department develops, implements, and manages an environmental program that provides assurance of environmental compliance for programs, projects, and institutional efforts at all levels of the Center, including offsite locations. To support the various MSFC programs and serve as an environmental technical complement to the mission of the Center. The Environmental Engineering Department can assist in environmental compliance of proposals being submitted across the Center.

Facilities Engineering Department—The Facilities Engineering Department (FED) provides safe, reliable, and effective facilities and services to support the mission success of MSFC. The facilities at MSFC can be critical to the support required in the proposal development, where special facilities are required to carry out specific research needs.

Information Services Department—The Information Services Department (ISD) provides leadership and insight with the goal of supplying IT for programs and projects at MSFC and throughout the Agency. ISD services are provided by a partnership between ISD and four major service contractors (1) Computer Sciences Corporations (CSC), (2) the Program Information Systems Mission Services (PrISMS) contract; (3) Lockheed Martin, the Consolidated Space Operations Contract (CSOC); and (4) Cortez III Service Corporation, the Institutional Services for MSFC contract. In the proposal development process where specific services are required, this department can be of support in providing specific computer hardware, software, and maintenance support. This department also has the Technical Illustrations and Publications Office Proposal Production Team to provide dedicated support to the growing requirements to submit proposals. This team ensures that each proposal is in a format and appearance that will optimally demonstrate MSFC's professionalism, expertise, and ability. The Proposal Production Team adheres to a style and format that will distinguish your proposal in a consistent and uniform manner. A proposal not only represents you, but also reflects the dedication and talent put forth by this team.

Logistics Services Department—The Logistics Services Department provides the safest and highest quality transportation, supply, and equipment management products and services possible to our customers. Where special supplies, equipment, or transportation requirements are needed in the proposal development process this department can be useful in helping serve you.

Protective Services Department—The Protective Services Department provides a safe and secure workplace, and protects NASA Marshall critical infrastructure and technology. To be successful, our teamwork extends to all NASA Centers, Federal, and state law enforcement and intelligence agencies, academia, and industry. We perform these responsibilities in a manner that is responsive to the needs of our employees and is supportive of the MSFC mission. This department can ensure a safe workplace for any pre- and postproposal development needs.

Customer and Employee Relations Directorate

Education Programs Department—The Education Program at MSFC uses its unique resources to support educational excellence for all. We involve the educational community in our endeavors to inspire America's students, create learning opportunities, and enlighten inquisitive minds. In doing so, we seek to provide excellence in America's educational system by supporting America's teachers and faculty, inspiring America's students, facilitating development of instructional products, seeking creative and innovative solutions, and improving processes and services. These services can be used to hire summer faculty in support of proposal activities.

Employee and Organizational Development Department—The Employee and Organizational Development Department (EODD) strives to improve the effectiveness and efficiency of Government operations and to stimulate the participation of employees through the Awards Program, Co-Op Program, Educational Technology Center (EDTeC), Electronic Meeting System (EMS), Learning Channels, and training opportunities. EODD can work to coordinate new work development and proposal development training initiatives.

Government and Community Relations Department—The Government and Community Relations Department serves as the principle liaison between the Marshall Center and Government leaders at the local, state, and federal levels. In addition, we serve as the main interface with the public. Through services such as the Public Inquiries Office, the Speakers Bureau, the Freedom of Information Act, and the community-based outreach efforts, we strive to keep the public informed about Marshall's vital roles and missions within NASA. For any involvement with the proposal process, that requires Government, local, state, and federal level leaders this department can serve as the primary interface with the public.

Human Resources Department—The Human Resources Department provides a staffing and recruitment program that maintains a level of civil service FTEs to adequately support Center missions, proposal development, and maintains diversity in the Center's workforce. This department conducts a nationwide recruiting program that seeks out the best and brightest college graduates for the Center's workforce, incorporates a strategy into the recruiting program to increase the representation of minorities and individuals with disabilities in the Center's workforce, ensures an effective workforce that enables MSFC to succeed in a dynamic external environment, and provides quality products and services to our customers.

Internal Relations and Communications Department—The Internal Relations and Communications Department focuses on employee communications. The department uses several media tools to keep employees aware of Centerwide events and policies. These include the Marshall Star, Daily Planet, Inside Marshall (intranet), Marshall Center Homepage, electronic message boards, and employee television (ETV). These resources allow you to stay abreast of the events and policies required to develop and prepare proposals and communicate potential solicitations being announced.

