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Selected Content from *Understanding Aviation Safety Data*

Thank you for downloading this document from AirSafe.com. This document provides the table of contents from the book, one of the book's chapters, and other material from the book *Understanding Aviation Safety Data*. The book is available from the publisher, SAE International at www.sae.org. For background information about the book and the author, or to pre-order the book, visit airsafe.com/books/book1.htm. If you have any questions about the book, please contact the author, Todd Curtis.

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Understanding Aviation Safety Data: Using the Internet and other Sources to Analyze Air Travel Risk

Contents

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Chapter Six: Systematic Analysis of Aviation Safety Questions

One thing that the Internet has not changed is the need to think clearly when asking or answering an aviation safety question. For each aviation-related safety or operations question, a variety of things must be known or generally understood before the question can be addressed. A systematic approach to dealing with aviation-related questions would help to focus the question, identify what information is needed to answer the question, and will point to sources of data or other information that can be used in analyzing that question. The nature of the question will determine if an analysis of available data can even address the question and provide useful information. While there is no one process for systematically addressing a question, the following process will go a long way toward structuring a reasonable response to a question. No matter how simple or how complex the question, these basic steps in the process that must be completed if a question is to be answered well:

1. Understanding the question,
2. Making a plan for answering the question,
3. Carrying out the plan,
4. Reviewing the completed solution,
5. Presenting the results, and
6. Evaluating the process.

Each of these components can be further broken down and the combined steps can serve as a checklist that should be used when answering any question that makes use of aviation safety or operational data.

Understanding the Question

This part of problem solving involves a combination of tasks that will serve to categorize the question and suggest what kind of analysis will answer the question. Necessary steps in this portion of the analysis include:

1. State or restate the question clearly so that it is easy to point out the principal parts of the question, the assumptions that are made about the overall situation, and the kind of answers that are expected.
2. Separate the various parts of the question and if possible write them down.
3. Specify the boundaries of the question or of the data needed to answer the question.
4. Determine what special terms or definitions are stated or implied by the question.
5. Determine what kind of question has to be answered.

The most likely problem encountered in the first two steps is a either a question that is not clearly formulated, a question that has an ambiguous meaning, or a question that is very complex. A question may not seem to have any of those problems, but one may still have to be careful about how the question is worded. For example, an accident is generally understood to mean an unintended event with a negative consequence. However, an accident is an event that has a very specific meaning when the NTSB or the FAA uses that term

The third and fourth steps in this phase of the analysis procedure will usually resolve any ambiguities or uncertainties about what the question should mean. An aviation safety question will have to be answered using data that is well defined or data that is not well defined. If it is well defined, it may be sufficient to word a question in such a way that it uses the definitions for that well defined data. If the question deals with data or concepts that are not previously defined, then the question statement should include a specific and relevant definition. For example, the NTSB considers an aircraft accident related injury to be fatal only if the victim dies within 30 days of the accident. Any question that relies on fatality data from the NTSB should explicitly note this same limitation.

The fifth step of determining the kind of question that has to be answered is crucial for later stages of the analysis process. Questions tend to be of two types, those that can be addressed with objective and measurable data and those that can't. Objective data can be measured using procedures or scales that are commonly agreed upon. There may be disagreements on the accuracy of a measurement, but not on the procedure used to make that measurement. Examples of this kind of data include time or distance measurements.

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An aviation safety question is usually asked about some kind of event or about some kind of entity. Some kinds of events include outcomes like an aircraft accident or hazardous conditions such as a near midair collision. An entity could be a legal entity like an airline or aircraft manufacturer, or it could be a physical entity such as an airport, aircraft, or aircraft component. Entities and events are both defined by some set of recognizable characteristics. When developing an aviation safety question, these characteristics should be specified with care since even a minor change in those characteristics may lead to significant changes in the kind of data that is needed to answer a question.

