



Case Study Methodology



Creating Case Studies in NASA Project Management: A Methodology for Case Writing and Implementation

At Goddard Space Flight Center (GSFC), knowledge management (KM) is built on an architecture of linked practices. Together these practices make up an integrated approach to organizational learning, with a focus on improving project management. One of the pillars of the Goddard KM architecture is the case-study method, a powerful, proven learning tool. Case studies are being used at GSFC, and increasingly at other NASA centers, in forums ranging from workshops and conferences to training programs and interactive media.

This guide to NASA case writing first examines some principles of the case-study method. It then outlines the objectives of case-based learning at GSFC/NASA. The second section describes the step-by-step methodology that the GSFC Office of the Chief Knowledge Officer (OCKO) uses to develop, publish, and implement cases. It includes two appendices: a table describing the types of case studies developed at Goddard (**Appendix 1**), and an outline and task list for the case-creation process (**Appendix 2**).

What Is a “Case Study”?

A case study (or case story) may be understood best as a narrative, based on actual events, that creates an opportunity for conversation, problem analysis, and virtual decision-making. An effective case study transfers specific knowledge by placing the student or workshop participant in a position to think through choices faced by decision-makers in real-life situations. By confronting actual scenarios, participants develop and refine analytical skills for solving similar problems in their own projects.

The rationale for the case method is that organizational learning is most effective when knowledge is shared in usable ways among organization members, and that knowledge is most usable when it is contextual—when it relates to one’s own experience. Inert information databases, as in a lessons-learned system, may be part of a knowledge-management process, but by themselves, they are insufficient. To create dynamic organizational learning, the context of the stories must be brought into the KM system. The case study is the main vehicle to do this.

Decision-oriented case studies—the type developed and used at GSFC—are structured and written from the viewpoint of a key player, the protagonist. They are framed around information available to the protagonist at the time of the event. The case typically builds to a point where the decision-maker is confronted with open-ended choices. The reader is left to analyze the information and scenarios and then make critical decisions based on contextual analysis.

A NASA case study is a way to disseminate the experience and wisdom embedded in the stories of NASA missions to managers and project team members. A documented NASA case story engages participants intellectually and emotionally through their involvement in virtual decision-making, sharpening their analytical, problem-solving, and management skills by sparking insight and creating connections between events, incidents, or systems.

The case-study method is especially effective in forums in which key players in the project are present. Whenever possible, case-based workshops at NASA involve central personnel from a project or mission (or program), providing opportunities for key players to present material, reflect on project insights, and share contextual knowledge. Hearing the story “from the horse’s mouth” (which may also take the form of quotations from interviews conducted for the case) creates an invaluable dialogue and can impart deeper insight. By hearing directly from those who were intimately involved with the actual events, participants have the benefit of learning from the decision-making process itself.

Case-based learning at NASA is active, experiential, and takes place within a context—all keys to the effectiveness of the case study as a knowledge-management tool. An effective case study...

- Leaves important issues unresolved;
- Allows for multiple levels of analysis;
- Captures a tension between courses of action;
- Generates more questions than answers;
- Fosters decision-making thinking.

What Isn’t a Case Study?

It is important also to describe what a case study *is not*. It’s not a story intended either to validate or denigrate someone’s career, project, or mission. That is, it does not set out to illustrate *per se* the good or the bad (or the ugly), but is designed to teach by telling a story in an objective, usually third-person narrative. Using the story, the reader can draw conclusions and learn lessons through contextual or experience-based learning. We are not so interested in “second-guessing” decisions as practicing thinking through how decisions are made.

Finally, a case study should not be considered a primary source of information or a complete account of a project or mission. It is a slice of a bigger story, told for the purpose of illuminating the decision-making process and the outcomes of that particular event, so that others can learn from past or current projects.

Creating the Case Study: From Kickoff to Launch

No less than any other NASA project, the creation, development, and implementation of case studies is process-driven, and the process must be managed systematically. Likewise, it must be deadline-driven—recognizing that some flexibility should be built into the process, since, as in any project, exigencies may warp the schedule. A case story incorporates many elements—human and technical aspects—as well as lessons learned. Good case writing takes time and effort (which take money); one should expect to make the proper investment to create quality cases.