Technology Transfer Department—The primary goal of the Technology Transfer Program at MSFC is to encourage broad use of Marshall-developed technologies by American private enterprise. *Working with Marshall Space Flight Center Technology Transfer Department* is designed to expedite the process of doing business with Marshall. Technology Transfer welcomes the opportunity to present our technologies and extends an invitation for you to partner with MSFC to maintain American industry as the world leaders

in technology development. In developing your proposal, one might consider the availability of resources within the Technology Development Department and the available opportunities to collaborate technologies with private enterprises.

Office of Chief Financial Officer

The Office of Chief Financial Officer (OCFO) serves as stewards of government resources. They develop and maintain processes and systems that ensure accurate financial control across the Center. If the proposal is awarded, the department business leads will ensure the resource requirements are submitted as part of the program operating plan (POP) and updates Center strategic planning agreements (SPAs) and collaborative work commitments (CWCs) are coordinated with OCFO.

Procurement Office

The Procurement Office serves to improve the effectiveness and efficiency of Center acquisitions through increased use of techniques and management tools that enhance contractor innovations and performance. After proposal selection is made, the Procurement Office can work with you to ensure contract agreements and methods of acquisition are appropriate for the task.

Systems Management Office

The Systems Management Office (SMO) provides a focal point for excellence in systems management including program and project management, systems engineering, and cost and economic analysis for MSFC programs and projects. SMO provides support and independent evaluations of projects and programs for compliance with the implementation of NPG 7120.5A, NASA Program and Project Management Processes and Requirements and, as appropriate, the *Marshall Quality Manual*. SMO determines consistency across product lines for Center systems engineering functions related to space systems program/projects including requirements development and requirements flowdown, program verification, and cost projections. SMO provides leadership, consultation services, and technical expertise on system engineering processes and provides support in forecasting costs to advanced program/project planning initiatives. Cost estimators from SMO may be required to assist you in preparing flight system proposals.

Office of Chief Counsel

The Office of Chief Counsel (OCC) supports MSFC's assigned roles and missions by providing sound, understandable, timely legal counsel and representation of the highest quality to all MSFC organization elements. The OCC is available to render legal assistance on legal issues that may arise during all phases of the proposal development process and post award.

Office of Inspector General

The MSFC Office of Inspector General (OIG) serves as an independent and objective organization to assist NASA by performing audits and investigations. The OIG prevents and detects fraud, waste, and abuse, and assists NASA management in promoting economy, efficiency, and effectiveness in its programs and operations. The OIG auditors and agents are located at NASA Headquarters and NASA Field Centers.

APPENDIX E
Example Cover Page

APPENDIX F
Technology Definitions

"Technology is defined as the practical application of knowledge to create the capability to do something entirely new or in an entirely new way. This can be contrasted to scientific research, which encompasses the discovery of new knowledge from which new technology is derived, and engineering which uses technology derived from this knowledge to solve specific technical problems."

—NASA Technology Plan

Technology Program—A technology program, under the definition of the NASA Program and Project Management Processes and Requirements document (NPG 7120.5A), is a major activity in the area of technology development that has defined goals, objectives, requirements, and funding levels and consists of one or more projects.

Technology Project—A technology project, again under the definition of NPG 7120.5A is a significant activity designated by a program and characterized as having defined goals, objectives, requirements, life-cycle costs (LCCs), a beginning, and an end. A technology project can be further defined as being comprised of technology tasks and nontechnology tasks.

Technology Task—A technology task is a defined subelement of a technology project that advances the state of the art in a single identifiable product. The product can be hardware, software, or information. It can be at the systems, subsystem, component, or basic material level.

Nontechnology Task—A task required by a technology project, that in-and-of-itself does not advance the state of the art.

Technology Workforce—A technology workforce is comprised of the following elements:

- Program management consists of the Program Manager and Deputy.
- Project management consists of the Project Manager and Deputy.
- Direct nontechnical support consists of the nontechnical support necessary to run a technology program including secretarial, business, purchasing, scheduling, finance, etc.
- Indirect nontechnical support consists of support provided to a technology program that is primarily related to maintenance of the Center infrastructure, e.g., security, property management, etc.
- Engineering support consists of the application of standard engineering/technical skills in design, analysis, and fabrication to a nontechnology task, i.e., one which does not advance the state of the art of the task or of the discipline/skill applied to the task.

