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AIR TRANSPORTATION OF HAZARDOUS CARGO:

HOW TO DO IT BETTER

by

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Transporting hazardous cargo by air is necessary in the Air Force to maintain our war fighting capability. To transport hazardous material by air safely, there must be an efficient system established that is designed to provide proper management oversight of regulations regarding air shipment of hazardous cargo. This system must also ensure rules and regulations are strictly adhered to and enforced. Currently, within the Air Force system, data collection associated with hazardous material incidents is limited. A more in-depth system that monitors hazardous material incidents needs to be implemented to ensure proper management oversight. Additionally, when negligence is involved in an incident, improved procedures need to be initiated if we are going to hold shippers accountable for their actions. Current initiatives by Air Mobility Command (AMC) management to review incidents regarding air shipment of hazardous cargo are encouraging. If resources permit, it would be more thorough to incorporate a program to capture data on all hazardous material incidents once they enter the air transportation system. The Air Force should put in better controls to properly manage and enforce correct air shipment of hazardous cargo. Some suggestions are made toward the end of my paper to help take the first step in improving the current process. This first step consists of two items. First, to put in controls so data, Air Force wide, can be kept and studied to alert management of possible problems. Second, to set up a system to adequately deal with violators of federal regulations regarding air shipment of hazardous material. I am hoping that these suggestions will help achieve a better and safer way to move hazardous cargo by air, not only in AMC, but also within the Department of Defense as a whole. Planes and equipment are too expensive and personnel are too valuable to take chances with such a serious subject.

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Contents

Page

Illustrations

Page

Tables

Page

Preface

I chose the topic of "Air Transportation of Hazardous Cargo—How to do it Better" because of a suggestion from Air Mobility Command (AMC) Headquarters, to try and find out why there appeared to be an increase in hazardous material incidents on AMC aircraft. After trying to gather initial data to confirm the increase of incidents, I found that historical data available in the Air Force was limited. An additional factor that limited data was that much of the information was considered sensitive and was not releasable for this project. I decided to look at the Department of Transportation, which did have detailed information on hazardous material incidents, and try and relate it as close as possible to the Air Force. The purpose of this research paper is to try and offer suggestions that will improve the current system in AMC in managing safe air transportation of hazardous material. I would like to thank Mr Delbert Hamilton of HQ AMC/DON, SMSgt Denny Meyers, MSgt Charleton Ivester, MSgt Eric Gadow, TSgt Tom Gross, 633 Air Mobility Support Squadron, Kadena AB, Japan, Ms Joanne Williams, US Department of Transportation, Mr Louie Alley, Air Force Safety Center, Kirtland AFB, and Major Deanna A. Paulk, my research advisor, for all their support and encouragement.

Abstract

Transporting hazardous cargo by air is necessary in the Air Force to maintain our war fighting capability. To transport hazardous material by air safely, there must be an efficient system established that is designed to provide proper management oversight of regulations regarding air shipment of hazardous cargo. This system must also ensure rules and regulations are strictly adhered to and enforced. Currently, within the Air Force system, data collection associated with hazardous material incidents is limited. A more in-depth system that monitors hazardous material incidents needs to be implemented to ensure proper management oversight. Additionally, when negligence is involved in an incident, improved procedures need to be initiated if we are going to hold shippers accountable for their actions. Current initiatives by Air Mobility Command (AMC) management to review incidents regarding air shipment of hazardous cargo are encouraging. If resources permit, it would be more thorough to incorporate a program to capture data on all hazardous material incidents once they enter the air transportation system. The Air Force should put in better controls to properly manage and enforce correct air shipment of hazardous cargo. Some suggestions are made toward the end of my paper to help take the first step in improving the current process. This first step consists of two items. First, to put in controls so data, Air Force wide, can be kept and studied to alert management of possible problems. Second, to set up a system to adequately deal with violators of federal regulations regarding air shipment of hazardous

material. I am hoping that these suggestions will help achieve a better and safer way to move hazardous cargo by air, not only in AMC, but also within the Department of Defense as a whole. Planes and equipment are too expensive and personnel are too valuable to take chances with such a serious subject.

Chapter 1

Transporting Hazardous Cargo is a Matter of Life and Death

> *November 1997 a C-17 carrying 86 personnel and equipment from the 82nd Airborne Division crashed shortly after takeoff from Pope AFB, North Carolina, en-route to the Persian Gulf. Aircraft was completely destroyed and there were no survivors. Initial investigation results indicate a fire in the cargo compartment may have spread to gasoline powered generators causing fuel tanks to explode in-flight.*
>
> —Fictitious Article

Are we in danger of these headlines being broadcast over Cable News Network? You bet. Every day in the dynamic mission of Air Mobility Command (AMC) these kinds of dangers are ever present because of our requirement to transport hazardous material to support our war fighting effort. By the time you finish reading this paper you will hopefully understand the need to take steps to minimize the likelihood of something like this from happening. How can we do it? This is the basis of my thesis. Transporting hazardous material by air in the Air Force can be improved by implementing a better reporting process of hazardous material incidents and by improving the accountability of shippers who ship hazardous material by air in the Air Force.