An aviation safety question can come from many sources. In its original form, the question may include many vaguely defined terms or may be so broadly worded that it would be difficult to answer. The question may be a legitimate one in the mind of the person who is asking the question, but it is often possible to address only those parts of the question that can be answered using some kind of objective or measurable data. One of the first steps in answering an aviation safety question is categorizing the question. This helps the analyst to understand what kinds of data would be needed to address the question and may help the analyst to identify the parts of the question that cannot be addressed using some kind of objective data. The following list is a comprehensive, but by no means an exhaustive, descriptions of the common kinds of aviation safety questions that can be answered with objective, measurable data:

- Existence: has a certain kind of event ever happened or does a certain kind of entity exists,
- Event History: how many times has a particular kind of event occurred,
- Population: how many entities with a specific set of characteristics exist,
- Categorization: what are the specific characteristics that define a particular kind of entity or event,
- Frequency: how many times does a specific kind of event occur within a larger but well defined set of events,
- Distribution: how are specific kinds of entities or events distributed within a larger but well defined population,
- Pattern: how are a specific set of underlying characteristics linked or distributed within a group of entities or events that share a set of common characteristics,
- Exposure: how often or under what circumstances is an entity or an activity is exposed to some specified set of conditions,
- Probability: how likely is it that a particular population of entities or events will have one or more specific characteristics,
- Conditional Probability: for a population of entities or events with a specific set of characteristics, what is the likelihood that some additional set of attribute exists,
- Risk Level: what is the combination of a specific hazard and either a probability of occurrence or frequency of occurrence of that hazard, or
- Identification: what information uniquely identifies a particular event or entity.

Answering a simple or specific question may only require one type of data, but answering a complex or more general question may require several categories of data. However, if the early analysis steps of clearly stating the question were completed and if the terms or concepts used in the questions were unambiguous, it should be easy to determine what kinds of data are needed to answer the question.

Some aviation safety questions, such as questions about the frequency of some type of safety related event, require two or more values in order to be computed. In the case of the frequency of an event two values are needed: the number of times the event occurred, and the population of comparable events that did not involve the safety event in question. The only difference between the two types of events should be whether the safety event took place. For example, if you needed to compute the rate of fatal airline accidents for a particular time period, you would need to know the number of fatal accidents in the period and the number of non-accident airline flights for that same period. The rate would be given by the following equation:

(Number of fatal events) ÷ (Number of fatal events + Number of non-fatal events).

In most cases, the number of safety events is much smaller than the number of nominal events, so the equation could be simplified to:

(Number of fatal events) ÷ (Number of non-fatal events).

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If a question is worded in such way that it can't be answered using some kind of objective and measurable data, it is usually for one of two reasons: either the wording of the question is not specific and detailed enough, or the question is inherently subjective. An example of the first is the question "How many people were killed in airplane wrecks last year?" Given more knowledge about the nature of aviation safety databases, the question may be reworded to something more specific such as "How many occupants were killed in airline accidents in the U.S. in 1998 involving U.S. certificated carriers performing operations under Title 14, Part 121 of the Code of Federal Regulations (14 CFR 121)?" By comparison, the question "How safe should flying be?" is difficult to answer objectively because the concept of safe is not defined and because the question appears to be asking a philosophical or rhetorical question rather than one that has a definitive, objectively defined right answer.

Making a Plan for Answering the Question

Answering a question related to aviation safety is in many ways like building a house or completing any other special project. There one or more well defined objectives and a time or resource limit imposed on the project and the end result can be classified as successful or unsuccessful depending on how well the project meets those objectives. Detailed planning is often the difference between success and failure when answering a question. While the same basic procedures and sources of data can be used to answer any particular question, the context in which each question is asked, the resources needed to answer the question, and the intended use for the answer to each question will be different. Taking the time and effort to make a unique plan for each question will very likely improve one's ability to answer each question.

Making a plan for dealing with a particular question includes dealing with resource issues, understanding the knowledge limitations of those who are analyzing the information, and knowing how the answer to the question will be used. The level of effort used for planning and the amount of detail will vary widely. Planning for a simple problem may take a single person only a few minutes while a more complex question may require the coordination of several people over a period of weeks. In either case, planning will be easier if the earlier steps of understanding the problem were completed. Planning activities for every question or situation involving the analysis of aviation data will include at least some of the following:

- Goals and Objectives: This task includes understanding the reason for asking the question, determining what outcomes are expected, determining acceptable alternative outcomes, providing success criteria, and determining the conditions under which the analysis activity should cease.
- Data: These activities include identifying likely sources of data, evaluating the quality of that data, determining how the data will be acquired, identifying data storage or data management requirements, and developing other tools to facilitate further analysis.
- Methods of Analysis: These methods include identifying appropriate methods for analyzing the data, assessing the feasibility of using those methods, identifying alternate methods of analysis, and developing an appropriate interim review process for the analysis.
- Resource Management: This may be accomplished by estimating the requirements for people, time, equipment, budget, training, and the other resources required to address the question or by determining how resource limitations may affect the ability to answer the question.
- Managing Tasks: Task management includes breaking down the work needed to answer the question into well defined units of effort and estimating the resources needed to accomplish those efforts.
- Using the Analysis Outcome: This includes identifying the requirements of the primary audience for the analysis, identifying other potential audiences, and developing the most appropriate presentation of the analysis or the results.
- Administration: Activities in this area include determining the requirements for recording, storing, and retrieving the analysis and the associated results.