- Research and technology (R&T) development consists of the application of science/engineering/technical skills in design, analysis, and fabrication of technology tasks, which advance the state of the art.

Total Technology Program Workforce—Includes all Center personnel associated with direct support of the program: Program/project management, direct nontechnical support, engineering support and R&T development. It does not include indirect support.

In-house R&T Core Workforce—Includes only personnel that are directly involved in technical activities associated with technology tasks that are being performed onsite or offsite by Center personnel.

It includes R&T development.
It includes engineering support that is an integral part of the internal R&T effort.
It does not include engineering support provided to a contractor.
It does not include program/project management.
It does not include direct nontechnical support.
It does not include indirect nontechnical support.

Basic R&T—Basic R&T are closely aligned with fundamental scientific research. The primary distinction being in the end goals of the research, which are often only perceptible in the minds of the individual researchers. This activity occurs at TRL 0, and is without exception discipline oriented.

Applied Technology Development—Applied technology development is the application of basic R&T to the solution of a particular problem. It occurs from TRL 1–TRL8.

Focused Technology Development—Focused technology development is independent of TRL. It relates to the definition of an area for concentration focusing on a class of problems. One can have focused programs at all levels of TRL, from 0 through 8.

Blue-Sky Technology—Technology that is required in the >20 year time. This is basic R&T and is focused on enabling the long-term strategic goals of the Agency.

Far-Term Technology—Technology that is required in the 6–20 year time frame. In general, this technology will tend to be a very low TRL-level activity that requires long-term development. By its very nature it tends to be discipline oriented, e.g. materials, electronics, optics, etc. It can also be oriented toward component/system development e.g. detectors, integrated electronics, smart structures, etc. or, process oriented, e.g., advanced optical figuring processes, nanotechnology fabrication, etc. It may also be software or information oriented.

Mid-Term Technology—Technology that is required in the 3–6 year time frame. In general, this technology tends to be mid-TRL technology that is applied i.e. oriented toward specific functional applications.

Near-Term Technology—Technology that is required in the 1–3 year time frame. This technology because of its time constraints must be at least mid-TRL and the focus is on tailoring the technology to program-specific requirements and to the demonstration of technology at the component, subsystem, and system level through ground-based test-beds and, if required, in space.

Advanced Technology—This encompasses both far-term and blue-sky technology and chronologically speaks to technology that is further than 6 years from reaching TRL 6.

Technology Push/Pull—

- The distinction between push and pull is a relative distinction that is dependent only upon who thought of it first.

- It is not related to TRL.

- If the originators of the mission concept identified the technology as needed, then it is pull.

- If the technologists surface a technology that is a potential solution to a mission problem—or enables an entirely new concept—then it is push, until it is accepted by the mission at which point it becomes pull. It remains pull until it is either successfully infused into the mission architecture or rejected as inapplicable or unsuccessful.

Technology Push—Technology push activity (by definition) is activity that is supported solely by a technology program. It continues as a push activity until it has gained acceptance by an Enterprise mission study/mission. (Acceptance is based on a combination of necessity, perceived risk, and the stage of development of the mission study in relation to the stage of development of the technology.)

Technology Pull—Technology pull is that technology that has been accepted as an integral part of an Enterprise mission study/mission. It is consequently supported by the mission study/mission either by itself or in collaboration with a technology program.

Technology Core Competency—The core technology competency of a Center is that unique concentration of technical expertise that resides physically at the Center (or a recognized formally constituted extension of that Center).

APPENDIX G
Example Personnel Resume

RESUME FOR PRINCIPAL INVESTIGATOR MIKE TINKER
NASA MARSHALL SPACE FLIGHT CENTER
MS ED21, Marshall Space Flight Center, AL 35812
TELE: (256) 544–4973; EMAIL: Mike.Tinker@msfc.nasa.gov

RELEVANT PROFESSIONAL EXPERIENCE

July 1989 to Present: *Aerospace Technologist/Structural Dynamics : NASA MSFC*

- Technical direction of dynamic modeling efforts for five-meter thin-film inflatable antenna/ collector with composite support struts
- Dynamic modeling, modal test planning, model correlation of shooting star solar thermal upper stage inflatable structure
- Technical coordination of team for dynamic testing, modeling, and model verification for Solar Orbital Transfer Vehicle inflatable solar concentrator assembly
- Technical direction of deployable aerobrake structural development study; material tests and modeling for deployable aeroassist vehicles
- Transient response and loads analysis of Space Shuttle and Spacelab, Hubble Space Telescope and Aeroassist Flight Experiment (AFE)
- Study and development of alternate modal survey test techniques for Space Shuttle payloads
- Team member for Space Station node modal testing and analysis; pretest analysis for X–33 ground vibration test.