The Federal Aviation Administration (FAA) received a wake-up call when 110 people died on ValuJet flight 592 in May 1996 because of an in-flight fire allegedly caused by transporting hazardous cargo. Many significant improvements were made by

the FAA as a result of the accident to ensure safe transportation of hazardous cargo. In the Air Force, are we being as vigilant? What have we done in the Air Force to prevent the loss of a new C-17 or C-5 cargo aircraft as a result of the crash of ValuJet flight 592? Certainly the potential for a serious accident within the Air Force is there and it is real. With the costs associated with new aircraft and the potential loss of life, the Air Force must ensure it has an airtight program for safely transporting hazardous cargo by air. I am not suggesting that the Air Force is anything less than completely professional with its administration of current programs surrounding the airlift of hazardous materials, but is there a need to improve the process? Can we minimize the likelihood of a disaster from happening? That is the basis of my research paper. To put forward a few suggestions that can improve the way we do business in the Air Force in transporting hazardous cargo by air.

Overview

In my research paper I will address the ValuJet crash in 1996 and identify corrective actions the FAA initiated to ensure this type of tragedy doesn't happen again. To build a roadmap of how the FAA and the Air Force handle hazardous material incidents, I will describe the current reporting and enforcement processes involving hazardous cargo incidents of the FAA and Air Force. Then I will show where we are today with respect to transporting hazardous cargo by air in the Air Force. I will investigate and sort through current data from the FAA and from the Air Force Safety office and try and put the data in perspective by identifying hazardous cargo trends. Using all the information in the previous sections, I will introduce new procedures for safer transport of hazardous materials. This research paper can be a first step in attaining a solid program for safe

transportation of hazardous materials by air in the Air Force and hopefully prevent a tragedy from happening in the future.

Limitations

Collecting information involving hazardous material incidents from civil aviation authorities was not difficult and was very comprehensive. Collecting the same type of data from Air Force activities and other services within the Department of Defense (DOD) was difficult and in several cases non-existent. Most of the information was protected under Air Force Instruction (AFI) 91-204, which regulates official use of privileged information and was not releasable for this research project. I did the best I could with the data that was released from the Air Force, but it is limited at best.

The difference in the 965 documented incidents I received from the database of the FAA and the hazardous material incidents reported under the Hazardous Material Information System are different. Apparently, the report generated for me for this research project did not capture all the data elements in the database that are associated for all of the hazardous material reports that are on file. For the purposes of this research project, I will use the 965 documented incidents as the total amount reported to the FAA from 1990 through 1996.

Chapter 2

ValuJet Crash–New FAA Initiatives

Since 1996, the Department of Transportation (DOT) through the FAA has taken bold initiatives to improve the process of transporting hazardous materials by air. A complete listing of these can be found on the Internet at http://www.dot.gov/affairs/apa11097.htm.[1] I have extracted the most relevant ones that are worthy of discussion and may have possible implications for the Air Force.

- The FAA created a new Division of Dangerous Goods and Cargo Security to raise the visibility of hazardous material issues.
- It is currently evaluating hazardous materials programs at all carriers.
- The DOT realigned $14 million in FY 1997 to improve oversight of hazardous materials.
- The DOT staff of 14 inspectors for dangerous goods was increased to 106 with a final goal of 132.
- Eleven of 12 new FAA attorneys have been hired specifically to deal with hazardous materials in air transportation.
- Training time for dangerous goods inspectors has increased from two to six weeks.
- A data system is being developed to target repeat offenders. $3.4 million has been earmarked.
- As of April 1997 significant enforcement actions have been announced and are being taken. Between April and August 1997, the FAA has already levied four fines in excess of $50,000 each.

As outlined above, the FAA has taken some very costly and bold steps to improve its processes. It has improved training, increased manpower, increased inspections and enforcement actions to ensure safer transportation of hazardous goods and compliance with federal regulations.

What are the implications for the Air Force regarding the events that led to the crash of ValuJet flight 593? Everything that happened on board the ValuJet flight could have easily happened on a military flight. The oxygen cylinders that allegedly caused the fire on the aircraft could have just as easily been transported to a military installation, been processed by our military personnel and loaded on a contracted Flying Tigers or other type of commercial aircraft carrying military troops and families to their destination. Would the same cylinders have been caught by our special handling personnel in the aerial port? Hopefully, the answer is yes, but are we doing everything we can to minimize the danger?