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All of these activities are important, but obtaining the necessary data is probably the most critical. Many of the aviation databases and reference sources that are used to answer aviation safety and operations related questions are periodically expanded or updated. Also, those who are responsible for this data are often associated with governments or aviation industry organizations and will likely remain in operation well into the future. In addition to the various aviation databases, other sources of aviation data include interviews from those with a personal knowledge of information or circumstances related to the question, personal observation or knowledge, or from other written sources.

No matter what form the relevant data may take, answering the following questions about the data is a good starting point for finding out where that data may reside:

1. What individuals, groups, or organizations, would know?
2. What individual, group, or organization would care?
3. What individual, group, or organization would care enough to record the information?
4. If the data is recorded, where would it reside and how can it be accessed?
5. If the data can be accessed, how much time, effort, or resources are required?
6. Does the data have to be independently verified?

The most important benefit gained from these planning efforts is that by the time planning is complete, the information gained from this process will make it easy to decide if it is worth pursuing the answer. If during the planning it becomes clear that there is not sufficient time or resources or that answering the question is not feasible, it makes sense to either change the objectives or to not attempt to answer the question. Other reasons for not answering the question could be that the benefit or knowledge gained by answering the question is not worth the effort needed to get the answer. A well thought out plan may reveal that delaying the effort to answer the question may allow the use of more or better resources.

Carrying out the plan

While it is impossible to foresee every possible problem, the time and energy spent at the planning stage will make it easier to carry out the plan for answering the question. The main objectives of this phase is to make sure that the tasks that make up the plan for answering the question are being accomplished and that the resource limits are not being exceeded. The activities that have to be completed at this stage include the following:

- Adjusting the original plan as more insights are gained about the question,
- Dealing with interruptions to the work of answering the question.
- Maintaining communication with those who are doing the work, those who are supplying data or other resources, and the intended audience for the answer.
- Documenting the process of answering the question.
- Tracking planned progress against actual accomplishments.
- Dealing with unexpected problems and other obstacles.
- Ensuring that the work that led to the answer was technically correct.
- Confirming that the objectives related to answering the question were achieved.

Unless a question can be answered in a very short amount of time, those working toward that solution will have to deal with one of two realities: either other work has to be accomplished at the same time, or unexpected events may interrupt the process of answering the question. The possibilities include other tasks being given a higher priority, or resources needed to deal with the question may be made unavailable. These changes could have a number of negative effects such as reducing the enthusiasm of those working on answering the question or reducing the amount of critical resources needed to deal with the question.

Careful planning and execution may reduce the impact of unforeseen problems, but it will not eliminate them entirely. If the various activities that are associated with this part of the task of answering the question are being executed competently, everyone who is involved with answering the question should be aware of what is going on and should not be surprised by changes in the schedule or the objectives. If the process has been well documented, people who may have to be assigned temporarily to other tasks should be able to pick up where they left off once they are able to return to the task of answering the question. Also, if circumstances delay work on one part of the question, it could be an opportunity to change the plan and deploy resources to address another part of the question.

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A different problem that often occurs with data is that during the course of collecting the data, the analyst realizes that the quality of the data is much better than anticipated. Better data opens up the possibility of using more sophisticated analyses to answer the question or expanding the scope of the original question. However, any desire to expand the scope of the question to be answered has to be balanced against those who will use the answer. The needs of the ultimate user should provide the decision criteria for those analyzing the data. If those users are aware of the opportunities that the better data provides and are willing to allocate the time and resources to analyze the new data, than that expanded analysis can be done. Otherwise, one should continue to work toward the original objectives and document that fact that better data is available to help answer future questions.

Once the question is answered, one issue that has to be addressed is whether the objectives related to answering the question were achieved. During the planning stage, the objectives should have been clear to those who were answering the question as well as to those who were going to eventually use the answers. During the process of doing the work to answer the question, any changes in the objectives should have been communicated to those same people. Once the question has been answered, if there is any incompatibility between the objectives that were met and the objectives that were expected, then it is probably due to a failure to communicate.