July 1999 to Present: *Adjunct Associate Professor of Mechanical Engineering and Materials Science; Duke University*

- NASA advisor for thin-film inflatable structure research and dissertation of doctoral candidate, member of doctoral committee
- Collaboration with School of Engineering faculty in the research of thin-film inflatable structures.

EDUCATION

1989 Ph.D. Aerospace Engineering, Auburn University, Auburn, Alabama
Dissertation: Damping Phenomena in a Wire Rope Vibration Isolation System. Advisor: Professor Malcolm A. Cutchins

1985 M.S. Aerospace Engineering. Auburn University, Auburn, Alabama
Thesis: Coupling of Flexural and Torsional Vibrations of a Tapered Elastic Wing. Advisor: Professor Malcolm A. Cutchins

1983 B.S. Aerospace Engineering (cum laude), Auburn University, Auburn, Alabama.

RESEARCH INTERESTS

- Dynamics and design of thin-film and inflatable structures
- Modal test methods, including constrained boundary methods, alternative free-suspension residual flexibility and mass additive approaches, and localized dynamic stiffness techniques.

PROFESSIONAL SOCIETIES AND TECHNICAL COMMITTEES

Associate Fellow—American Institute of Aeronautics and Astronautics
Member—AIAA Space Inflatables Working Group
Member and Vice-Chair—AIAA Structural Dynamics Technical Committee
Member—AIAA Adaptive Structures Technical Committee
General Chair—Year 2000 Dynamics Specialists Conference
Technical Program Chair—1996 Dynamics Specialists Conference

AWARDS

Best Paper Award for Southeastern Simulation Conference, 1993
Marshall Space Flight Center: Numerous awards, including Incentive, Group Achievement, Outstanding Performance, Special Service, Technical Innovation, and Research & Technology
Who's Who in Science and Engineering, Selection for Millennium Edition, 2000–2001

SELECTED RELEVANT PUBLICATIONS

Tinker, M.; Lassiter, J.; Fischer, R.; and Schunk, G.: "Multidisciplinary Testing of Thin-Film Inflatable Structures," chapter to be published in *AIAA Progress in Astronautics and Aeronautics* Volume, 191, Gossamer Spacecraft: Membrane and Inflatable Structures Technology for Space Application, 2000.

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Tinker, M.; Leigh, L.; and Hamidzadeh, H.: "Dynamic Characterization of an Inflatable Concentrator for Solar Thermal Propulsion," *Proceedings of Gossamer Spacecraft Forum*, Seattle, WA, April 2001.

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APPENDIX H
Example Project Schedule

ID	Task Name	Duration		1st Quarter			2nd Quarter			3rd Quarter			4th Quarter			1st Quarter		
			Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1	Order materials	65 days?																
2	Define GEO environments	65 days?																
3	Generate dose-dept. profile	130 days?																
4	Modify existing test systems	130 days?																
5	Initiate material test	55 days?																
6	Interim annual report	56 days?																
7	Continue material testing	261 days?																
8	Final report	66 days?																

APPENDIX I
Cost Template

BUDGET SUMMARY for RESEARCH PROPOSAL

For (check one): __ Total Period of Performance from (M/D/Y) _____to _____
__ For Year ___ of ___ from (M/D/Y) _____ to _____

1. Civil Service Labor Costs
   a. This includes PMS taxes and other applicable charges. _____

2. Subcontracts
   a. Identify each Subcontractor and give total cost of subcontracts. _____

3. Other Direct Costs
   a. Consultants _____
   b. Capital Equipment _____
   c. Supplies _____
   d. Travel _____
   e. Other (Identify) _____

4. Subtotal _____

5. General and Administrative Costs
   a. Provide G&A Rates as defined by MSFC's Chief Financial Office (CFO) _____

6. Total Costs _____

7. Less Proposed Cost Sharing (if any) _____

8. Total Project Price _____

Instructions for Budget Summary

- Provide a complete Budget Summary for the total as well as each individual year of the proposed period of performance.