To add further relevance of the importance of lessons learned from the ValuJet crash and accountability, I would like to use an example. This example comes from FAA circular Aviation Public Affairs (APA) 143-97, dated 16 October 1997.[2] In September 1995 a FedEx employee working at the sort center found a fiberboard box that was leaking. The outer box contained three inner boxes, all of which contained Fuji color bleach replenisher, which by regulation is classified as corrosive liquid. The package had been transported from Dallas, Texas, to Indianapolis, Indiana, on board a regularly scheduled cargo-only FedEx flight. The package was not properly classed, described, packaged, marked and labeled required by regulations. It also exceeded quantity limitations for cargo-only aircraft. On 16 October 1997, the FAA proposed a $100,000 fine against the shipper, Reuters America Inc., of New York for shipping undeclared hazardous materials. The reason this case was properly identified and dealt with is because the FAA has established guidelines for reporting all hazardous cargo incidents and each case is reviewed for negligence and safety implications.

If the same incident in the previous example happened on a military installation more than likely the shipper would not have been held accountable for his actions. In paragraph 1.9 in Air Force Joint Manual (AFJM) 24-204 it states to report any release of a hazardous substance in a quantity equal or greater than its reportable quantity to the Environmental Protection Agency (EPA) through the Coast Guard. If the Standard Forms (SF) 361 or 364 are filled out and submitted, there is no central data collection point in the Air Force that the information is input to identify hazardous cargo trends. Additionally, there is no way to identify repeat violators so action can be taken for disregarding federal regulations. If a violator is identified, the Air Force has virtually no enforcement agency to hold shippers accountable and the information is not given to the FAA. Since there is no substantial reporting system of hazardous material incidents in the Air Force there is no real way to identify violators of federal regulations. Since there is no real enforcement agency in the Air Force to hold violators accountable for their actions, there is no real incentive for shippers to comply with federal regulations while shipping by air through the Air Force. In all probability, the shipment in this example would have been frustrated at the aerial port and the shipper would have been notified to fix the shipment or remove it from the transportation system.

The bottom line is that in civil aviation, the offender was caught and was held accountable for his actions because they have a system that is designed to do that very thing. In the Air Force, there is no comprehensive system designed to identify hazardous material incidents, and even if a violator is found, we have limited resources to effectively deal with violators of federal regulations regarding the shipment of hazardous materials.

The actions taken by the FAA in response to the ValuJet accident are extremely relevant and should be studied. It makes no difference whether hazardous material is shipped on a commercial or Air Force aircraft. The potential of an incident or accident is the same on either aircraft.

Notes

[1] Research and Special Programs Record 110-97, FAA Oversight of ValuJet,
[2] Research and Special Programs Record 143-97, FAA Proposes Fine for Hazardous Materials Violation

Chapter 3

Reporting Processes of Hazardous Material Incidents

The reporting processes of hazardous material incidents are extremely important in that they identify vulnerabilities as well as safeguards in transporting hazardous cargo by air. Without an accurate reporting process, there would be inaccurate data that would result in possible mismanagement of resources to attempt to fix problems that are insignificant or do not really exist. The following paragraphs will address the processes of the FAA and the DOD

FAA Current Process

Hazardous material incident reporting for all modes of transportation was mandated in 1971 to meet the requirements of the Hazardous Materials control Act of 1970 The current guide for Hazardous Materials Incidents Reports can be found on the Internet at http://hazmat.dot.gov/spills.htm. In the guide, the verbiage used for when it is necessary to report a hazardous material incident is “during the course of transportation.” Since my topic is on air transport, I interpret this to mean after the hazardous material is accepted for air shipment from a transportation function. Under the current process, a written report is required whenever there is any unintentional release of hazardous material during transportation. For a small leak, the carrier has 30 days to submit. For more serious incidents, the requirements are more intense and time sensitive. The report is

completed on DOT Form 5800.1. A copy of this form can be obtained on the Internet at http://hazmat.dot.gov/spills.htm. The form has 50 blocks to be filled out by the carrier to extract many different types of data about the incident to include a written description of events. Once this completed form is sent to the FAA, all of the information is entered into a database that is able to maintain all the information that was reported. The FAA, for safety and legal implications, also reviews the report if negligence is in question.