Reviewing the Completed Solution

A second issue that must be addressed after the question is answered is determining whether the answer was technically correct. Even if only one person did all of the work, it is important to go back over all calculations, database development, or other activities associated with answering the question to make sure the right data and methods were used at every stage. This is also a good time to review all the assumptions that were made during the planning stage, especially assumptions about the data. In most cases, assumptions concerning the data are the ones most likely to be proven partly or completely untrue. The organizations that collect and distribute aviation data are dealing with a changing aviation and social environment. Rules about how information is collected, what information is collected, or how information is categorized changes over time and those changes may have significant effects on how specific pieces of information should be treated. In short, the review process consists of the following activities:

- Review the assumptions that were made concerning the key questions in the analysis.
- Review the quality of all data that was used in the analysis with respect to the circumstances under which the data was gathered or processed.
- Review all mathematical calculations, database development, research, and other activities associated with the analysis.

Presenting the Results

Unless there are no plans or desires to show the answer to the question to anyone, some effort should be made to provide concise information on not only the answer, but also on what data and methods of data analysis were used to get to the answer. This is the case even if those who are going to use the answer are also planning to develop their own presentations. Planning for the presentation of the results should also be included at the beginning of the planning process rather than after the question has been answered. At the beginning of the planning process, no one can foresee what the exact answer will be. However, if the type of question is known and if some of the attributes of the data are known, it would be possible to plan a data display that would convey the relevant information needed to answer the question. At a minimum, a presentation of the insights gained from answering the question should accomplish:

- State the reasons why the question was addressed.
- State the answer to the question.
- Provide information about the source of the data.
- Provide information about the methods used to evaluate the data.
- Discuss outcomes or insights that came about through answering the question.

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There are usually only a few options available for presenting data or the results of data analysis. The presentation can be made orally, in writing, visually, or using a combination of these methods. The same information may be presented in a number of different ways, some of which may be more successful than others for reaching a particular audience. At a minimum, the following principles of data content and organization should be kept in mind when developing a presentation using charts, graphs, or other visual depictions of the data or the analysis:

- The purpose of any chart, graph, or picture in a data analysis presentation is to help the viewer reason clearly about the data and the analysis .
- Charts or graphs should stand on their own without relying on supplementary explanatory notes or a live speaker to interpret the chart's meaning.
- Emulating the styles of those who have effectively presented the same kind of information is usually a more sensible option than creating a new way to present the data.
- If a chart or graph is made into a slide and projected on a screen, the slide should be easily seen and interpreted from any point in the room.
- Use color, shading, animation, and other special effects, only if it enhances the ability of the viewer to understand the information in the presentation.

Evaluating the Process

The process of asking and answering a question includes a number of different activities. Improving on that process is possible only if the insights and lessons learned from going through the process are used when it is time to answer the next question. One place where this learning can be retained and retrieved is in any kind of written checklist or procedure that an individual or organization may have for answering certain kinds of questions. Another convenient place where such insights will be in any documentation associated with the question that was answered. Performing the following actions are especially useful for improving the data acquisition and data analysis processes:

- Deciding what data should be kept for future use.
- Determining the data sources that could be used in the future.
- Determining whether the methods of analysis were adequate.
- Evaluating whether the answer could have been derived more efficiently using another method.
- Determining if the answer or the method be used for some other question.
- Identifying the circumstances that made it more difficult to answer the question.
- Identifying the circumstances that made it more difficult to access and use the data.
- Evaluating whether the resources needed for answering the question were adequate.
- Identifying additional resources that would have made answering the question easier.
- Determining whether the resources used for answering the question could have been reduced or eliminated.

Example Question Taken Through the Analysis Checklist

The following question will be put through the steps of the analysis checklist in order to demonstrate how the steps can be executed and what role that various data sources play in answering the question. "On how many occasions between 1994 and 1996 was at least one passenger killed on a flight involving a U.S. airline?" In this example, the answer to the question will be incorporated into a news release on the subject of airline safety and only one person is available to both answer the question and to write the report. That same person is responsible for performing all of the organization's background research on matters related to aviation.