- Enter the proposed estimated costs on the lines provided.

- Provide, as attachments, detailed computations of all estimates in each cost category, with narratives as required to fully explain each proposed cost as follows:

1. Civil Service Labor Costs: This cost is NOT a civil servant's salary, but rather includes institutional costs associated with civil service labor, such as Program Management Sxxx (PMS) taxes, computer costs (i.e., ODIN), etc. This cost is established by the Office of the Chief Financial Officer (OCFO) at MSFC and is updated annually. It may also vary from Directorate to Directorate.

2. Subcontracts: For each proposed subcontractor, list the subcontractor by name and the number of hours proposed. Identify how the subcontractor was selected (competitive or noncompetitive) and how the proposed costs were determined to be fair and reasonable.

3. Other Direct Costs:
   a) Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the project, and rates of pay.

   b) Equipment: List separately. Explain the need for items costing more than $5,000. Describe basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested to be made as a direct charge under this award must include the equipment description, how it will be used in the conduct of the basic research proposed, and why it cannot be purchased with indirect funds.

   c) Supplies: Provide general categories of needed supplies and the estimated cost.

   d) Travel: Describe the purpose of the proposed travel in relation to the contract and provide the basis of estimate, including information on destination and number of travelers where known.
   NOTE: Civil service travel dollars are generally not allowed on proposals submitted to NASA solicitations.

   e) Other: Enter the total of direct costs not already covered. Attach an itemized list explaining the need for each item and the basis for the estimate.

4. Subtotal: Enter the sum of items 1 through 3.

5. General and Administrative (G&A) Costs: While in many cases this cost would not be applicable, in selected cases it would include any facility cost not covered in item #3, Other Direct Costs.

6. Total Costs: Enter the sum of items 4 and 5.

7. Proposed Cost Sharing (if any): Cost to be shared by other parties.

8. Total Project Price: Total cost of project: All costs less any cost sharing. Subtract item 7 from item 6 to obtain Total Project Price.

APPENDIX J

Capabilities and Guidelines of MSFC Proposal Production Team

Ensure that each MSFC proposal, regardless of size, is in a format and appearance that will optimally demonstrate MSFC's professionalism, expertise, and ability.

Services include—

- Text editing—Clear and concise content, grammar, punctuation, style, and format
- Graphics production—Technical illustration, scanning, conversion
- Proposal layout—Ensure uniformity and compliance to proposal guidelines
- Camera-ready art—Electronically formatted to be sent to reproduction
- Coordination with reproduction and printing.

Other—

- Coordinate scheduling among development and production groups
- Establish an MSFC single point of contact
- Provide guidelines for submission of material

Services are provided by Cortez III in Building 4200, Room G28

Supervisor: Janice Robinson, 544–4580
MSFC POC: Jane Posey, 544–4852
MSFC Form 1678, Visual Aids Requisition, with fund code (5 digits)

Process Recommendations—

Scheduling—

- If assistance is anticipated, the Cortez III Proposal Production Team (PPT) should be notified as soon as possible of an upcoming proposal.

- We will assist you in formulating a production schedule that will clarify and enhance the processes involved.

- Submit Visual Aids Requisition, MSFC Form 1678, with signature and 5-digit programmatic code.

- Assign a single organizational point of contact to be liaison with the PPT.

Submitting to the PPT—

- All text should be submitted in Microsoft Word and sent electronically to the PPT.

- Graphics, tables, and charts should be kept separate from the text (not embedded) and if submitted electronically, should be in JPG, GIFF, or TIFF formats with a minimum 300-dpi resolution. Graphics in native formats would be preferred over being inserted into Powerpoint, Word, etc. We provide a scanning service for original images.

- The Team will create new figures and tables from your submissions or rough sketches.

- Photographs will be scanned by the PPT at 300 dpi.

The Process—

Editors—

- Involve the assigned editor(s) as soon as possible. Gain the advantage of concise, clear, reader friendly text that enhances the evaluators ability to hear your message.