The following section describes the steps in the case-development process, from identifying a topic to publishing and implementing the case study.

A 10-Step Approach to Case Writing

Before setting off on the case-writing course, keep in mind a few objectives that should guide the development of NASA case studies throughout the process. The NASA case writer and facilitator seek to...

- Deliver lessons from a current or recent mission experience—successes as well as failures—for application on other projects;
- Build the case around a relationship with stakeholders;
- Create a learning opportunity for discussion and debate that sharpens thinking;
- Involve at least one key decision-maker to assist in an interactive facilitated discussion, to give the case the force of veracity and to provide critical insights.

Step One: Pick a Target

When seeking a subject for a case, look for (a) a topic that needs to be addressed; (b) an experience that has presented itself; (c) a key player in a project or mission who is willing to tell his or her story; or (d) all of the above. Subjects that make for compelling cases include...

- Well-known mission or project failures or successes;
- Close calls, incidents, and “lucky” outcomes;
- “You make the call” events that engage decision-making skills;
- Lessons learned: technical and/or project lessons;
- Design decisions and consequences (what worked or didn’t work);
- Safety reminders and “safe” stories;
- Personal insights: leadership and/or management of current tough decisions.

Step Two: Define the Parameters of the Case

The success of the story depends on staying focused on the learning objectives by “bounding” the case, or defining the parameters of the story. The most important guideline for this early step is to identify the learning objectives of the case study. The writer must have a definite teaching purpose in mind. The purpose may change over time as the case unfolds (new learning opportunities often emerge that trump the original intent) but the writer should be careful to negotiate any change in focus with the key case stakeholders. Remember: “It’s their story to tell.” Set the boundaries for the story by identifying...

- Events to be included (and what not to include);
- Persons to be included (whose story is it?);
- Teaching points to be emphasized—as determined by the “So what?” factor.

Step Three: Do the Homework: Background Research

Research is essential to the success of any case study. Before talking to the principals involved, gather as much background information on the project as possible. Access public information and collect data from historical and/or current project materials, briefings, and documents, such as reports by the NASA Mishap Investigation Board (MIB). Identify the primary sources of information; these are the decision - makers. Gather background material on the project principals through published accounts, such as news stories, official Web sites, and other certifiably valid information on the Internet.

Step Four: Interview Key Players to Get Their Story

This is perhaps the most important step in the case-creation process: interviewing the primary sources. Without direct, open participation by protagonists in constructing the narrative, not only will critical perspectives and information be missing, the story will lack the color and depth only firsthand accounts and quotes can provide. In addition, more than one side of the story (from primary sources) should be collected. Conduct interviews with any (and possibly all) of the following:

- Program and/or project manager;
- Principal investigator;
- Contractors;
- Chief/project scientist or engineer, other personnel from the project lead center;
- Team members or personnel from other NASA centers;
- Academic and foreign partners.

Trust is the key to success in one’s relationship with primary sources. In arranging an interview, relate your experience and connection with the case project. Provide contacts and references if necessary.

Describe the case method and its purpose at NASA, and give examples of cases and how they have been applied successfully.

In the interview, in addition to the specific questions you will have prepared based on background research, ask a few broad questions to get a larger context and feel for the story. For example:

1. “Why did you decide to take the action you did?”
2. “How do you feel about the outcome of the mission?”
3. “What were the sources of the disagreements or setbacks (or successes)?”

A few interviewing tips:

- If possible, meet on-site. There is no substitute for face-to-face interaction.
- Whether interviewing on-site or remotely, tape-recording is recommended (and gaining consent from the interviewee for taping is essential).
- If you are meeting on-site, always try to leave with any supplementary materials including releases (if needed) in hand; it is usually much more difficult to attain documents once you leave.

Step Five: Evaluate Story Lines for Learning Points

At this point in the process, a reality check is in order. Depending on the outcome of the research, in general, and the interviews, in particular, the case writer should now be better able to assess (or may need to reassess) what points can be illustrated by the case, and what story lines can be pursued. Now is a good time to clear those ideas with the sponsor (e.g., at Goddard, the OCKO) of the case -writing effort. This will make it easier to zero in on what story people are willing to tell and how they will present it, with implications for the final case study and its likely use. Bear in mind...