Air Force Current Process

Hazardous material incident reporting for air shipments have specific procedures outlined in AFJM 24-204. In paragraph 1.9 it requires any release of a hazardous substance in a quantity equal to or greater than its reportable quantity to the EPA. In paragraph 1.9, it also says to consult local installation operating procedures and reporting requirements. For local reporting requirements Air Force safety offices are required to report mishaps in accordance with AFI 91-204. This regulation specifies classes of mishap reports relevant to their degree of severity. The mishap reports are forwarded to the Air Force Safety Center at Kirtland AFB, New Mexico, and entered into a database maintained by the safety office. In addition to the above reporting procedures, Headquarters AMC has sent out a message requiring 100 percent inspection of hazardous material shipments.[1] This initiative will hopefully stem the rather large amount of in-flight incidents now being experienced in AMC, but it still does not address the two problems of identifying tools for management to identify trends associated with hazardous material incidents and accountability of the shippers for not following federal regulations. In paragraph five of the above message it directs that packaging discrepancies discovered during tactical airlift operations be identified in the deployed

transportation unit's after action report in place of submitting a SF 364. Information in the after action report of a unit is not the correct place to receive proper management oversight. In paragraph eight of the AMC message it states that "the submission of Report of Discrepancies (RODs) form has been poor. To date, most RODs submitted do not specifically identify why the shipment was incorrect." This statement adds relevance to the point that the reporting process needs work. The current SF 364 is not designed to properly track hazardous material shipments. If the SF 364 and the DOT Form 5800.1 were compared, it is apparent that the intent of the use of the two forms is very different. The SF 364 was not designed to collect the information needed to be used as a vehicle for tracking trends in hazardous material incidents or enforcement of violators of federal regulations.

Differences in Reporting Systems

There are a few major differences in the two reporting systems that should be highlighted. In the Air Force system, many hazardous material incidents are not reported to the Air Force Safety center. AFJM 24-204 paragraph 1.9 states "Report deficiencies on SF 361, Transportation Discrepancy Report, or SF 364, Report of Discrepancy. Report leaks from packages, equipment, and self-propelled vehicles during loading or unloading, or in flight as a packaging deficiency." This type of discrepancy would not get reported to the Air Force Safety Center to be entered into the database. Another major difference in that the SF 361 and SF 364 are limited in identifying data that would be useful if it was entered into a data base. The final and most significant difference is that the FAA has a database that is standardized and able to produce data for management oversight for all hazardous material incidents. The Air Force has no such system. AMC

Headquarters has started tracking major incidents involving hazardous cargo, but it is not comprehensive and it is limited in scope.

Notes

[1] HQ AMC Scott AFB IL//DON// Message Date Time Group of R232150Z Oct 97, Subject is AMC HMIF 97-1: Hazardous Materials (HAZMAT) Inspection

Chapter 4

Where We Are Today in Transporting Hazardous Cargo

The Air Force routinely transports hazardous cargo by air and experiences incidents of leaking hazardous cargo that at times poses a serious threat for safe flight operations. In 1997 alone, eight aircraft have been diverted in-flight in AMC from January through August 1997 because of problems associated with hazardous cargo.[1] The potential for a serious incident is ever present and should be kept to a minimum and monitored on a regular basis.

To try and come up with recommendations for safer transportation of hazardous cargo, it is necessary to look at the past. The FAA keeps thorough records on all hazardous cargo incidents. As stated previously, a hazardous cargo incident in the civil aviation side is any release of a hazardous substance once it is entered into the transportation system. All shippers are required by federal regulations to report to the FAA any incident relating to spill or leakage associated with hazardous cargo. The FAA reviews the incident and determines if there was negligence or non-compliance with current federal regulations. I contacted the FAA and was able to obtain 965 records of hazardous material incidents dating from 1 January 1990 through 31 December 1996.[2] I will give a summary of the data and highlight some interesting points that will be relevant in my recommendations toward the end of my paper.

In table 1 below, the majority of reasons why a container failed are in the “other” category. This by itself shows a flaw in the reporting process. If the main reason for container failure cannot be identified, then the report needs to be modified to indicate what is common with container failures. I bring up this point only to reinforce several recommendations later on in my paper. It also must be noted that although the Department of Transportation does collect this type of information, it is not tracked to my knowledge. The information in my research paper was produced through analysis of raw data provided by the FAA. None of the information in the tables in this chapter was recreated from any formal reports that are available from the FAA or another agency. With the majority of the failures not identified, it is hard to draw good conclusions from the data. In the second and third categories in table 1, I would contend that they could be combined because of their similarities (loose/defective fittings/valves). In most of the cases I reviewed, it was hard to substantiate if the valve or fitting was actually defective. If we combine the loose/defective fittings/valves categories it raises the container failure rate to just over 35 percent. This is a significant finding as compared to the other categories.

Table 1. Container Failure Incidents

Type	Total	Percentage
Other	336	30.38%
Loose Fittings, Valves	269	24.32%
Defective Fittings, Valves	124	11.21%
Dropped	116	10.49%
Improper Loading	70	6.33%
Struck/Rammed	64	5.79%
Overloading/Overfilling	42	3.80%
Improper Blocking	24	2.17%
Friction/Rubbing	24	2.17%
Venting	20	1.81%
Metal Fatigue	7	0.63%
Corrosion	3	0.27%
Freezing	3	0.27%
Incompatible Materials	3	0.27%
Fire/Heat	1	0.09%
TOTALS ==========>	**1106**	**100%**

NOTE: 965 individual incidents were evaluated. The difference between 965 and the total is that some incidents had more than one type of failure. 1990 through 1996

Table 2 indicates that about half of the shipments failed due to another object or outside interference causing it to fail. Twenty seven percent of the container failures that were identified out of the 50 percent that had an object cause its failure were placed in the "other" category. What is important to gather from this table is that about half of all containers fail not due to their design, but fail because of contact with another object or some type of outside condition.