- Also, they can be a point of contact for submissions, issue style guides to contributors (especially outside MSFC), and they can be the keeper of the baseline document so versions are kept current for efficiency and accuracy.

- The editors will review the AO or NRA to assess their workload, the scope of the product we are to produce, and provide you with an outline of subject matter and activities.

- The editors should be involved as early as receipt of the Blue Team comments.

- The editors will also review all graphics and tables to provide continuity in style and subject matter for the readers.

- The editors will edit your document for grammar, style, spelling, consistency, and organization. The Government Printing Office (GPO) Style Guide will be the baseline reference. Deviation from GPO recommendations will be honored if it will enhance the ability of the reader to assess your document. These situations should be discussed early.

- As your text is finalized, the editors will submit your text to the illustrators for layout.

- **It is necessary to allow the editors a review cycle after all layouts have been completed or modified.**

Sample Editorial Recommendations—

- Acronyms—First time used, spell them out. We usually try to look them up ourselves but we always have to go back and ask the author if they are correct or ask them to provide appropriate definitions.

- Units of measure—Consistency is the key here, using metric or standard abbreviations throughout the document.

- Word documents—The old typewriter rule used to be two spaces after a period, colon, etc. That rule has been changed since the advent of computers. One space only.

- When signs or symbols are used in the document, please spell out the symbol name in parenthesis on the first use. Many times font problems, e-mail, or other glitches cause signs and symbols not to be recognized as intended.

- Please reference figures and tables in the text with a figure caption and table title. These can be put in parenthesis and will be used for reference purposes in the final layout.

- References should be called out in the text by author name in parenthesis.

- Our references are formatted last name first, no space between initials, as follows:
  Baker, D.N.; Allen, J.H.; Kanekal, S.G.; and Reeves, G.D.: "Disturbed Space Environment May Have Been Related to Pager Satellite Failure," EOS, Vol. 79, pp. 477–483, 1998.

- Avoid long sentences and long paragraphs. If more than two items are cited within a sentence, make them into a list.

- Capitalize the first letter of the first word in all series following a colon.

- Minimize use of prepositional phrases to start sentences and paragraphs.

- Close attention should be given to the page count limit as stated in the AO/NRA.

Illustrators—

- A good layout can help organize information and emphasize critical points.

- Many times graphics are used from previous proposals, projects, presentations. These can be submitted early and formatted for the current proposal. New artwork should be submitted early enough to not slow down the layout process. A new graphic could take several days to produce!

- The illustrators are responsible for having all of the figures and tables reviewed by the editors.

- The illustrators are responsible for formatting and stylizing any figure or table to the format and standards set by our office to produce a professional document.

- The illustrators will provide the author with a review copy of the requested figure or table before insertion to the layout.

- The illustrators have the responsibility to layout the document according to approved formats, specified by the AO/NRA, NASA standards, and professional industry standards.

- The illustrators will also be responsible for formatting the document in such a manner that will gain the most efficiency when your document is reproduced or printed. The PPT will be responsible for scheduling and transmitting your document to MSFC Reproduction services and ensuring that you receive a quality product. A signed MSFC Form 150 should be completed and submitted to the Reproduction Office in advance of the final printing.

Overtime Factors—

There are many factors that contribute to the need for overtime in the production of proposals. Some of these include:

- Getting started—
  Participants work to the pressure of the deadline rather than getting/giving full-time commitment from the start for preliminary groundwork and baseline documents.

- Not utilizing the document manager—
  Establish a single technical point of contact (POC) through which all text must be submitted. Resolve conflicting and inconsistent information issues before submitting to the editors. Establish a baseline document from which all contributors must work. Not working from the latest version can also result in wasted conflicting revisions, comments, and queries.

- Not utilizing resources—
  Being overwhelmed with the task, pride of authorship, or control issues limit the use of resources that could more efficiently and professionally prepare the requirement. Use your time more productively and delegate the items that are not content critical to others. (See what the PPT can do for you!)

- Number of pages to be produced—
  A 100-page document takes longer to coordinate, format, and finalize than a 30-page document.

- Number of illustrations (i.e., figures, tables, front cover art, etc.)—
  The earlier these items can be submitted for production, the more efficient production will be. Submit these early, and have them completed when text is submitted and finalized.