- More than one case study may eventually be extracted from the stories you collect. Keep an eye out for follow-up or entirely separate case studies in the stories you are gathering. In this respect, it’s helpful to maintain a list.
- The person you first talk with may not be the one willing and capable of leading a good case study. Identify one or two people who can tell the story effectively and are willing to do so—but get other names too.

Step Six: Draft the Case into a Narrative

Writing the first draft of the case requires assembling the material—research and interviews—into a narrative, complete with characters, plot, beginning, middle, and end. A couple of simple guidelines should be in the back of the writer’s mind, from the first sentence to the final decision question, while crafting the story. There are two principles for drafting a good case study:

1. *Get the story right.* This is critical for believability and buy-in.
2. *Make the story compelling.* This is essential for drawing in participants and keeping them engaged—it addresses the “so what?” criterion.

Beginning the Story: Setting the Context

The initial step in drafting the case is to do a “brain dump.” Combine your research and interview information. This should include any diagrams, charts, and photos you may have gathered. As you begin to fashion a cohesive story, remember that you can count on doing several revisions, beginning with a couple of drafts before the final case and then more revisions likely after the case study has been tested with an audience.

The case study typically begins with a scenario that frames the issue (or issues) facing the decision-maker as described from his or her point of view. This introduces both the topic and the protagonist(s), as well as the central issues of the case, typically in less than a page.

Middle: Fleshing Out the Story

With the contemporary scenario in place, framing the issues and foreshadowing the decisions ahead, the case writer now tells the “back-story” and builds a narrative that ultimately will return to the time and place at which the case began. Chronologically, the history of the problem is described first, in a project or mission background section. In addition to scientific and mission/project-specific data and historical facts, here is the place for a generous supply of quotations from key players interviewed in the research phase. These should be quotes from any primary sources (meaning first-hand or direct accounts), most importantly (but not only) the key player(s).

In sum, more data pertaining to the problem as it exists is provided—but this middle part of the story is not simply a section for providing critical information and data. Here the tension of the story is created that drives the story and eventually leads to decision points.

Ending: Back to the Beginning

Following the background and detailed discussion of issues, the case returns to the problem depicted in the opening scenario. By this point, the reader should be prepared to analyze the problems—and be ready to make decisions. He or she now has in hand the project and mission history, critical facts about the situation, perspectives on the problem from different people involved in the event, as well as some information that may be ambiguous or appear to be in conflict.

The case has now fully immersed the reader in the story. The reader should now be able to conduct an analysis for the discussion or decision-making part of the case. This final section, then, presents a recap of the situation and a recreation of the decision scenario that was established at the beginning of the story. This is followed by a set of questions requiring participants to make decision choices and to consider the potential outcomes of implementation of their decisions.

Finalizing the Draft

Once the draft is in a complete narrative form, copy-editing should be done and any missing pieces, such as source attribution of images, should be added. The case should be formatted into standard layout (following the conventions of the Goddard Space Flight Center Style Guide), and graph/chart/table titles should be checked for consistency. This cleanup and final editing is in preparation for circulating the draft for review by primary stakeholders. Also, organize and retain for your records all notes and materials you cut from the draft.

Writing and Style Points

Our standard (following business-school convention) calls for case studies to be written in the past tense. This technique should be maintained consistently throughout the body of the case. Depending on the nature of the story and the decision-making context at the end, however, some cases may conclude with a “Decision Time” discussion section that places the reader or participant in a present-tense scenario (e.g., “You are the project manager—what will you do?”). A word regarding content: Once online, the case should refer to technical details (such as test results) and provide links to the relevant sources, so readers can get more background on issues that arise in the reading of the case. (See the GSFC Style Guide for more writing tips and formatting and style standards).

Finally, a reminder: Though the case study will continue to evolve as it is revised, even in the first-draft stage it is important have a well-written and cleanly edited story ready for review by stakeholders—the next step in the process. Stakeholders who will be reviewing it will probably not want to, or have the time to, review multiple drafts. The draft at this point should be good enough for some stakeholders to sign off on; while others may have comments or corrections, it should be essentially “ready to go.”