Understanding the Question

The question as originally stated was "On how many occasions between 1994 and 1996 was at least one passenger killed on a flight involving a U.S. airline?" This is a rather simple question for analysis because it already is bounded both in the time frame that is to be investigated and the kinds of data that is sought. However, there are several terms that may need further definition, specifically the terms airline, airline flight, and passenger killed. Air carriers may operate under a number of different sets of federal aviation regulations, but for this question, operations under 14 CFR 121 are most appropriate. Since the included accidents would all be before 1997, the question would also imply that the involved aircraft would be limited to those with a capacity of more than 30 passenger seats. The event of interest in this question is a fatal injury of one or more passengers, so the word "occasion" can be interpreted as meaning a fatal injury accident. If the question were changed to make the meaning more explicit, it could be worded to use more precise language that would allow someone reading the question to be quite clear about what was needed in the way of an answer. Following the checklist for this portion of the analysis, the checklist item and its response would be as follows:

1. State or restate the question clearly so that it is easy to point out the principal parts of the question, the assumptions that are made about the overall situation, and the kind of answers that are expected - The restated question is "Between 1994 and 1996, how many fatal accidents involved 14 CFR 121 air carriers where at least one passenger sustained fatal injuries during the flight?"
2. Separate the various parts of the question and if possible write them down. - This step was not really needed for this simple question.
3. Determine what special terms or definitions are stated or implied by the question. - The terms fatal injury, fatal accident, flight, air carrier, 14 CFR 121 all have a specific meaning in this context.
4. Determine what kind of question has to be answered. - This is an event history question that asks for the total number of specifically defined set of events that occurred within a certain time frame.

The question was reworded so that the intent of the original question was not changed and that the definitions of the words used in the question matched definitions used by the authorities that collect aviation and distribute aviation data. When stating or restating questions dealing with U.S. aviation accidents and incidents, there are two good reasons to use words that that have a precise meaning as used by the U.S. government organizations, specifically the FAA and the NTSB, that are responsible for collecting accident and incident information. First, when these organizations collect aviation safety data, each data attribute or data category has a specific definition. Second, other organizations that are involved in aviation safety related activities often use the same definitions and categories as the FAA and the NTSB.

Making a Plan for Answering the Question

This example question is not a very complex one and depending on the requirements for data access and retrieval, it may not need an extensive plan for developing an answer. The revised question only asks for one number, the total number of accidents in a specific time frame that also had one or more passenger fatalities. Since the answer to the example question will be used as part of a relatively short news release, it is probably sufficient to state the answer and cite the source of the information. The checklist for this portion of the analysis would reveal the following about the work needed to answer the question:

Goals and Objectives

There are two key objectives at this point of the process: identify a reliable source of data for airline passenger fatalities involving flights on aircraft operating under 14 CFR 121 rules, and use that source to find the total number of accidents involving passenger fatalities during the years 1994 and 1996.

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Data

Going through the six-part data checklist provides a clear understanding of the nature of the data that is needed and how to go about acquiring that data:

1. What individuals, groups, or organizations, would know? - Fatal airline accidents involving U.S. air carriers are of great interest to major U.S. media concerns such as CNN and the New York Times and such events are often the subject of significant news coverage in the print and electronic media. Most of the major public and private organizations concerned with aviation safety would be aware of any fatal airline event.
2. What individual, group, or organization would care? - The NTSB is an organization that is specifically chartered by the U.S. Congress to investigate these events and is the lead government agency that investigates both fatal and non-fatal airline accidents that occur in the U.S.
3. What individual, group, or organization would care enough to record the information? - In addition to investigating accidents, the NTSB also publishes reports on the investigations of some of the more prominent aircraft accidents, maintains a database of aviation accidents, and publishes a number of summary reports containing a variety of aviation safety statistics
4. If the information is recorded, where would it reside and how can it be accessed? - NTSB publications can be requested directly from the NTSB and in some cases can be accessed through the organization's Web site.
5. If the information can be accessed, how much time, effort, or resources or required? - Information from the Web site can be accessed within minutes from a computer with access to the Web. A phone or written request for data can be made directly to the NTSB and the data will be mailed free of charge anywhere within the U.S.
6. Is the data sufficiently valid? - The data and data definitions used by the NTSB is the standard that is followed by most U.S. organizations that collect or report aviation safety data. While the data in written publications and on the main NTSB database represent the official version of the data, it is reasonable to expect that the fatality data that is accessible from the Web will be consistent with the fatality data from the other NTSB data sources.

Methods of Analysis

The method for this question is to identify and total the number of accidents that fit the criteria given in the question.