Table 2. Object Causing Failure

Object	Total	Percentage
None	514	50.99%
Other	274	27.18%
Ground/Floor/Roadway	90	8.93%
Other Freight	64	6.35%
Roadside Obstacle	24	2.38%
Nail/Protrusion	18	1.79%
Forklift	12	1.19%
Other Transport Vehicle	7	0.69%
Water/Other Liquid	5	0.50%
TOTALS ==========>	**1008**	**100.00%**

NOTE: 965 individual incidents were evaluated. The difference between 965 and the total is that some incidents had more than one type of failure. 1990 through 1996.

Table 3, as in the previous tables, the “other” category makes it almost impossible to determine a trend. How the container failed is mostly determined by the circumstances surrounding the incident. Not much emphasis will be put in this area because the results are largely inconclusive. It is important however to see from this chart that a lot of time and effort are being spent in collecting data that is mostly useless because of a flawed reporting process.

Table 3. How Package(s) Failed

What Happened	Total	Percentage
Other	601	59.74%
Cracked	113	11.23%
Burst/Internal Pressure	87	8.65%
Crushed	59	5.86%
Rubbed/Abraded	51	5.07%
Punctured	49	4.87%
Ruptured	42	4.17%
Ripped	4	0.40%
TOTALS ==========>	**1006**	**100%**

NOTE: 965 individual incidents were evaluated. The difference between 965 and the total is that some incidents had more than one type of failure. 1990 through 1996

Table 4 clearly shows what is the most important part of a container to check. With almost 60 percent of the failures coming from the top of the container, a significant amount of emphasis should be put in this area. This table gives a much better representation than the others do because most of the failures have been identified.

Table 4. Package Area That Failed

What Failed	Total	Percentage
Top	606	59.88%
Other	184	18.18%
Bottom	124	12.25%
Center	57	5.63%
Side, Left	19	1.88%
Side Right	17	1.68%
End, Rear	3	0.30%
End Forward	2	0.20%
TOTALS ==========>	**1012**	**100%**

NOTE: 965 individual incidents were evaluated. The difference between 965 and the total is that some incidents had more than one type of failure. 1990 through 1996.

Table 5 indicates that about 50 percent of the failures come from the closure portion of the container, and about 25 percent from the packing material. It is disturbing to have that many failures from the packing material. Most of the time this cannot be checked unless you open the container. It also indicates that this is a condition that can be controlled.

Table 5. What Failed On Package(s)

What Failed	Total	Percentage
Closure	530	49.26%
Basic Package Material	270	25.09%
Other	155	14.41%
Fitting/Valve	71	6.60%
Weld/Seam	37	3.44%
Inner Liner	7	0.65%
Chime	5	0.46%
Hose/Piping	1	0.09%
TOTALS ==========>	**1076**	**100%**

NOTE: 965 individual incidents were evaluated. The difference between 965 and the total is that some incidents had more than one type of failure. 1990 through 1996.

I've listed all the results to give a better picture of what the FAA tries to determine with each incident involving hazardous cargo. As I indicated earlier there also appears to be some flaws in the reporting process it uses. This is important to recognize if we want the data being collected to be useful. I do not want to be overly critical of the FAA, because it has by far the best process of collecting hazardous material incidents I have found. I only point out the deficiencies to allow this report to be a useful tool in developing a future process of reporting.

The Air Force does collect data on mishaps involving aircraft, but does not have a standard process of reporting hazardous material incidents. I was able to get some

information from the Air Force Safety Center in Kirtland AFB, New Mexico. The information was very restricted because the reports contain privileged information and are strictly controlled under the guidelines of AFI 91-204. The information I did get I analyzed to try and get the most useful information I could. The table below indicates the top 10 types of containers that were carrying hazardous materials that were reported to the safety office. As you can see, most of the containers are associated with service

Table 6. Types of Container

Type	**Total**	**Percentage**
Gen Container	34	18.48%
Generator	13	7.07%
F100 Engine	11	5.98%
Tank(s)	10	5.44%
Engines	8	4.35%
Hobart Generator	5	2.72%
Helicopter	5	2.72%
J79 Engine	4	2.17%
Drums	4	2.17%
TF33 Engine	3	1.63%
TOTALS ==========>	**97**	**52.73%**

support equipment. The majority of the support equipment carries a particular type of flammable liquid. When I analyzed the types of hazardous materials that were reported, out of the 184 cases that I studied, approximately 72 percent involved some type of fuel for powered equipment to include vehicles. Below you can see the table indicating which type of fuel is most prevalent.