Step Seven: Circulate the Draft

The draft is now ready for review by stakeholders in the project that is the focus of the case, as well as by those involved in the case-study process. The draft should be stamped “For Internal Use Only” and provided to anyone you may have agreed to allow review the case before publication, people you think could provide valuable criticism, and/or anyone whose signoff is required for case to be published. In this step, be realistic about the number of drafts that case writing demands. This is an iterative process that will most likely involve multiple revisions.

Step Eight: Test the Case with a Local Audience

Before a case study is put into practice, it should be tested with a low-risk audience. This may take place in training courses in-house, on team retreats, or in focus groups. These test runs provide important information, insight, and feedback for the final revision and tune-up prior to implementing the case as part of a course curriculum or workshop agenda. The case writer should be present to see how the case comes across. It is important to hold this “safe run,” before you post the case study on a Web site (see Step Ten) for the world to copy and use. Cases have a way of coming across differently to various audiences, so it is essential to find that out while you can still modify the final version.

Step Nine: Create a Teaching Note and an Epilogue

Two accompanying pieces are integral to a complete case-study package: (1) an epilogue of “what happened,” which provides closure to the story to date; and (2) a teaching note. Epilogues are written with the information gathered during research, interview material not used in the case, and any relevant information that may have become available since the project concluded.

The teaching note is a guide for case instructors. It presents the views of the facilitator (and/or case protagonist) on how the case can be taught most successfully, sometimes step by step. The emphasis is on conveying the learning objectives of the case. Creating an optimally effective teaching note requires that the case writer observe the case being put into practice to see first-hand what works, to witness participants’ responses, and so on. Feedback from participants may also be helpful in guiding the writing of teaching notes.

Step Ten: Validate, Publish, and Roll out the Case

The final step in the methodology is to put the case study into practice. Before it can be published and made publicly available for implementation, however, the case must be officially authorized. Validation involves, first, making sure all the individuals mentioned in the case study have had a chance to get their story heard. Keep in mind that the case is intended to help people learn. This requires that everyone in the story be included, to the extent possible, in the case-study events. Once the sponsor has approved the case, it can be used in public forums.

All case studies carry an appropriate disclaimer at the bottom of the first page, limiting their authority (see the following). It is a good practice also to ensure that cases are copyrighted with rights to government usage granted. Be sure to check with your legal department to follow all its guidelines for public release and copyright procedures.

GSFC Case Study Disclaimer

Copyright © 2008. United States Government as represented by the Administrator of NASA. All Rights Reserved. This case has been approved for public release under the terms and conditions of the License Agreement associated therewith. The views expressed in this document do not reflect official policy or position of NASA or the United States Government. It was developed for the purpose of discussion and training by the Goddard Space Flight Center's Office of the Chief Knowledge Officer with support from the NASA Academy of Program/Project & Engineering Leadership. The material here is extracted from publicly available sources and personal interviews with key mission personnel. It is not a comprehensive account of the mission and should not be quoted as a primary source. Feedback on this document may be sent to Dr. Ed Rogers, Chief Knowledge Officer, at Edward.W.Rogers@nasa.gov or (301) 286-4467. This document is available at:

<http://library.gsfc.nasa.gov/public/casestudies.htm>.

When the case study has been validated, copyrighted, and approved for release, it is ready for roll-out. At GSFC, this process is initiated by publishing the case and ancillary materials (primarily the teaching note and epilogue) to the Goddard Case Study Library. The case may then be put to use in any number of forums. NASA/GSFC case studies, as mentioned at the beginning of this guide, are incorporated into many programs, including training courses, knowledge-sharing workshops, and conferences, at Goddard and in NASA-wide forums, such as the annual Project Management Challenge.

As well as leading the practice of case-study learning at GSFC as part of the center's knowledge-management architecture, the OCKO supports the implementation of case-based programs and workshops at NASA headquarters and other centers.

Conclusion: The NASA Story Is Unique—and Universal

Developing a NASA case study is a unique endeavor, given the nature of NASA's business. The principles of the case method of teaching, however, are universal. Told the right way—accurately, vividly, and with clearly defined learning objectives—a NASA case study has the potential to influence mission success and to help fulfill the NASA mandate to educate and share all that we learn in an open way. Clearly, there is much to learn from how NASA works in addition to the tremendous science discoveries NASA makes.