Resource Management

One person will answer the question and write the report that incorporates the answer to the question. The primary source will be the NTSB. Other sources will be found if the NTSB is not able to supply the data. The use of a phone, traditional mail, and a computer with Internet access may be needed in order to acquire the proper data.

Managing Tasks

The major task that must be completed is the collection of the accident data followed by a review of that data to determine the sum of the events of interest. The question can be answered only after the complete set of relevant accident data is available for review.

Using the Analysis Outcome

Incorporating the answer into a specific news release is the only objective; no other users of the answer or of the data were identified.

Administration

The answer to the question will be incorporated into a news release that will be archived under existing procedures. Fatality data from past accidents will not change, so any NTSB data retrieved for this question can be reused to answer future questions. If there are only a few events, the details of these events may be included in the news release.

Because the answer is released to the general public, there is a good chance that the answer and the means used to produce the answer would be criticized, so it may be necessary to answer the question as well as provide additional details about how the answer was derived.

Carrying Out the Plan

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From the planning stage, it was determined that the Web accessible accident and incident database of the NTSB contained the necessary raw data and that no information from other sources was needed to confirm this data. The searchable NTSB accident database located at www.ntsb.gov/NTSB/Query.htm allows a customized search of the entire database and could be limited by a number of factors including date ranges, accident severity, and type of operation. Two searches were conducted: the first for fatal airline events between January 1, 1994 and December 31, 1996 involving scheduled 14 CFR 121 flights and a second run involving non-scheduled flights. These data runs revealed nine entries for fatal accidents involving scheduled flights and three entries for fatal accidents involving non-scheduled flights in the database. Five accidents, including the three involving non-scheduled flights, were cargo flights. Of the remaining seven, three of the database entries indicated that at least one passenger was killed and four did not specify if the fatalities included passengers.

While the NTSB has a searchable database accessible from the Web, the entries for each accident are not comprehensive. Each entry for a fatal accident indicated the number of fatalities, some of them specified the total number of passenger or crew fatalities, but four of the passenger aircraft accidents did not. This is a typical situation with Web accessible databases of the NTSB and other government organizations. The Web databases contain only some of the information that is available in the official database. For the NTSB, it is possible to make a written or telephone request to the organization and make a request for the information from the full database. However, in this case all of the accidents that did not break down the passenger and crew fatalities were also listed elsewhere on the NTSB site. One NTSB page has a listing of all 14 CFR 121 accidents since 1982 that involved passenger fatalities. Another part of the site provided full accident reports for recently completed major accident investigations. Those other online NTSB resources revealed that these other four accidents all had at least one passenger fatality.

Reviewing the Completed Solution

Although this was a question that only required counting the number of times a particular event happened, there was a need to review the method used in accessing the data needed to answer the question. The data should be double-checked to make sure that the accidents fit the criteria of the question.

Presenting the Results

Because the answer to the question was a single number, the data could easily be presented as a simple statement in the news release. The statement "According to the NTSB, from 1994 to 1996, there were seven accidents involving U.S. airlines operating under 14 CFR 121 where at least one passenger was killed." provided the answer to the question and information about the source of the data. For a news release, this level of detail is probably sufficient. Other kinds or reports or presentations may require a more in depth presentation that details the procedure for acquiring and analyzing the data.

Evaluating the Process

In this example, the person who answered this particular question is responsible for answering all of the organizations questions related to aviation. This makes it likely that this person will be tasked to perform other duties that involve finding and evaluating aviation data. Given that situation, it would be a good idea for this person to do the following in order to make answering future questions easier:

- Bookmark selected Web pages that contain frequently used data,
- Either print or electronically save the information that is frequently accessed on the NTSB Web site,
- Write down the procedure needed to retrieve specific data or information from the Web,
- Locate a specific person or office within the NTSB that can be used to either request a search in the main database or to assist in finding data in a Web search, and
- Request NTSB documents that contain frequently used data.

Analysis Process Checklist

The steps in the preceding example are summarized in an analysis process checklist in Appendix Seven.