Table 7. Commodity Type

Commodity	Total	Percentage
Fuel	69	37.50%
JP-4	26	14.13%
Diesel Fuel	10	5.43%
Mogas	9	4.89%
Gas	7	3.80%
JP-5	5	2.72%
JP-8	2	1.09%
Jet Fuel	2	1.09%
Torpedo Fuel	1	0.54%
JP-7	1	0.54%
TOTALS ==========>	**132**	**71.73%**

The commodities of hazardous materials carried by the military are very much different than what is carried by civilian industry. Table 8 will compare and contrast the top 10 commodities shipped by civilian versus Air Force aircraft.

Table 8. Top Ten Shipments

Top Ten	Total	Percentage	Top Ten	Total	Percentage
Air Force Shipments			**Commercial Shipments**		
Commodity Type			*Commodity Type*		
Fuel	69	37.50%	Flammable Liquids	110	8.72%
JP-4	26	14.13%	Gasoline	84	8.70%
Diesel Fuel	10	5.43%	Paint or Paint Related	82	8.49%
Mogas	9	4.89%	Resin Solution	46	4.76%
Gas	7	3.80%	Consumer Commodity	37	3.83%
JP-5	5	2.72%	Corrosive Liquids	36	3.73%
JP-8	2	1.09%	Ink Printers Flammable	28	2.90%
Jet Fuel	2	1.09%	Extracts Flavoring	25	2.59%
Torpedo Fuel	1	0.54%	Adhesives	21	2.17%
JP-7	1	0.54%	Battery Wet Acid	17	1.76%
TOTALS ===>	**132**	**71.73%**	**TOTALS ===>**	**486**	**47.65%**

It is apparent from table 8 that the military carries many more fuel commodities as a percentage of the total hazardous materials carried on Air Force aircraft than commercial aircraft.

Trends of In-flight Incidents

The trend in in-flight incidents involving hazardous cargo, where the aircraft had to divert to an alternate airfield, have remained relatively flat in the civilian industry with about two or three in-flight diversions a year. In the Air Force, Headquarters AMC recently started collecting data involving incidents involving air transport of hazardous materials. From the reporting period of January 1997 through August 1997, AMC experienced eight instances of aircraft having to divert to an alternate airfield because of dangers associated with the hazardous material they were carrying. In the commercial aviation side, in the last three years, commercial aircraft had to divert a total of six aircraft because of hazardous cargo related incidents. In fact, from 1990 through 1996, civilian aircraft had to divert in-flight because of hazardous cargo problems only 17 times. In AMC, during an eight-month period, aircraft had to divert in-flight a total of eight times because of problems associated with hazardous cargo. What this means is that in eight months, AMC had to divert approximately the same amount of aircraft civilian industry had to divert in a three year period. Is that significant? I think that anytime you have to divert an aircraft from its scheduled flight path because of an in-flight emergency, it is significant. The fact that AMC is experiencing this problem significantly more than the civilian airline industry is cause for concern and action.

Trends in Reported Incidents

In civil air, there has been over 400 percent increase in the number of reported incidents of leaking hazardous cargo from 1990 through 1996 according to the Hazardous Materials Information System.[3] Is this an indicator that could have been used to alert management of a problem before the accident of ValuJet flight 593? Referring to the figure below, does the increase in the number of incidents involving hazardous cargo relate to the probability that a serious accident was likely to happen? It may not have been the single indication that a disaster was imminent, but it should have raised a flag for management. Looking back, it is definitely a strong indication that something was broken and needed to be fixed.