The Big Picture: Final Thoughts on Creating NASA Case Studies

- A case study focuses on a specific aspect, event, or time horizon in the life of a project. Cases do not cover the whole mission, but only tell a certain story.
- Each story has one or more learning objectives that can be used in a discussion, presentation, or self-reflection.
- We write cases, but the story is not ours. It is someone else's story we are borrowing.
- Case writers build cases on respect and trust, not authority.
- Cases are living documents intended for interaction. They are not dead, cold reports of facts with which no one can argue.

Appendix 1

Case Studies Developed at GSFC

Type of Case	Length	Purpose
Technical	1–3 pages	Very focused technical decision used for illuminating the trade-offs and decision processes around solving technical challenges. Often at the design, component, or subsystem level. Usually led by the engineer or technical expert involved. Educates about some technology, but focus is on the decision process, not the technology <i>per se</i> .
Lessons Learned	1-4 pages	Focuses on errors and what happened in specific incidents, mishaps, or other significant events. Oriented to capturing lessons learned from mishaps. Revisits decisions that led up to the event.
Teaching	4–8 pages	Used in courses, workshops, and training programs. Stories structured around a protagonist’s point of view/experience, usually leading up to several key decision points. Focuses on specific learning objectives. Includes epilogue and teaching note.
Academic	10–30 pages	For universities and other settings outside NASA. Expanded version of the NASA teaching case generally with more background for non-NASA users. Examines the big picture, takes a longer time frame. Includes epilogue and teaching note.
Extended	30-100 pages	Factual story focusing on multiple aspects of missions/projects. Educational about mission objectives and science accomplishments, with historical project-management decisions highlighted. May be broken up into parts to cover different phases or perspectives of the story.

Appendix 2

Project Outline and Task List for Developing NASA/GSFC Cases

Case Project Name: _____

Project Start Date: _____

Project Finish Date: _____

Phase I: Topic Identification

Selection of issue/problem/project

Time/deadline: _____

Phase II: Research

Background research: Historical-data collection

Interviews: On- and off-site research

Time/deadline: _____

Phase III: Case Draft

Outline

First narrative draft

Graphic/illustration preparation

Time/deadline: _____

Phase IV: Review

Circulation to/signoff from stakeholders

Time/deadline: _____

Phase V: Revision

Follow-up, supplementary research, interviews

First revision

Final graphic production

Time/deadline: _____

Phase VI: Product Deliverable

Draft delivered for final review and sign-off

Time/deadline: _____

Phase VII: Validation, Publication, and Roll-out

Draft authorized, published in official sites, released for use

Time/deadline: _____

Resources

Rogers, Edward W. "Building a Healthy Learning Organization at NASA: Knowledge Management Systems as Human Systems." White paper. NASA/Goddard Space Flight Center, 2008.

Yemen, Gerry. "On Writing Cases Well." Charlottesville, VA: University of Virginia Darden School Foundation, 2006. UVA-PHA-0058.

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OCKO website

<http://www.nasa.gov/goddard/ocko>

Case Studies website

<http://library.gsfc.nasa.gov/public/casestudies.htm>



Case Studies Magazine

http://www.nasa.gov/centers/goddard/pdf/452484main_Case_Study_Magazine.pdf

This magazine is a collection of case studies put together by the NASA Safety Center and Office of the Chief Knowledge Officer, Goddard Space Flight Center. It includes four decision-oriented case studies, three system failure case studies, two cases of interest as well as a condensed version of the case study methodology.



A Catalog of NASA-related Case Studies

http://www.nasa.gov/centers/goddard/pdf/450420main_NASA_Case_Study_Catalog.pdf

This catalog of NASA-Related Case Studies lists cases from a range of sources, including NASA's APPEL program, NASA/Goddard's Office of the Chief Knowledge Officer, NASA's Safety Center, as well as the Harvard Business Review and the Center for Systems Engineering at the Air Force Institute of Technology.



Digital Case Study Library

<http://library.gsfc.nasa.gov/public/casestudies.htm>

This repository of OCKO case studies includes cases that vary in length and focus.

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