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Appendix Seven: Analysis Process Checklist

1. Understanding the question
    - State or restate the question clearly so that it is easy to point out the principal parts of the question, the assumptions that are made about the overall situation, and the kind of answers that are expected.
    - Separate the various parts of the question and if possible write them down.
    - Specify the boundaries of the question or of the data needed to answer the question.
    - Determine what special terms or definitions are stated or implied by the question.
    - Determine what kind of question has to be answered:
        - ◊ Existence: has a certain kind of event ever happened or does a certain kind of entity exists,
        - ◊ Event history: how many times has a particular kind of event occurred,
        - ◊ Population: how many entities with a specific set of characteristics exist,
        - ◊ Categorization: what are the specific characteristics that define a particular kind of entity or event,
        - ◊ Frequency: how many times does a specific kind of event occur within a larger but well defined set of events,
        - ◊ Distribution: how are specific kinds of entities or events distributed within a larger but well defined population,
        - ◊ Pattern: how are a specific set of underlying characteristics linked or distributed within a group of entities or events that share a set of common characteristics,
        - ◊ Exposure: how often or under what circumstances is an entity or an activity is exposed to some specified set of conditions,
        - ◊ Probability: how likely is it that a particular population of objects or events will have one or more specific characteristics,
        - ◊ Conditional Probability: for a population with a specific set of characteristics, what is the likelihood that some additional attribute exists,
        - ◊ Risk level: what is the combination of a specific hazard and either a probability of occurrence or frequency of occurrence of that hazard, or
        - ◊ Identification: Information that uniquely identifies a particular event or entity.

2. Making a Plan for Answering the Question
    - Goals and Objectives: understanding the reason for asking the question, determining what outcomes are expected, determining acceptable alternative outcomes, providing success criteria, determining the conditions under which the analysis activity should cease.
    - Data: identifying likely sources of data, evaluating the quality of that data, determining how the data will be acquired, identifying data storage or data management requirements, and developing other tools to facilitate further analysis. Data related questions that should be answered include the following:
        - ◊ What individuals, groups, or organizations, would know?
        - ◊ What individual, group, or organization would care?
        - ◊ What individual, group, or organization would care enough to record the information?
        - ◊ If the information is recorded, where would it reside and how can it be accessed?
        - ◊ If the information can be accessed, how much time, effort, or resources are required?
        - ◊ Is the data sufficiently valid?
    - Methods of Analysis: identifying appropriate methods for analyzing the data, assessing the feasibility of using those methods, identifying alternate methods of analysis, developing an appropriate interim review process for the analysis.
    - Resource Management: estimating the requirements for people, time, equipment, budget, training, and other resources required to address the question; determining how resource limitations may affect the ability to answer the question.

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- Managing Tasks: breaking down the work needed to answer the question into well defined tasks and estimating the resources needed to accomplish those tasks.
- Using the Analysis Outcome: identifying the requirements of the primary audience for the analysis, identifying other potential audiences, developing the most appropriate presentation of the analysis or the results.
- Administration: determining the requirements for recording, storing, and retrieving the analysis and the results, determining requirements for future use of the analysis.

3. Carrying Out the Plan
   - Adjusting the original plan as more insights are gained about the question.
   - Dealing with interruptions to the work of answering the question.
   - Maintaining communication with those who are doing the work, those who are supplying data or other resources, and the intended audience for the answer.
   - Documenting the process of answering the question.
   - Tracking planned progress against actual accomplishments.
   - Dealing with unexpected problems and other obstacles.
   - Ensuring that the work that led to the answer was technically correct.
   - Confirming that the objectives related to answering the question were achieved.
4. Reviewing the Completed Solution
   - Review the assumptions that were made concerning the key questions in the analysis.
   - Review the quality of all data that was used in the analysis with respect to the circumstances under which the data was gathered or processed.
   - Review all mathematical calculations, database development, research, and other activities associated with the analysis.
5. Presenting the Results
   - State the reasons why the question was addressed.
   - State the answer to the question.
   - Provide information about the source of the data.
   - Provide information about the methods used to evaluate the data.
   - Discuss outcomes or insights that came about through answering the question.
6. Evaluating the Process
   - Deciding what data should be kept for future use.
   - Determining the data sources that could be used in the future.
   - Determining whether the methods of analysis were adequate.
   - Evaluating whether the answer could have been derived more efficiently using another method.
   - Determining if the answer or the method be used for some other question.
   - Identifying the circumstances that made it more difficult to answer the question.
   - Identifying the circumstances that made it more difficult to access and use the data.
   - Evaluating whether the resources needed for answering the question were adequate.
   - Identifying additional resources that would have made answering the question easier.
   - Determining whether the resources used for answering the question could have been reduced or eliminated.

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