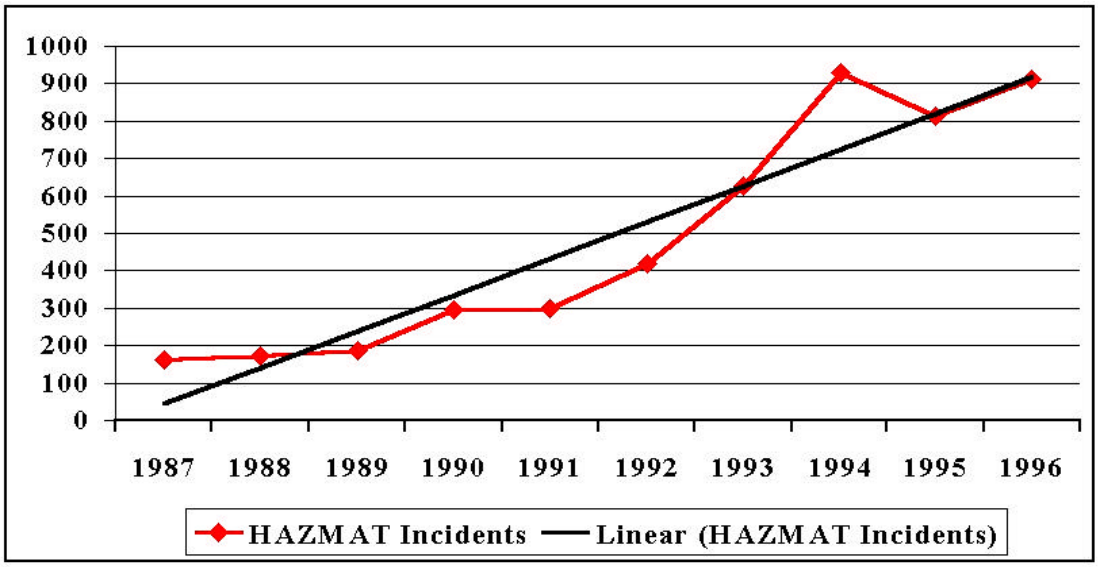

Figure 1. Reported Hazardous Material Incidents

Relevance of data

From the data presented so far it is relevant in that it has pointed to trends that indicate problem areas of not only in the physical characteristics of the containers

themselves, but also of problem areas that warrant management's attention. It is also evident that although the FAA does keep good records of hazardous material incidents, the reporting process needs work if it is going to be effective. In contrast to the Air Force, there is no database designed to capture all hazardous material incidents once they enter the transportation system. Air Mobility Command has taken the initiative and started looking at in-flight incidents, but is limited in resources in doing much more.

Where we are today

It appears that in the FAA they have good procedures for reporting all types of hazardous material incidents. They also have a great database that has many types of data elements, which can be used in determining trends and problem areas. The report I requested from the FAA had to be sorted on unique data elements to create a custom report on hazardous material incidents. This was a special report developed just for my information. If most of the data elements in the database are in the "other" category as we have seen from tables 1, 2, and 3 then the reporting method needs to be changed. In the Air Force, there is a database at the Air Force Safety Center that tracks Air Force mishaps, but is not designed for capturing data involving hazardous material incidents. The database is limited and it was only by chance that the safety center was able to capture fields that contained hazardous material information in them. Thanks to the hard work of the individuals there, I was able to get some data. The bottom line is that the FAA is far ahead of the Air Force in tracking and maintaining data on hazardous material incidents. It takes reporting seriously and has a complete history of each reported incident. It also follows up on violators to hold them accountable. Other than the initiative of AMC in tracking major hazardous material incidents starting in 1997, there is

virtually no tracking system at all for hazardous material incidents. Since this is the case, it can be assumed that the Air Force could do better in trying to identify trends or management problems associated with hazardous material incidents.

Notes

[1] Delbert Hamilton, Headquarters AMC/DON, AMC FY97 HAZMAT Incident Report, August 1997,. 1-2.

[2] US Department of Transportation, Hazardous Material Safety, In-flight Air Incidents, 965 case files, 1990-1997, Hazardous Materials Information System [database] [cited 4 December 1997]

[3] Hazardous Material Information System, Research and Special Programs Administration, Department of Transportation,

Chapter 5

Improved Procedures for Transporting Hazardous Materials

Based on the data I've collected, I have come up with some recommendations that should improve the safety of transporting hazardous material in the Air Force. There are two major areas that I would like to address. The first area is to improve the reporting system of hazardous material incidents so it is a useful tool for management. The second area is accountability and enforcement of shippers that are negligent and pose a hazard to the safety of personnel and equipment.

Improved Reporting System

First, the current system in the Air Force needs to be expanded to report all incidents of hazardous cargo leakage to a central location so data can be collected and reviewed for trends and possible negligence. In the past, the SF 364, Discrepancy in Shipment report, has not been emphasized as a tool for identifying and tracking hazardous material shipments. A new form or a modified version of the SF 364 should be developed to act as a vehicle to collect data and information that could be used for incorporation into a database. The form and instructions should be available on the Internet for immediate availability for the user. The Internet could also be used to share information between special handling and traffic management personnel and other agencies inside the Air Force to enhance the safety of transporting hazardous materials. A sample of a current

homepage can be found at Internet address http://www.hmix.dis.anl.gov/. This is a hazardous materials information exchange site that provides a forum for hazardous material information. The DOT Internet site that provides information on all hazardous material information, including rules, regulations, reporting and a host of other important information is http://hazmat.dot.gov/. This site has all the information for shippers in the civil airside at their fingertips. For organic moves requiring joint inspections and discrepancies found during joint inspections can also be placed on the Internet through the use of a data collection medium. At Kadena AB, Japan, the aerial port in 1995 documented all discrepancies found during joint inspections and during training sessions, the data was given to mobility personnel so they were aware of common mistakes. If this were done AMC wide, it would have a synergistic effect and allow the sharing of knowledge that would emphasize problem areas.