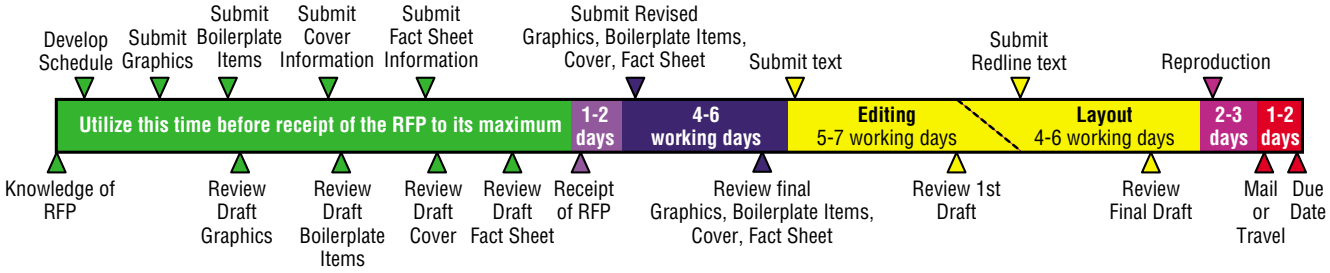
- Format of text and artwork submissions—
  Follow editors' guidelines to submit text in a clear format, so to decrease timely author queries. The editors have prepared recommended guidelines for all contributors to follow from the beginning of the project.

- When artwork is embedded in Microsoft Word or Powerpoint, the illustrators spend as much time extracting the artwork than the time it may have taken to produce the artwork. Submit artwork in native formats.

- All contributing partners meeting schedules and limitations for submissions—
  Offsite partners are generally the last to submit. All contributors want to submit more information, rather than making their first efforts concise. While typesetting does gain space, the addition of figures, organization, and layout may not leave room for that extra page or two of submitted text.

PPT Timeline

Upon knowledge of the request for proposal (RFP), the following should occur to expedite the editing, layout, and design process:
(Times based on an 80 page document)



- Work backwards from the due date in developing your schedule for each section and process.

- In most cases, the PI will know months in advance of an upcoming RFP. To utilize this time to its maximum, known information should be submitted to the PPT as soon as possible.

- Submit graphics—tables, charts, photos, etc. Some of these may have to be redrawn, so submit these as soon as possible.

- Submit boilerplate items—resumes, statement of work, letters of endorsement, etc. Many times, these need to be revised to be consistent with the rest of the document. We can be working on these while you are working on the text.

- Submit cover information.

- Submit fact sheet information.

- Submit text—text should be submitted in order and within the page limitations specified by the RFP.

APPENDIX K
Proposal Development Checklists

Preproposal Activities

- ☐ Develop win strategies
- ☐ Understand the characteristics of a winning proposal
- ☐ Develop proposal plan
  - ☐ Develop rigid proposal outline
  - ☐ Identify proposal team
- ☐ Qualify the customer
- ☐ Prepare competitive analysis
- ☐ Perform industry survey
- ☐ Perform commercialization assessment
- ☐ Analyze draft solicitation requirements
- ☐ Highlight evaluation factors
- ☐ Qualify evaluators
- ☐ Establish collaboration
- ☐ Anticipate illustrations
- ☐ Anticipate needed institutional support

Proposal Preparations

- ☐ Analyze solicitation requirements
- ☐ Kickoff meeting
- ☐ Proposal content
  - ☐ Letter of transmittal
  - ☐ Cover page
  - ☐ Executive Summery
  - ☐ Technical section
  - ☐ Management section
  - ☐ Cost section
  - ☐ Letters of commitment
  - ☐ Appendices

Proposal Preparations (Continued)

- ☐ Preparation for delivery
  - ☐ Obtain packaging materials
  - ☐ Prepare outside address label
  - ☐ Check courier service schedules (number of days and time required for delivery)

Review and Approval Process

- ☐ Establish a review plan
- ☐ Plan/conduct Proposal Team Reviews
- ☐ Plan/conduct Department Review
- ☐ Plan/conduct Red Team Review
- ☐ Plan/acquire Director's concurrence

Postproposal Activities

- ☐ File solicitation, master copy of proposal, and other written documentation
- ☐ Request a debriefing (if not accepted)
- ☐ Lessons learned/brainstorming session
- ☐ Prepare for questions/oral presentation/demonstration

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