A new form should be developed to provide useful information for management, identify trends or problem areas and act as a source document so shippers are held accountable for improperly prepared shipments. The following areas at a minimum should be addressed on the new or revised form:

1. **General Information:**
- Name of individual reporting, organization, date, time and location of incident
- Description of events
- Describe the events that led to the incident and action taken to correct the problem

2. **Shipper Information:**
- Organization/Company name and location
- Certifying official on general declaration
- Unit Mobility Officer/NCO

3. **Shipment Information:**
- Proper shipping name, hazard class, identification number (UN)
- Commodity Type

- Estimated amount of hazardous substance release

4. Environment:

- Loading, unloading, in-storage, on aircraft, in-flight
- Why Equipment/Container/Package failed
- Improper packaging materials
- Loose/defective fittings/valves
- Dropped
- Improper Loading
- Closure Device Failed
- Overfilled
- Other

5. Action Taken To Prevent Future Incidents:

- What action was taken
- Results

I've tried to condense the information required to meet the intent of the report. The intent is to identify and prevent problems transporting hazardous material and to act as a vehicle for accountability. The data elements above can provide a starting point to provide management a tool to monitor trends on all hazardous material incidents. If the information is sent electronically so it can be input into a database, then the information collection and analysis can be done efficiently. The data can also be used to help inspectors to check identified critical areas of packages and equipment based on careful analysis of hazardous material transporting through the Air Force system.

Accountability

Currently, the Air Force has limited avenues to hold violators who are negligent in shipping hazardous cargo accountable for their actions. In civil aviation, violations of procedures in shipping hazardous cargo are routinely identified and shippers are generally held accountable through monetary fines and certification ability. In the Air Force, an office or agency needs to be charged with follow-up of improper shipments

where negligence was involved. The legal community should make an effort to work with offices of the FAA for action that is warranted for violation of federal regulations. Other options could be looked at such as charging the shipper for the expense occurred in diverting an AMC aircraft. Commanders could also review the certifications of mobility personnel performing shipper duties on organic moves during exercises or contingencies. Other options that effectively hold personnel accountable for the proper movement of hazardous materials should be exercised and used on a routine basis to reduce the likelihood of a serious incident.

Chapter 6

Conclusions

In my research paper I've addressed the importance of having a sound program for the safe movement of hazardous material by air in the Air Force. In chapter one, I addressed the possible dangers associated with air transport of hazardous material and pointed out some of the limitations of my research.

In chapters two and three, new initiatives were cited in lieu if the tragedy of the crash of ValuJet flight 593 and a more in-depth review of the reporting processes of the FAA and the Air Force. The new initiatives of the FAA involved beefing up computer systems for better tracking of data, inspection personnel for monitoring hazardous material shipments and a well-equipped legal staff to ensure shipper compliance with federal regulations. It was demonstrated again in chapter three that the current system in the Air Force of reporting hazardous material shipments and enforcing compliance of shippers to federal regulations needed some work to be more effective.

In chapter four, we saw where we are today in transporting hazardous cargo by air in the Air Force. We found that inspectors need to concentrate on inspecting loose fittings/valves on the top of containers. The closure of containers was almost 50 percent of what failed on the container. In the Air Force we saw that almost 72 percent of what was shipped was a fuel type commodity. On the down side there were flaws in the

reporting systems of the FAA and the Air Force. In the FAA, although they had a great system of collecting data, it was found that the right data was not being collected to properly track causes of hazardous material incidents. In the Air Force, we found that there was a limited system set up to track hazardous material incidents. With the information gathered, it is clear that the current system needs to be improved to track the right types of data that would alert management of hazardous material incidents that needed immediate attention. It was also discovered that the Air Force has no real system of holding shippers accountable for violations of federal regulations.

In chapter five I introduced new procedures the Air Force could use to take the first step in having a sound program for shipping hazardous materials by air. I introduced a new reporting system of hazardous material incidents and suggested some better ways of dealing with shippers who violate federal regulations when shipping hazardous cargo in the Air Force. Since AMC is designated to provide mobility airlift for all the services, I concentrated my research in this area. It must be understood that I hold a great amount of respect for the personnel at AMC headquarters and for the personnel in the field that have worked diligently to comply with Air Force regulations in dealing with the air transport of hazardous materials. It is through this research project that I hope improvements can be made to make the transportation of hazardous materials by air safer.

Glossary

AFI	Air Force Instruction
AFJM	Air Force Joint Manual
AMC	Air Mobility Command
APA	Aviation Public Affairs
DOT	Department of Transportation
FAA	Federal Aviation Administration
HAZMAT	Hazardous Material
ROD	Report of Discrepancy
SF	Standard Form

Hazardous Material Incident. The release of any quantity of hazardous material during Transportation.

Package/Container. Should be treated as being synonymous throughout the text.

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